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AP MACROECONOMICS · COURSE REVIEW AND PRACTICE

AP Macroeconomics Mastery.

Every unit on the exam: clear explanations, worked graph and calculation examples, practice problems with full explanations, free-response practice, and a full-length practice exam, with a bonus second exam as a separate PDF.

INSIDE

Basic Economic Concepts · Economic Indicators and the Business Cycle · National Income and Price Determination · The Financial Sector · Long-Run Consequences of Stabilization Policies · Open Economy · Practice Exam · Reference



Table of Contents.

Six units of AP Macroeconomics, an exam toolkit, a full practice exam, and a reference section.

Contents

Each section has an explanation, worked examples, and practice problems. Answers and explanations close every chapter. Click any entry to jump to that page.

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Welcome to AP Macroeconomics.

The ideas, the graphs, the calculations, and the practice you need for the exam.

Welcome

How to Use This Book

A complete AP Macroeconomics course: clear explanations, worked examples, practice problems with full explanations, and practice exams.

What is inside

All six units of AP Macroeconomics, in order. Start Here covers the exam and the graphing and calculation habits that earn points. Chapters 1 to 6 are the six units; each has explanations, worked examples, three practice sets per section, a 30-question multiple-choice set and four free-response questions. A full practice exam (plus a bonus second exam as a separate PDF) and a reference section close the book.

Your situation	Study plan
Taking the course now	Work one chapter at a time as your class does, then do that chapter's multiple-choice and free-response sets.
Starting 6 weeks before the exam	Read Start Here, then do two sections a day, mark weak units, and take the practice exam at the end of week 4.
Final week	Redo missed problems, drill the graph gallery and formula sheet, and take the bonus Practice Exam 2 (separate PDF) under timed conditions.

A routine that works

- 1. Read.** Study the key boxes, then work each example yourself before reading its solution.
- 2. Practice.** Do every Set A problem, then Sets B and C. Write your answers before you look.
- 3. Check.** Compare with the answers and explanations at the end of the chapter. Mark mistakes and note the reason, not just the right answer.
- 4. Review.** Return to missed problems the next day, then do the multiple-choice and free-response sections and the practice exams.

Graphs earn points

Label both axes, every curve, the equilibrium, and the direction of every shift. Draw one graph per question part, with a ruler, large enough to read.

Calculations

Show the formula, the substitution, and units. A correct answer with no setup often earns no credit on free-response questions.

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Start Here: The Exam and Your Toolkit.

3 sections with explanations and worked examples, then 42 practice problems. Answers and full explanations are at the end of the chapter.

0.1 The AP Macroeconomics Exam: Format, Scoring, and Study Plan

Learn how the exam is built and scored, how free-response points are earned, and how to turn your available weeks into a study plan that targets the heaviest units.

The AP Macroeconomics exam rewards students who know the structure of the test as well as the content. Before you study a single graph, you should know how many points each part is worth, how free-response points are earned, and how to spread your preparation over the time you have. This lesson gives you that map.

The exam has two sections. **Section I** is multiple choice and **Section II** is free response. Calculators are allowed on both sections, so arithmetic speed matters less than knowing which formula to use.

Part	Questions	Time	Weight	Notes
Section I: multiple choice	60 questions, 5 choices each	70 minutes	66.7% of exam score	No penalty for wrong answers, so never leave one blank
Section II, Question 1 (long)	1 question, 10 points	about 25 minutes	16.7% of exam score	Several parts: graphs, calculations, explanations
Section II, Questions 2 and 3 (short)	2 questions, 5 points each	about 15 minutes each	8.3% of exam score each	Usually one graph plus explanations

Exam structure to memorize

Multiple choice is two thirds of your score: 60 questions in 70 minutes, about 70 seconds each.

Free response is one third of your score: 3 questions, 20 raw points, in 60 minutes (the first 10 minutes are a suggested planning period).

Because 20 FRQ points carry 33.3% and 60 MC questions carry 66.7%, one FRQ point is worth 1.5 multiple-choice questions.

The exam covers six units, but they are not equally weighted. The ranges below show the share of multiple-choice questions that come from each unit.

Unit	Topic	Approximate MC weight
1	Basic Economic Concepts	5-10%
2	Economic Indicators and the Business Cycle	12-17%
3	National Income and Price Determination	17-27%
4	The Financial Sector	18-23%
5	Long-Run Consequences of Stabilization Policies	20-30%
6	Open Economy: International Trade and Finance	10-13%

Units 3, 4, and 5 together make up roughly two thirds of the multiple-choice section. They are also where most FRQ graphs live (AD-AS, the money market, loanable funds, and the Phillips curve). Units 1, 2, and 6 are smaller, but they supply easy points if you know your definitions and calculations.

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EXAMPLE 1: COMPUTING A COMPOSITE SCORE

A student answers 42 of 60 multiple-choice questions correctly and earns 11 of the 20 possible free-response points. What percentage of the total exam score has the student earned?

SOLUTION

Multiple choice: $42/60 = 0.70$, and this section is worth 66.7 points out of 100, so $0.70 \times 66.7 = 46.7$ points.
Free response: $11/20 = 0.55$, and this section is worth 33.3 points, so $0.55 \times 33.3 = 18.3$ points.
Total: $46.7 + 18.3 = 65.0$ out of 100. The student has earned about 65% of the available composite score.
Cut scores for 1 through 5 change from year to year, so treat this as a progress meter, not a guarantee of a particular grade.

EXAMPLE 2: WHERE DO EXTRA POINTS COME CHEAPEST?

A student has time to improve in only one area. Which gives more composite score: getting 3 more multiple-choice questions right, or earning 2 more free-response points?

SOLUTION

Each MC question is worth $66.7/60 = 1.11$ composite points, so 3 questions give about 3.33 points.
Each FRQ point is worth $33.3/20 = 1.67$ composite points, so 2 points give about 3.33 points.
The two gains are equal. Practical conclusion: FRQ points are worth more per item, but MC questions are quicker to gain, so a balanced plan works best.

How FRQ points are earned. Each free-response question is graded against a scoring guide that lists separate, independent points. You earn a point for each required element you show, and one error does not usually cancel a different correct element. The typical point types are:

- ◆ **Graph points:** correctly labeled axes, correctly labeled curves, equilibrium marked and labeled, and the shift drawn in the right direction with a new label.
- ◆ **Calculation points:** the right numerical answer. Showing the formula and substitution protects you if arithmetic slips.
- ◆ **Direction points:** stating that a variable increases, decreases, or does not change.
- ◆ **Explanation points:** a cause-and-effect reason linking the event to the result, not just a restatement of the answer.
- ◆ **Identification points:** naming the correct policy, curve, or term.

FRQ scoring rules that save points

Answer exactly what the command word asks. Extra material earns nothing, and a contradiction can cost the point.
If you make an error in part (a) and use it consistently in part (b), you can often still earn the part (b) points.
A graph that is not labeled cannot earn its points, even if the picture is perfect.
Write in short sentences and name the variable (real GDP, nominal interest rate), not 'it' or 'the economy'.

Study plans. The plan below assigns units in the same order as this book. Whatever length you choose, finish a full timed practice test at least twice before exam day, and keep a log of every missed question by unit.

Time	6-week plan (about 5 hours a week)	12-week plan (about 3 hours a week)
Start	Week 1: Units 1 and 2, toolkit lessons	Weeks 1-2: exam format, graphs, formulas, Unit 1
Core	Weeks 2-3: Unit 3 (AD-AS, multiplier, fiscal policy)	Weeks 3-4: Unit 2. Weeks 5-6: Unit 3
Money	Week 3-4: Unit 4 (money, banking, monetary policy)	Weeks 7-8: Unit 4 with money market and loanable funds graphs
Long run	Week 5: Units 5 and 6	Weeks 9-10: Unit 5. Week 11: Unit 6
Finish	Week 6: two full practice exams, review error log	Week 12: two full practice exams, review error log

What a 5 looks like. Students who earn a 5 typically answer roughly two thirds to three quarters of the available composite points. That means about 45 of 60 multiple-choice questions plus 13 or more of 20 FRQ points is a strong target. They draw every graph with all labels, they can do the calculations without hunting for formulas, and they attempt every question.

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Common mistakes

The most frequent point losses are: leaving axes or curves unlabeled; shifting the wrong curve (for example, moving AD when the event affects SRAS); writing 'it goes up' without naming what; mixing real and nominal values; stopping an explanation after the first link in a chain; spending too long on the 10-point question and rushing Questions 2 and 3; and leaving multiple-choice items blank even though there is no guessing penalty.

Practice**SET A Check Your Understanding**

Short answer. Write a complete answer with any calculation shown.

1. The multiple-choice section has 60 questions in 70 minutes. How many seconds per question is that on average, and what is a sensible pacing plan?
2. Question 2 on the free-response section is worth 5 raw points. What percentage of the whole exam score is Question 2, and how much composite score does one point on it earn?
3. A student gets 48 multiple-choice questions right and earns 9 free-response points. Calculate the composite percentage.
4. A question says 'Explain why real GDP falls when consumer confidence falls.' A student writes 'Aggregate demand decreases.' Why does this answer earn little credit, and what should be added?
5. Which three units together carry the largest share of multiple-choice questions, and what is one study implication?
6. A student plans to save all practice tests until the last two days before the exam. Give two reasons this is a weak plan and one improvement.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. How much time is allotted for the multiple-choice section of the exam, and what fraction of the score does it carry?
(A) 60 minutes; one half (B) 70 minutes; one half (C) 70 minutes; two thirds
(D) 50 minutes; one third (E) 90 minutes; two thirds
8. The long free-response question is worth 10 raw points and each short question 5 points. Compared with a short question, the long question counts what share of the exam?
(A) Twice as much (B) The same
(C) Three times as much (D) Half as much
(E) One and a half times as much
9. Which statement about the guessing policy is correct?
(A) Wrong answers lose a quarter point, so guess only when two choices can be eliminated
(B) Wrong answers lose one point, so skip unknown questions
(C) Only the first 40 questions are scored
(D) Blank answers earn partial credit
(E) Wrong answers are not penalized, so every question should be answered
10. A student answers 36 multiple-choice questions correctly and earns 8 of 20 free-response points. What is the composite percentage?
(A) 48.0 (B) 53.3 (C) 60.0 (D) 44.4 (E) 66.7
11. A free-response part asks, 'Explain how the Federal Reserve's purchase of bonds affects the interest rate.' Which response is most likely to earn full credit?
(A) The interest rate falls
(B) Bond purchases are expansionary monetary policy
(C) The Federal Reserve buys bonds to help the economy
(D) Purchases add reserves and increase the money supply, so the supply of money shifts right and the nominal interest rate falls
(E) Interest rates and bond prices move in the same direction

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12. Which unit has the widest range of multiple-choice weight and the highest upper limit?
- (A) Unit 1: Basic Economic Concepts
 - (B) Unit 5: Long-Run Consequences of Stabilization Policies
 - (C) Unit 2: Economic Indicators and the Business Cycle
 - (D) Unit 4: The Financial Sector
 - (E) Unit 6: Open Economy

SET C Apply and Extend

Answer in full. The answers give a model response with scoring points.

13. A student has eight weeks before the exam. She is strong in Units 1 and 2 but scores 40% on money market and loanable funds graphs (Unit 4) and misses most multiplier calculations (Unit 3). Design a weekly plan and justify how you allocate time. Include how and when she should use practice exams.
14. Read this response to the prompt 'Calculate the percentage change in real GDP if it rises from \$500 billion to \$520 billion, and explain why the economy produced more output.' Student answer: '20. The economy produced more because GDP went up.' Identify every scoring point the student missed and write a complete response.

0.2 Graphs and Labels That Earn Points

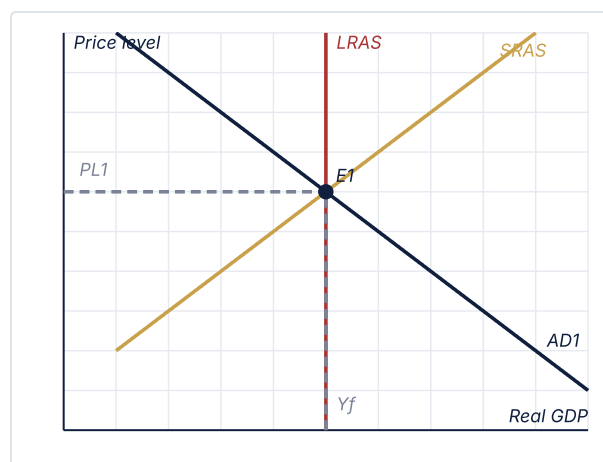
Learn the checklist that earns every graphing point and practice drawing each of the six standard macro graphs, including shifts and new equilibria.

Free-response graphs are scored with a fixed checklist, so a correct picture with missing labels loses points. The good news is that every macro graph follows the same recipe. Learn the six standard graphs once, apply the checklist every time, and graphing points become the easiest points on the exam.

The graph-drawing checklist

1. Label both axes with the exact variable (and units or 'real' or 'nominal' when relevant).
2. Draw each curve with the correct slope and label it directly (AD, SRAS, LRAS, Md, Ms, S, D).
3. Mark the starting equilibrium with a point and label the price/rate and quantity on the axes, with dotted lines to the axes.
4. Show any change with a shifted curve, a new label (AD2), an arrow, and a new equilibrium point with new axis labels.
5. Shift only the curve that the event actually affects, and shift it by one clear move.

Here are the six graphs you need to draw by hand. Notice which curves are vertical, because that is where students lose points.

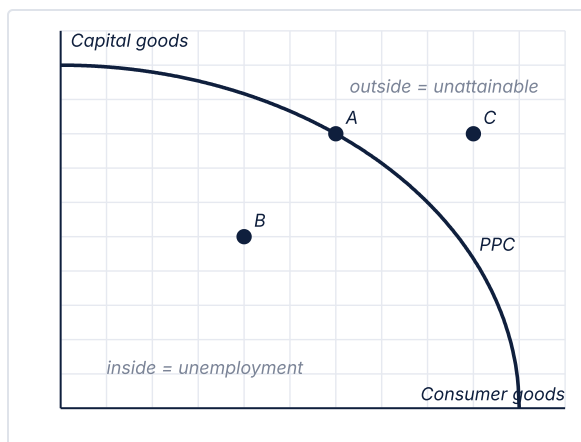


AD-AS: AD slopes down, SRAS slopes up, LRAS is vertical at full employment output (Y_f). Equilibrium E_1 is where AD meets SRAS.

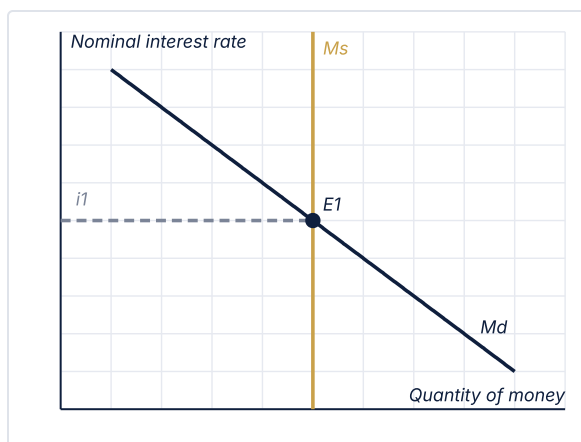
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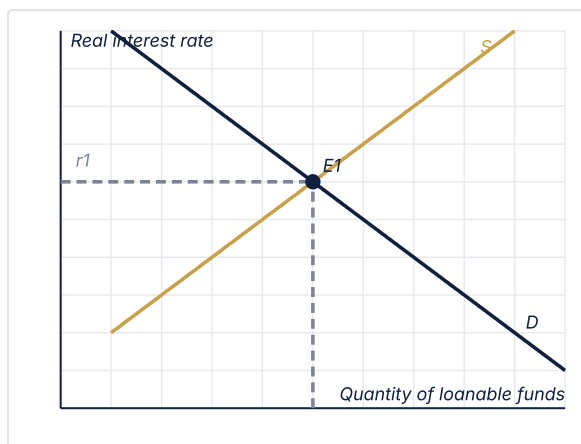
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PPC: A is efficient, B is inside (unemployed or unused resources), C is unattainable now.



Money market: M_s is vertical (set by the central bank), M_d slopes down.

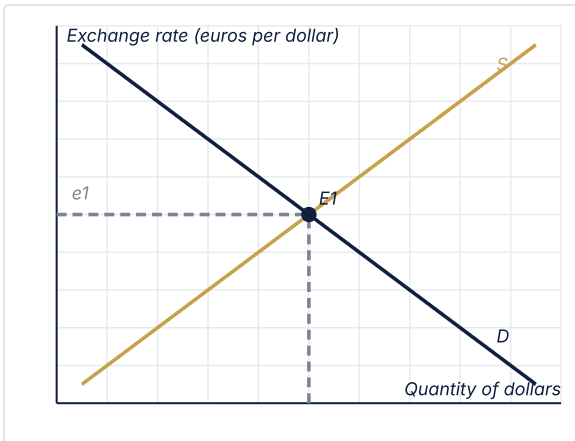


Loanable funds: saving supplies funds, borrowers for investment demand them.

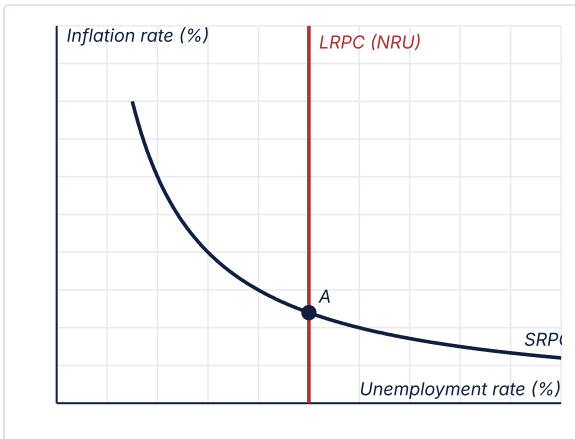
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Foreign exchange market for dollars: demand slopes down, supply slopes up; price is euros per dollar.



Phillips curve: SRPC slopes down; LRPC is vertical at the natural rate of unemployment (NRU).

Graph	Vertical axis	Horizontal axis	Curves and slopes
AD-AS	Price level (or aggregate price level)	Real GDP	AD down, SRAS up, LRAS vertical at Y_f
Production possibilities	One good (e.g., capital goods)	The other good	PPC bowed out (increasing opportunity cost)
Money market	Nominal interest rate	Quantity of money	M_d down, M_s vertical
Loanable funds	Real interest rate	Quantity of loanable funds	D down, S up
Foreign exchange	Price of currency (e.g., euros per dollar)	Quantity of the currency	D down, S up
Phillips curve	Inflation rate	Unemployment rate	SRPC down, LRPC vertical at NRU

Shift versus movement. A change in the variable on the vertical axis (price level, interest rate, exchange rate) is a movement along a curve. Events that change anything else shift a curve. The price level moves you along AD but never shifts it. A change in the money supply shifts M_s , and the new interest rate comes from sliding along M_d , not from shifting M_d .

Which curve shifts?

AD: consumption, investment, government purchases, or net exports change for a reason other than the price level.

SRAS: input prices, productivity, or inflation expectations change. LRAS: resources, technology, or institutions change.

M_s : the central bank acts. M_d : changes in price level or real income. Loanable funds S or D : saving or borrowing behavior changes, including the government deficit.

Foreign exchange D or S : foreign demand for exports or assets, tastes for imports, relative interest rates and inflation.

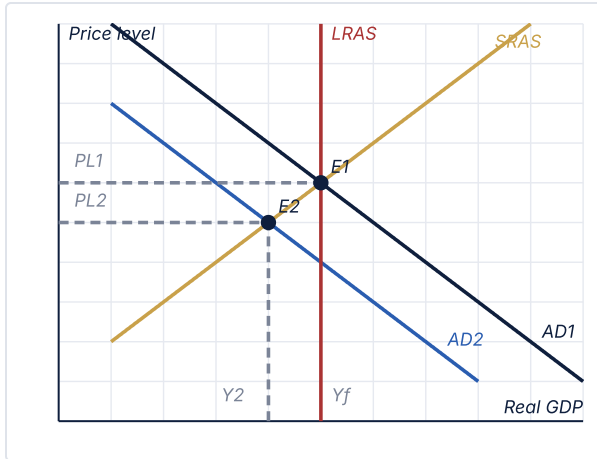
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EXAMPLE 1: AD-AS AFTER A FALL IN CONSUMER CONFIDENCE

The economy begins in long-run equilibrium. Consumer confidence falls sharply. Draw a correctly labeled AD-AS graph and show the short-run effect on the price level and real GDP.

**SOLUTION**

Draw axes labeled Price level and Real GDP, with AD1, SRAS, and a vertical LRAS at Y_f . Mark the starting equilibrium E1 at PL1 and Y_f .

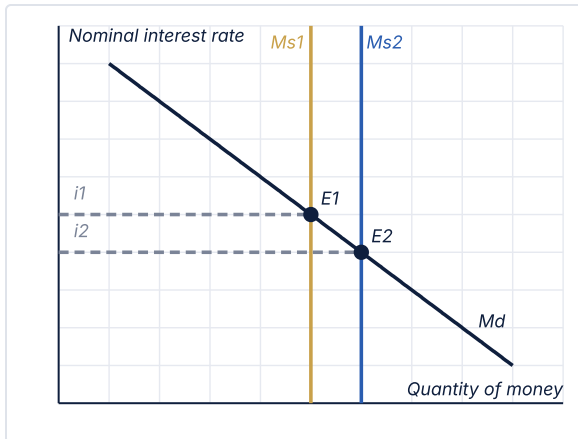
Lower confidence reduces consumption, so AD shifts left. Draw AD2 and an arrow. SRAS and LRAS do not move.

The new equilibrium E2 is on SRAS where AD2 crosses it. Label PL2 below PL1 and Y_2 below Y_f .

State the result: price level falls, real GDP falls, and unemployment rises (a recessionary gap).

EXAMPLE 2: MONEY MARKET AFTER AN OPEN MARKET PURCHASE

The Federal Reserve buys government bonds from banks. Show the effect on the nominal interest rate.

**SOLUTION**

Label axes Nominal interest rate and Quantity of money. Draw Md sloping down and a vertical Ms1. Mark E1 at i_1 .

Bond purchases add reserves, so banks can lend and the money supply increases: shift Ms right to Ms2.

The new equilibrium E2 lies on the same Md at a lower rate. Label i_2 below i_1 and the larger quantity.

Result: the nominal interest rate falls, which raises investment and shifts AD right.

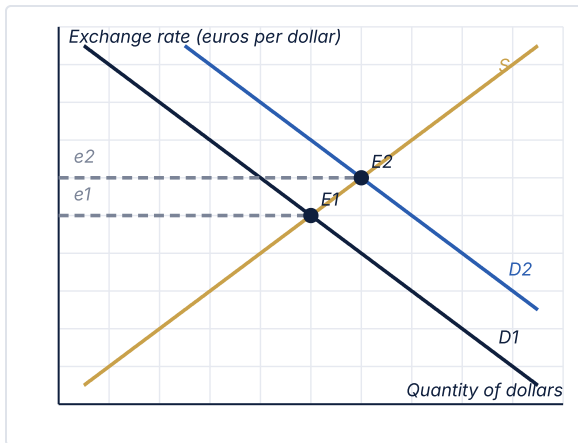
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EXAMPLE 3: FOREIGN EXCHANGE AFTER A RISE IN U.S. INTEREST RATES

U.S. interest rates rise relative to euro-area rates. Show the effect on the value of the dollar.

**SOLUTION**

Label axes Exchange rate (euros per dollar) and Quantity of dollars. Draw $D1$ and $S1$ and mark $E1$.

Higher U.S. returns attract euro-area investors who must buy dollars, so the demand for dollars shifts right to $D2$.

The new equilibrium $E2$ has a higher exchange rate. Label $e2$ above $e1$.

Result: the dollar appreciates, so U.S. exports become more expensive abroad and net exports fall.

Common mistakes

Do not draw an AD curve with the price level shifting it, do not make LRAS slope up, and do not forget that M_s is a vertical line. In the foreign exchange graph, state which currency is on each axis and what the price means. Always put the new equilibrium on the shifted curve and the old curve, because that is how graders check that you shifted only one curve.

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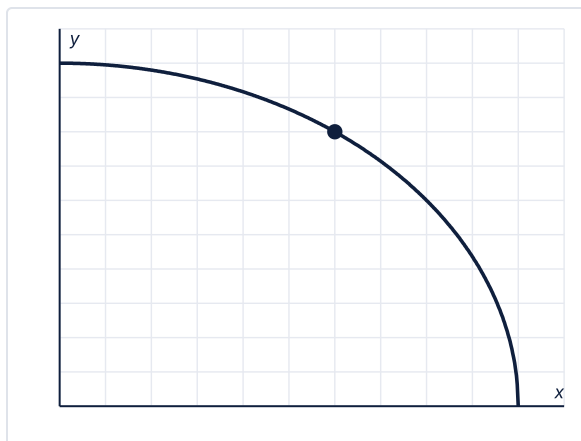
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Practice

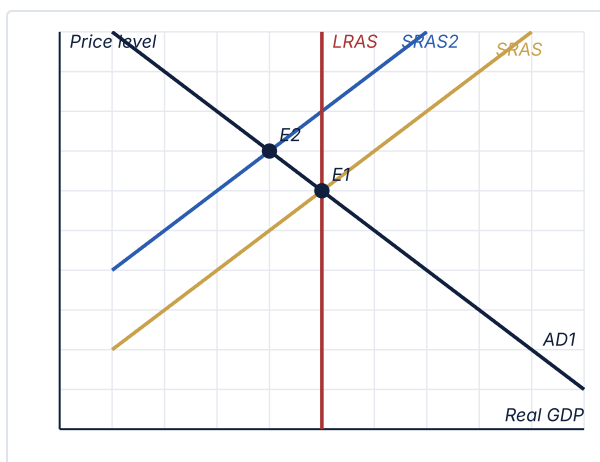
SET A Check Your Understanding

Short answer. Use the graph provided when there is one.

1. The graph below was drawn for a production possibilities question. List four things the student must add to earn full graphing credit.



2. In the AD-AS graph, SRAS has shifted left from SRAS1 to SRAS2. Name a possible cause, and describe the changes in the price level and real GDP.



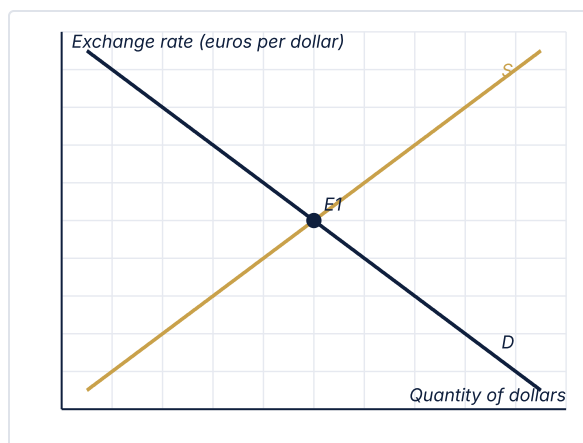
3. A student shows an increase in the money supply by shifting M_d to the right. Explain the error and the correct graph.

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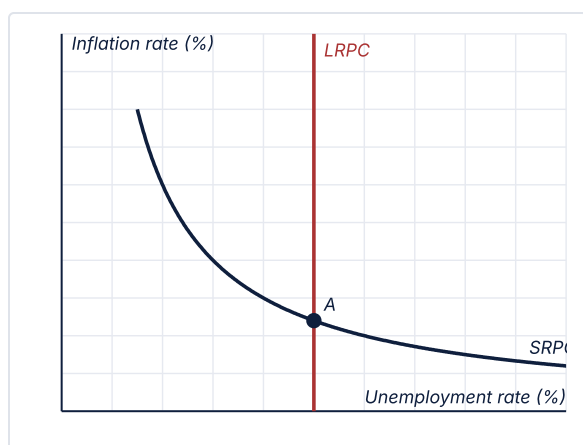
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4. In the foreign exchange graph, Americans start to buy more imported cars from Europe. Which curve shifts, in which direction, and what happens to the value of the dollar?



5. An economy is on its short-run Phillips curve at point A. A fall in aggregate demand occurs. Describe the movement on the graph and the effects on unemployment and inflation.



6. In a loanable funds graph, explain what each axis shows and why the interest rate on the vertical axis is the real rate.

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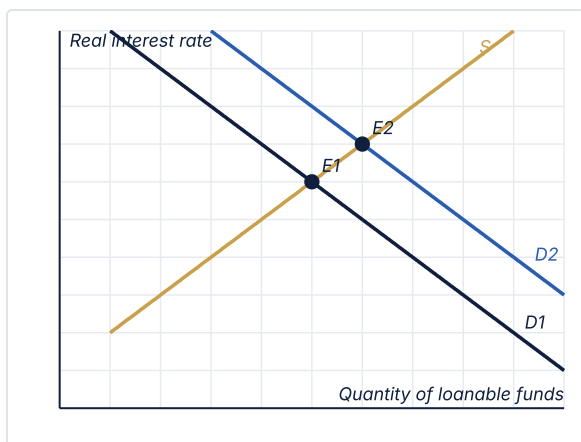
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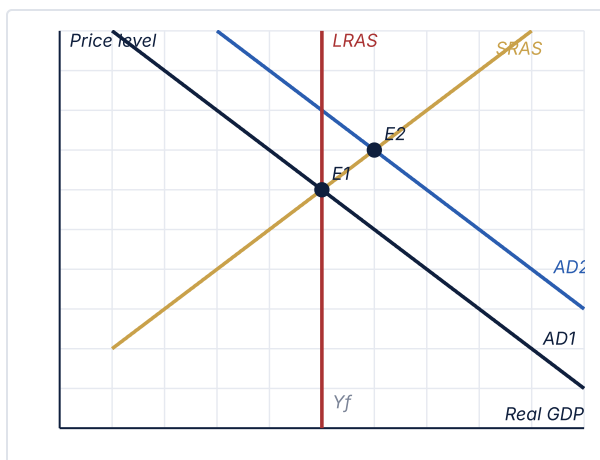
SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which set of labels is complete and correct for a money market graph?
- (A) Vertical axis: nominal interest rate; horizontal axis: quantity of money; curves labeled M_d and M_s with M_s vertical
- (B) Vertical axis: price level; horizontal axis: real GDP; curves AD and $SRAS$
- (C) Vertical axis: real interest rate; horizontal axis: quantity of money; M_s sloping up
- (D) Vertical axis: nominal interest rate; horizontal axis: quantity of loanable funds; curves S and D
- (E) Vertical axis: exchange rate; horizontal axis: quantity of money; M_d vertical
8. In the loanable funds graph, the government runs a larger budget deficit and borrows more. What is the most likely result?



- (A) S shifts right and the real interest rate falls
- (B) D shifts left and the real interest rate falls
- (C) S shifts left and the real interest rate falls
- (D) D shifts right and the real interest rate rises
- (E) Neither curve shifts, but the quantity of funds rises
9. In the AD-AS graph, the movement from E_1 to E_2 is the result of which event?



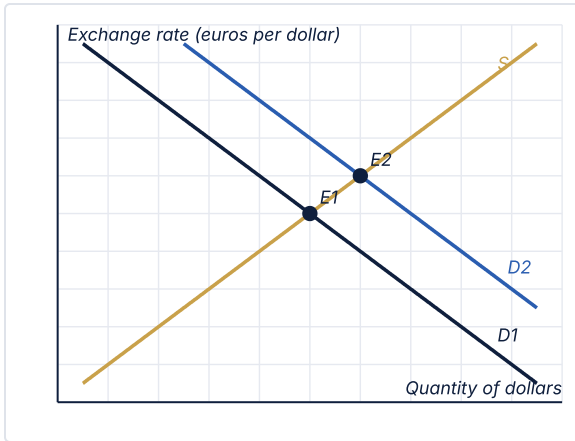
- (A) An increase in the price of imported oil
- (B) A fall in the nominal interest rate caused by a decrease in the money supply
- (C) A decrease in consumer wealth
- (D) A technological improvement
- (E) An increase in government purchases, leaving output above full employment

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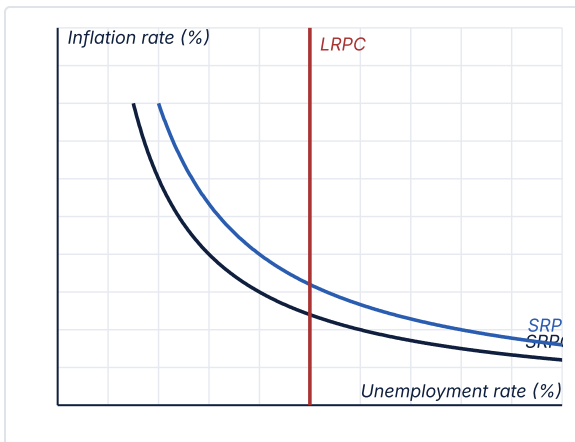
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10. In the foreign exchange graph, the shift of D from D1 to D2 is most likely caused by which event?



- (A) A rise in U.S. imports from Europe
 (B) A rise in U.S. interest rates relative to euro-area rates
 (C) A fall in foreign demand for U.S. exports
 (D) A fall in U.S. interest rates
 (E) A decrease in European demand for U.S. financial assets
11. The graph shows the SRPC moving from SRPC1 to SRPC2. Which event most plausibly caused this shift?



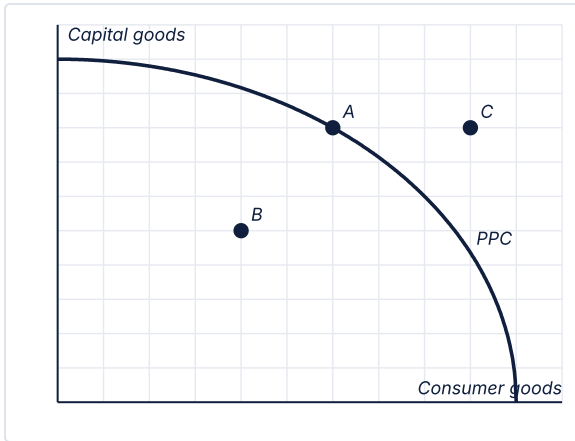
- (A) A decrease in aggregate demand
 (B) An increase in aggregate demand
 (C) An increase in expected inflation
 (D) A fall in the natural rate of unemployment
 (E) A movement along SRPC1 to the left

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12. On the PPC graph, which event moves the economy from point A on the curve to point C?



- (A) Greater use of existing unemployed resources
- (B) An increase in the price level
- (C) Trade restrictions that lower imports
- (D) Technological progress that raises output of both goods, followed by using it to produce more
- (E) A decrease in the labor force

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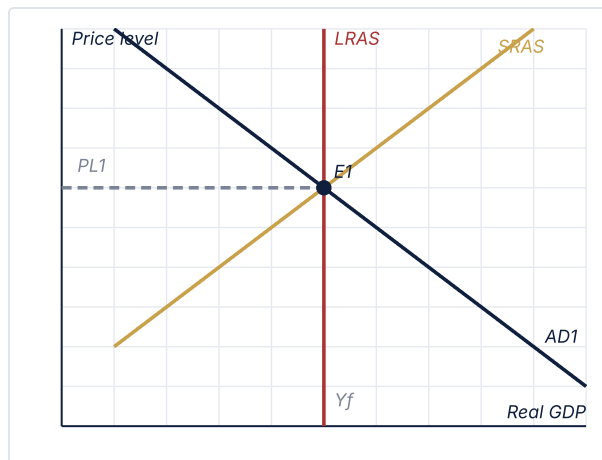
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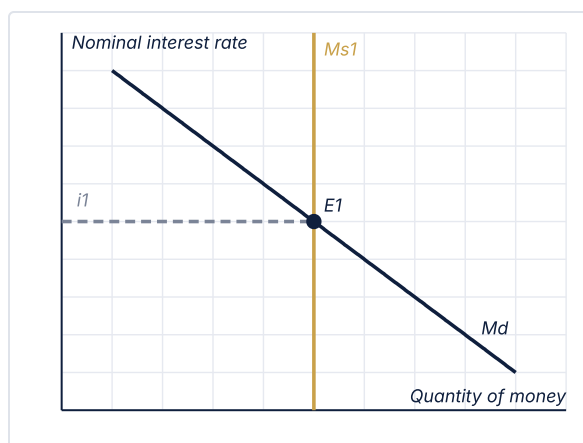
SET C Apply and Extend

Answer in full. Model answers list the scoring points.

13. The economy shown is in long-run equilibrium. A sharp rise in oil prices occurs. (a) Copy the graph and show the short-run effect. Label the new equilibrium, price level, and output. (b) State the effect on the price level, real GDP, and unemployment. (c) If the government and the central bank do nothing, explain what happens in the long run and show it on your graph.



14. The graph shows the money market in equilibrium. The Federal Reserve sells government bonds to banks. (a) Show the effect on the graph and label the new equilibrium. (b) Explain, in terms of bank reserves, why the money supply changes. (c) Explain how the change in the interest rate affects investment, aggregate demand, real GDP, and the price level.

**0.3 Calculations Toolkit and Command Words**

Master every formula the exam uses, practice each one with numbers, and learn what each command word asks you to write.

Every AP Macroeconomics exam includes calculations, and nearly every one uses a short list of formulas. You do not receive a formula sheet on the test, so you must know them cold. Just as important is reading the command word in each question, because it tells you how much to write and which points the grader is looking for.

Percent change and the rule of 70

Percent change = $(\text{new value} - \text{old value}) / \text{old value} \times 100$.

Growth rate of real GDP = $(\text{real GDP this year} - \text{real GDP last year}) / \text{real GDP last year} \times 100$.

Rule of 70: years to double = $70 / \text{annual percent growth rate}$.

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Measure	Formula	Quick note
GDP (expenditure)	$GDP = C + I + G + (X - M)$	Net exports = $X - M$; transfers and used goods are not counted
Real GDP	$Real\ GDP = Nominal\ GDP / GDP\ deflator \times 100$	$Deflator = Nominal / Real \times 100$
Unemployment rate	$Unemployed / Labor\ force \times 100$	$Labor\ force = employed + unemployed$
Labor force participation	$Labor\ force / Adult\ population \times 100$	Discouraged workers are not in the labor force
CPI	$Cost\ of\ basket\ now / cost\ in\ base\ year \times 100$	Base year CPI = 100
Inflation rate	$(CPI_2 - CPI_1) / CPI_1 \times 100$	Same method works with the GDP deflator
Real interest rate	$Nominal\ rate - inflation\ rate$	This is the approximation used on the exam
Spending multiplier	$1 / (1 - MPC) = 1 / MPS$	$MPC + MPS = 1$
Tax multiplier	$-MPC / MPS$	Negative: a tax cut raises GDP
Money multiplier	$1 / \text{required reserve ratio}$	Maximum change in money = excess reserves x multiplier
Opportunity cost	Amount of the other good given up / amount gained	Used with PPC and trade

The multiplier logic. A spending multiplier works because one person's spending is another person's income, and each recipient spends the fraction MPC of every extra dollar. The change in real GDP equals the multiplier times the initial change in spending. The tax multiplier is smaller in size than the spending multiplier, because the first round of a tax cut is partly saved (a government purchase is spent in full). A balanced budget change (G and taxes rise by the same amount) has a multiplier of 1.

EXAMPLE 1: EXPENDITURE GDP AND REAL VERSUS NOMINAL

In Year 1 (the base year), consumption is \$600 billion, investment \$150 billion, government purchases \$250 billion, exports \$120 billion, and imports \$100 billion. (a) Calculate GDP. (b) In Year 2, nominal GDP is \$1,224 billion and the GDP deflator is 120. Calculate real GDP and the growth rate of real GDP.

SOLUTION

(a) $GDP = C + I + G + (X - M) = 600 + 150 + 250 + (120 - 100) = \$1,020$ billion.

(b) $Real\ GDP = nominal\ GDP / deflator \times 100 = 1,224 / 120 \times 100 = \$1,020$ billion.

Growth = $(1,020 - 1,020) / 1,020 \times 100 = 0\%$.

Nominal GDP rose 20%, but all of it was higher prices. Real GDP did not change.

EXAMPLE 2: LABOR MARKET AND INFLATION

A country has an adult population of 250 million, 152 million employed, and 8 million unemployed. (a) Find the unemployment rate and labor force participation rate. (b) A market basket costs \$400 in the base year, \$440 in Year 1, and \$462 in Year 2. Find the CPI in each year and the inflation rate in Year 2. (c) If the nominal interest rate in Year 2 is 7%, find the real interest rate.

SOLUTION

(a) Labor force = $152 + 8 = 160$ million. Unemployment rate = $8/160 \times 100 = 5\%$. Participation rate = $160/250 \times 100 = 64\%$.

(b) CPI Year 1 = $440/400 \times 100 = 110$. CPI Year 2 = $462/400 \times 100 = 115.5$.

Inflation in Year 2 = $(115.5 - 110)/110 \times 100 = 5\%$.

(c) Real interest rate = $7\% - 5\% = 2\%$.

EXAMPLE 3: CLOSING A RECESSIONARY GAP

Real GDP is \$60 billion below full employment and the MPC is 0.75. Calculate the change in government purchases needed, and the tax cut needed, to close the gap. Assume lump-sum taxes and ignore crowding out.

SOLUTION

Spending multiplier = $1/(1 - 0.75) = 4$. Change in G = $60/4 = \$15$ billion.

Tax multiplier = $-0.75/0.25 = -3$. Tax cut needed = $60/3 = \$20$ billion.

The tax cut must be larger than the spending increase because part of each tax cut is saved in round one.

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Money and exchange rates. If the required reserve ratio is 20%, the money multiplier is $1/0.2 = 5$. A bank holding \$500 in deposits must keep \$100 in required reserves. If it holds \$500 in reserves instead, its excess reserves are \$400 and the banking system can expand the money supply by up to $400 \times 5 = \$2,000$. For exchange rates, if 1 dollar buys 0.90 euros, a 45-euro item costs $45/0.90 = \$50$. A rise in the number of euros per dollar is an appreciation of the dollar; a fall is a depreciation.

Command words

Identify, state, or define: name or give the meaning. No reasoning is required.

Describe: say what happens, with direction (increase, decrease, no change). A reason is not needed.

Explain: give the cause-and-effect reasoning. The answer must connect at least two steps.

Calculate: write the formula, substitute numbers, give the answer with units or percent sign.

Draw, label, or show on the graph: a labeled picture, including the shifted curve and new equilibrium.

Command word	Weak response	Strong response
Identify	The Fed does something.	Open market purchase of bonds.
Describe	Rates change.	The nominal interest rate decreases.
Explain	Interest rates fall so GDP goes up.	Lower interest rates reduce the cost of borrowing, so investment rises, AD shifts right, and real GDP rises.
Calculate	5	Multiplier = $1/(1 - 0.8) = 5$; change in GDP = $5 \times \$10 = \$50$ billion.

Cause-and-effect chains. The best explanations have the pattern: event, intermediate step, graph curve that shifts, final result. For example: the central bank buys bonds, so reserves rise and the money supply increases; the nominal interest rate falls; investment increases and AD shifts right; real GDP and the price level rise.

Exam tip

Always show the formula and the substitution, even for easy calculations. A wrong final number with a correct setup can still earn partial credit in many scoring guides, and a bare right number sometimes loses the point if the grader cannot see what you did. Use the correct unit (billions of dollars, percent, index points), and do not round before the final step.

Practice

SET A Check Your Understanding

Calculate. Show the formula, substitution, and answer.

- Consumption is \$800 billion, investment \$250 billion, government purchases \$350 billion, exports \$200 billion, and imports \$250 billion. Calculate GDP.
- Nominal GDP is \$2,640 billion and the GDP deflator is 110. Calculate real GDP. If real GDP was \$2,300 billion last year, calculate the growth rate.
- An economy has 150 million adults, 90 million employed, and 10 million unemployed. Calculate the unemployment rate and labor force participation rate. Then 5 million unemployed people stop looking for work. Recalculate both.
- The CPI is 104 last year and a basket costing \$500 in the base year costs \$546 this year. Calculate this year's CPI and the inflation rate.
- The required reserve ratio is 25%. A bank has excess reserves of \$600 million. Calculate the money multiplier and the maximum increase in the money supply.
- One dollar buys 150 yen. A product costs 12,000 yen. (a) What is its dollar price? (b) If the dollar falls to 120 yen, what is the new dollar price, and by what percent did the dollar's value change?

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SET B Exam-Style Multiple Choice

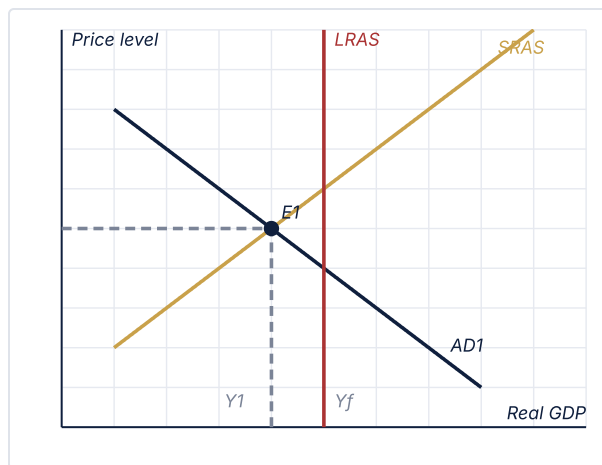
Choose the best answer.

7. Nominal GDP is \$3,300 billion and the GDP deflator is 110. What is real GDP?
 (A) \$3,630 billion (B) \$2,700 billion (C) \$3,410 billion
 (D) \$3,000 billion (E) \$3,190 billion
8. The marginal propensity to consume is 0.9. Government purchases rise by \$5 billion. By how much does real GDP rise, ignoring crowding out?
 (A) \$50 billion (B) \$4.5 billion (C) \$45 billion
 (D) \$9 billion (E) \$5 billion
9. A question says 'Explain how a decrease in the money supply affects investment.' Which response earns full credit?
 (A) Investment decreases
 (B) The money supply decreases, so investment decreases
 (C) The nominal interest rate rises
 (D) Investment is interest sensitive
 (E) The money supply decrease raises the nominal interest rate, which raises the cost of borrowing and lowers investment
10. The nominal interest rate is 9% and inflation is 4%. What is the real interest rate?
 (A) 13% (B) 5% (C) 4% (D) 9% (E) -5%
11. There are 200 million adults, a labor force of 130 million, and 123.5 million employed. What is the unemployment rate?
 (A) 6.5% (B) 3.25% (C) 5% (D) 4.2% (E) 6.8%
12. An economy's real GDP grows at a steady 3.5% a year. About how many years will it take real GDP to double?
 (A) 35 years (B) 14 years (C) 7 years (D) 20 years (E) 50 years

SET C Apply and Extend

Answer in full. Model answers list the scoring points.

13. The economy is in a recession with output \$60 billion below its full employment level, as shown. The MPC is 0.8, and the government plans to close the gap with fiscal policy. (a) Calculate the spending multiplier. (b) Calculate the change in government purchases that would close the gap. (c) Calculate the tax cut needed instead. (d) Show on the graph the effect of the fiscal action chosen in (b).



14. Use the table to answer. (a) Calculate real GDP in Years 2 and 3. (b) Calculate the growth rate of real GDP in Year 3. (c) Calculate the inflation rate in Year 3 using the deflator. (d) If the nominal interest rate in Year 3 is 8%, calculate the real interest rate, and explain what it means for borrowers.

Year	Nominal GDP (\$bn)	GDP deflator
1	2,000	100
2	2,310	105
3	2,640	110

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Answers**Start Here: Answers and Explanations**

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

0.1 The AP Macroeconomics Exam: Format, Scoring, and Study Plan**SET A · CHECK YOUR UNDERSTANDING**

- 70 minutes is 4,200 seconds, and $4,200/60 = 70$ seconds per question. A sensible plan is to finish a first pass in about 55 to 60 minutes, answering easy items fast and marking hard ones, then use the remaining time to return to marked questions. Never leave an item blank, since wrong answers are not penalized.
- Section II is 33.3% of the exam and Question 2 is a quarter of that section, so it is 8.3% of the whole exam. Divided over 5 points, each point is worth about 1.67% of the total score ($33.3/20$).
- Multiple choice: $48/60 \times 66.7 = 53.3$. Free response: $9/20 \times 33.3 = 15.0$. The sum is 68.3, so the student has earned about 68% of the composite score.
- The answer states a result but does not give the reasoning that 'explain' requires. It should add the chain: lower confidence reduces consumption spending, so aggregate demand shifts left, and at the lower demand the equilibrium level of real GDP falls. Naming the component (consumption) and the direction of each step is what earns the explanation point.
- Units 3, 4, and 5 carry the largest shares (17-27%, 18-23%, and 20-30%), about two thirds of Section I together. The implication is to give them the most practice time, especially on the AD-AS, money market, and loanable funds graphs, while still reviewing Units 1, 2, and 6 for quick, reliable points.
- First, mistakes discovered at the end leave no time to fix gaps in content. Second, pacing and stamina for 130 minutes of testing need repeated practice. An improvement is to take a timed section every week, log each missed question by unit, and use the log to decide what to study next.

SET B · EXAM-STYLE MULTIPLE CHOICE

- C. Section I has 60 questions in 70 minutes and carries 66.7% of the score. Choice B has the right time but halves the weight, a common confusion from thinking the two sections count equally.
- A. The long question is 50% of Section II and each short question is 25%, so it counts twice as much. Choice B confuses the three-question total with the ratio of one question to another.
- E. There is no deduction for wrong answers, so a blank can never help. Choice A describes an older scoring rule that no longer applies.
- B. Multiple choice: $36/60 \times 66.7 = 40.0$. Free response: $8/20 \times 33.3 = 13.3$. The sum is 53.3. Choice A comes from weighting each section by raw proportion equally.
- D. The best response gives the full cause-and-effect chain from the action to the money supply to the interest rate. Choice A gives only the result, which is not an explanation, and choice B only labels the policy.
- B. Unit 5 is weighted 20-30%, a ten-point range with the highest maximum. Unit 4 is a close second at 18-23% but has a narrower range and lower ceiling.

SET C · APPLY AND EXTEND

- Model response. Point 1: allocates more than half the time to Units 3 and 4, because they are heavily weighted and are her weak areas (for example, weeks 1-2 on multiplier calculations and fiscal policy, weeks 3-4 on money, banking, and the two interest-rate graphs). Point 2: includes brief maintenance review of Units 1 and 2 (about one session a week) rather than ignoring them. Point 3: covers Units 5 and 6 in weeks 5-6, including Phillips curve and exchange-rate graphs. Point 4: schedules a diagnostic timed section early and full timed practice exams in weeks 7 and 8. Point 5: uses an error log sorted by unit and redraws each missed graph from memory with all labels.
- Model response. Point 1 (calculation): the correct value is $(520 - 500)/500 \times 100 = 4\%$. The student gave the change in dollars, not a percentage, so the point is lost. Point 2 (work): writing the formula and substitution protects credit. Point 3 (explanation): the student restated the result. A full explanation names a cause, for example that an increase in aggregate demand or a gain in productivity raised real GDP, and links it step by step, such as lower interest rates raising investment, which shifts AD right and raises output. Point 4: noting that the value is real, adjusted for price changes, so the increase is in output and not just higher prices.

0.2 Graphs and Labels That Earn Points**SET A · CHECK YOUR UNDERSTANDING**

- Missing items: (1) a label on the vertical axis (for example, capital goods), (2) a label on the horizontal axis (consumer goods), (3) a label on the curve (PPC), and (4) labeled points or a clear marker for the point being discussed. Without these, a grader cannot tell what the graph represents.
- A negative supply shock such as a rise in oil prices (higher input costs) shifts SRAS left. The new equilibrium has a higher price level and lower real GDP, a situation called stagflation, with unemployment rising.
- An increase in the money supply shifts the vertical Ms curve to the right, not Md. Md depends on the price level, income, and interest-rate-sensitive spending decisions. With Md fixed, the larger quantity of money is willing to be held only at a lower nominal interest rate, so the equilibrium moves down along Md.
- Americans must supply dollars to buy euros in order to pay for the imports, so the supply of dollars shifts right. The exchange rate (euros per dollar) falls, so the dollar depreciates.
- The fall in aggregate demand lowers output, so unemployment rises above the natural rate. The economy moves along the SRPC to the right and down, to higher unemployment and lower inflation. The SRPC itself does not shift because of a change in demand.

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6. The vertical axis is the real interest rate because lenders and borrowers care about the purchasing power of the funds they repay. The horizontal axis is the quantity of loanable funds, the total amount saved and lent. Using the real rate keeps inflation expectations out of the picture, which is why the graph uses it and the money market graph uses the nominal rate.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. A. The money market uses the nominal interest rate against the quantity of money, with a vertical M_s set by the central bank. Choice D mixes the money market axes with the loanable funds curves.
8. D. Government borrowing adds to demand for funds, so D shifts right and the real interest rate rises, crowding out private investment. Choice A treats the deficit as extra saving, which is the opposite of what happens.
9. E. E_2 comes from a rightward shift of AD (price level and output both rise), which fits increased government spending and puts output above Y_f (an inflationary gap). Choice A describes a leftward SRAS shift. Choice C shifts AD left.
10. B. Higher U.S. interest rates raise the demand for dollars as foreigners buy U.S. assets, moving the dollar up. Choice A would shift the supply of dollars right instead.
11. C. A shift of the SRPC up and to the right is caused by higher expected inflation or a negative supply shock. Choices A and B are movements along a given curve, not shifts of it.
12. D. Point C is beyond the current frontier, so it requires the PPC itself to shift outward through technology, resources, or education. Choice A moves from inside the curve to the curve, not outside it.

SET C · APPLY AND EXTEND

13. Model response. (a) 1 point: SRAS shifted left and labeled SRAS2 (AD and LRAS unchanged). 1 point: new equilibrium E_2 marked and labeled with PL2 above PL1 and Y_2 below Y_f , with dotted lines. (b) 1 point: price level rises. 1 point: real GDP falls. 1 point: unemployment rises (output below potential, a recessionary gap with stagflation). (c) 1 point: high unemployment puts downward pressure on nominal wages and input prices, so SRAS shifts back right to SRAS1. 1 point: the economy returns to the original equilibrium E_1 at Y_f and the original price level, with the oil shock fully reversed on the graph.
14. Model response. (a) 1 point: M_s shifts left, drawn as a vertical line left of M_{s1} and labeled M_{s2} . 1 point: new equilibrium at a higher nominal interest rate i_2 , shown on the unchanged M_d curve. (b) 1 point: banks pay for the bonds with reserves, so reserves fall; with fewer reserves banks can make fewer loans, and the money supply decreases. (c) 1 point: higher interest rates raise the cost of borrowing, so investment (and interest-sensitive consumption) falls. 1 point: the fall in spending shifts AD left. 1 point: real GDP falls and the price level falls in the short run.

0.3 Calculations Toolkit and Command Words

SET A · CHECK YOUR UNDERSTANDING

1. $GDP = C + I + G + (X - M) = 800 + 250 + 350 + (200 - 250) = 1,400 - 50 = \$1,350$ billion. Net exports are negative because imports exceed exports, which subtracts from GDP.
2. $Real\ GDP = 2,640 / 110 \times 100 = \$2,400$ billion. $Growth = (2,400 - 2,300) / 2,300 \times 100 = 4.3\%$.
3. Labor force = 100 million. Unemployment rate = $10/100 = 10\%$. Participation = $100/150 = 66.7\%$. After 5 million leave the labor force, unemployed = 5 and labor force = 95. Unemployment rate = $5/95 = 5.3\%$. Participation = $95/150 = 63.3\%$. The rate fell only because discouraged workers are no longer counted.
4. This year's CPI = $546/500 \times 100 = 109.2$. Inflation = $(109.2 - 104) / 104 \times 100 = 5\%$.
5. Money multiplier = $1/0.25 = 4$. Maximum increase in the money supply = $600 \times 4 = \$2,400$ million, if no one holds cash and banks lend all excess reserves.
6. (a) $12,000/150 = \$80$. (b) $12,000/120 = \$100$. The dollar changed by $(120 - 150) / 150 \times 100 = -20\%$, a depreciation of 20%. Japanese goods become more expensive to Americans.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. D. Real GDP = $3,300/110 \times 100 = 3,000$. Choice A multiplies by the deflator, the most common inversion.
8. A. The multiplier is $1/(1 - 0.9) = 10$, so $5 \times 10 = \$50$ billion. Choice B uses MPC times the change in G, forgetting the multiplier.
9. E. Only this response connects the action to the intermediate step (higher rate) and then to the result. Choice B skips the mechanism, so it does not explain.
10. B. Real rate = $9\% - 4\% = 5\%$. Choice A adds inflation instead of subtracting it.
11. C. Unemployed = $130 - 123.5 = 6.5$ million. Rate = $6.5/130 \times 100 = 5\%$. Choice B divides unemployed workers by the adult population instead of the labor force.
12. D. Rule of 70: $70/3.5 = 20$ years. Choice A multiplies the growth rate by 10 instead of dividing.

SET C · APPLY AND EXTEND

13. Model response. (a) 1 point: multiplier = $1/(1 - 0.8) = 5$. (b) 1 point: increase in G = $60/5 = \$12$ billion. (c) 1 point: tax multiplier = $-0.8/0.2 = -4$, so the tax cut = $60/4 = \$15$ billion. (d) 1 point: AD shifts right from AD1 to AD2, labeled, with the new equilibrium at Y_f on the vertical LRAS. 1 point: shows the price level rising and real GDP rising to Y_f , with output returning to full employment.
14. Model response. (a) 1 point each: Year 2 real GDP = $2,310/105 \times 100 = \$2,200$ billion; Year 3 real GDP = $2,640/110 \times 100 = \$2,400$ billion. (b) 1 point: $(2,400 - 2,200) / 2,200 \times 100 = 9.1\%$. (c) 1 point: $(110 - 105) / 105 \times 100 = 4.8\%$. (d) 1 point: real rate = $8\% - 4.8\% = 3.2\%$. 1 point: borrowers repay in dollars that are worth less, so the real cost of borrowing is 3.2%, lower than the nominal 8%.

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Chapter 1: Basic Economic Concepts.

7 sections with explanations and worked examples, then 106 practice problems. Answers and full explanations are at the end of the chapter.

1.1 Scarcity, Opportunity Cost, and Choice

Learn why scarcity forces choices, how to measure opportunity cost, how marginal analysis guides rational decisions, and how to tell positive from normative statements.

Economics begins with one fact: people want more than the world can provide. **Scarcity** is the condition that human wants are unlimited while the resources available to satisfy them are limited. Scarcity is not poverty. A billionaire and a student both face it, because both have only 24 hours a day and neither can buy everything. Because of scarcity, every choice has a price, and the central job of economics is to study how people, firms, and governments choose.

Key definitions

Scarcity: unlimited wants versus limited resources; it forces choices.

Opportunity cost: the value of the next best alternative given up when a choice is made. It is the best alternative only, not the sum of all alternatives.

Trade-off: giving up some of one thing to get more of another.

Marginal analysis: comparing the additional benefit of one more unit with the additional cost of that unit.

Resources (factors of production). Everything used to make goods and services falls into four categories, and each earns its own kind of income.

Resource	What it is	Payment it earns
Land	Natural resources: soil, oil, water, minerals, and the land itself	Rent
Labor	Human effort and skills of workers	Wages
Capital	Human-made goods used to produce other goods: machines, factories, tools (not money)	Interest
Entrepreneurship	Organizing the other resources, taking risks, and innovating	Profit

Common mistakes

Financial capital (stocks, cash, bonds) is not capital in the economic sense; only physical capital that produces output counts. Also, scarcity does not mean a good is rare. Sand is plentiful, yet it is still scarce because producing it uses resources that could have made something else.

Opportunity cost. Every real choice gives up something. If you spend Saturday working a shift that pays \$80 instead of studying, the opportunity cost of working is the value of the studying you gave up, and the opportunity cost of studying is the \$80 of wages. Opportunity cost includes implicit costs such as your time, not just money paid out. **Sunk costs**, money already spent that cannot be recovered, are not part of opportunity cost and should be ignored when making a new decision.

When two goods are traded off at a constant rate, opportunity cost is a ratio: the amount of the good given up divided by the amount of the good gained.

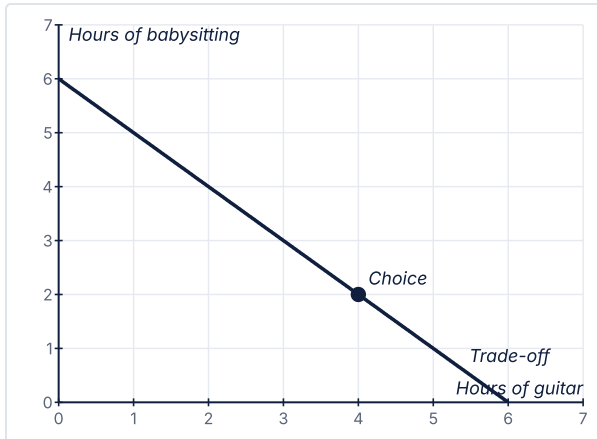
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EXAMPLE 1: OPPORTUNITY COST FROM A BUDGET

Dana has 10 hours this weekend. She can use each hour either to babysit (earning \$12 per hour) or to practice guitar. Each hour of guitar practice raises her skill by one unit, and she has 4 hours of fixed chores. (a) Graph her trade-off between hours of babysitting and hours of guitar. (b) What is the opportunity cost of one hour of guitar? (c) If she chooses 4 hours of guitar, how much does she earn?

**SOLUTION**

Hours available for choice: $10 - 4 = 6$ hours. So babysitting hours + guitar hours = 6, which gives babysitting = $6 - \text{guitar}$.

(a) The trade-off line runs from (0 guitar, 6 babysitting) to (6 guitar, 0 babysitting), shown at right.

(b) Each hour of guitar gives up one hour of babysitting, which is \$12 of earnings. The opportunity cost of an hour of guitar is \$12.

(c) With 4 hours of guitar she babysits $6 - 4 = 2$ hours and earns $2 \times \$12 = \$24$.

Rational choice and incentives. Economists assume people act in their own self-interest and compare costs and benefits. An **incentive** is anything that rewards or penalizes a behavior, such as a price, a tax, a subsidy, or a wage. When the cost of something rises, people tend to do less of it; when the benefit rises, they do more. This is why a higher price reduces purchases and a bonus raises effort.

Marginal analysis. Most choices are not all or nothing but about one more unit. A rational decision maker keeps doing an activity as long as the **marginal benefit (MB)** is at least the **marginal cost (MC)**, and stops where the next unit would cost more than it brings. Marginal benefits typically fall as you consume more, which is the idea of diminishing marginal utility: the first slice of pizza is worth more than the fifth.

Marginal decision rule

Do more of an activity while $MB > MC$.

Stop (the best amount) when $MB = MC$, or at the last unit where $MB \geq MC$.

Never do a unit where $MB < MC$. Past spending (sunk cost) does not belong in MB or MC.

EXAMPLE 2: HOW MANY HOURS SHOULD MARCUS STUDY?

Marcus is preparing for an exam. Each extra hour of study raises his expected score as shown, and each hour costs him \$10 of lost wages (his opportunity cost). He values each exam point at \$4.

Hours studied	Total points gained	Marginal points
1	12	12
2	21	9
3	27	6

SOLUTION

Marginal benefit in dollars = marginal points $\times$ \$4: hour 1 = \$48, hour 2 = \$36, hour 3 = \$24, hour 4 = \$12, hour 5 = \$4.

Marginal cost is \$10 per hour.

Compare: hours 1 through 4 have MB (\$48, \$36, \$24, \$12) at least \$10, so they are worth doing. Hour 5 has MB of \$4 < \$10.

Marcus should study 4 hours. The marginal benefit falls as hours increase, so the rule stops him where the next hour is not worth its cost.

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EXAMPLE 2: HOW MANY HOURS SHOULD MARCUS STUDY?

Marcus is preparing for an exam. Each extra hour of study raises his expected score as shown, and each hour costs him \$10 of lost wages (his opportunity cost). He values each exam point at \$4.

Hours studied	Total points gained	Marginal points
4	30	3
5	31	1

SOLUTION

Marginal benefit in dollars = marginal points x \$4: hour 1 = \$48, hour 2 = \$36, hour 3 = \$24, hour 4 = \$12, hour 5 = \$4.

Marginal cost is \$10 per hour.

Compare: hours 1 through 4 have MB (\$48, \$36, \$24, \$12) at least \$10, so they are worth doing. Hour 5 has MB of \$4 < \$10.

Marcus should study 4 hours. The marginal benefit falls as hours increase, so the rule stops him where the next hour is not worth its cost.

Positive versus normative. A **positive statement** describes what is, was, or will be and can in principle be tested with data ('Raising the minimum wage to \$15 reduced hours worked by 3 percent in this city'). A **normative statement** expresses a value judgment about what ought to be ('The minimum wage should be raised'). A positive statement can be false and still be positive. Economists use positive analysis to show consequences, while normative conclusions depend on values. Words such as should, ought, fair, and best usually signal a normative claim.

Statement	Type	Why
The unemployment rate fell to 4 percent last year.	Positive	Checkable fact
The government should lower unemployment before fighting inflation.	Normative	Value judgment about priorities
Higher gas taxes will reduce driving.	Positive	Testable prediction, even if it turns out wrong
Income inequality is too high.	Normative	'Too high' is a judgment

EXAMPLE 3: CHOOSING BETWEEN TWO OPTIONS

Lena can attend college for a year (tuition \$9,000; she would otherwise work and earn \$28,000) or start a job now. She has already paid a nonrefundable \$500 deposit. What is the explicit cost, the implicit cost, and the total economic cost of the year of college? Should the deposit count?

SOLUTION

Explicit cost (actual payment): tuition = \$9,000.

Implicit cost (forgone earnings): \$28,000.

Total opportunity cost = \$9,000 + \$28,000 = \$37,000.

The \$500 deposit is a sunk cost, already paid and nonrefundable, so it does not change the cost of the decision going forward.

Exam tip

On free-response questions, name the opportunity cost as the specific next best alternative (for example, 'the 2 hours of babysitting forgone'), not a vague phrase. When asked to identify a statement as positive or normative, point to the word that signals a value judgment or to the fact that it could be tested.

Practice**SET A Check Your Understanding**

Answer each item in 2 to 4 sentences, showing any calculation.

1. Define scarcity and explain why a wealthy person still faces it.
2. Classify each as land, labor, capital, or entrepreneurship: (i) a bakery oven, (ii) a farmer's tractor, (iii) an owner who starts a new delivery company and risks her savings, (iv) an iron ore deposit.
3. Priya has one free evening. She can see a movie, babysit, or study. She values the movie at \$30 (after paying for the ticket), the babysitting earnings at \$40, and studying at \$25. She chooses babysitting. What is the opportunity cost of her choice?

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4. A pizza shop will sell a seventh slice only if $MB \geq MC$. The seventh slice costs \$2 to make and a customer values it at \$1.50. Should the shop's customer buy it? Apply marginal analysis.
5. Classify as positive or normative and justify: (a) 'Tuition at public universities rose 4 percent this year.' (b) 'Tuition at public universities ought to be free.'
6. Jamal paid \$60 for a concert ticket. Before the show he is offered a chance to work a shift paying \$80, and he does not value the concert at more than \$50. Explain whether the \$60 should affect his decision.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following best defines opportunity cost?
 - (A) The money price paid for a good
 - (B) The total value of all alternatives given up
 - (C) The value of the next best alternative given up
 - (D) The cost of production for a firm only
 - (E) The sum of explicit and sunk costs
8. A farmer uses a field to grow wheat. Wheat earns \$500, corn would have earned \$650, and soybeans would have earned \$400. The opportunity cost of growing wheat is
 - (A) \$ 400
 - (B) \$ 500
 - (C) \$ 1,050
 - (D) \$ 0 because the wheat earns a profit
 - (E) \$ 650
9. Which is an example of capital as economists use the term?
 - (A) A delivery truck owned by a bakery
 - (B) A share of stock
 - (C) A \$1,000 savings account
 - (D) A government bond
 - (E) A worker's wage
10. Which statement is normative?
 - (A) The inflation rate was 3 percent last year.
 - (B) Raising interest rates reduces borrowing.
 - (C) Unemployment is higher in country X than in country Y.
 - (D) The central bank should always put price stability before employment.
 - (E) Bread prices rose after the drought.
11. A student faces these marginal benefits for hours 1 through 4 of practice: \$30, \$22, \$14, \$6. Each hour has a marginal cost of \$10. To maximize net benefit the student should practice
 - (A) 1 hour
 - (B) 3 hours
 - (C) 2 hours
 - (D) 4 hours
 - (E) 0 hours
12. A firm spent \$2 million on a factory that cannot be sold. It now decides whether to produce, and revenue is expected to exceed additional costs. The \$2 million is
 - (A) A sunk cost that should be ignored
 - (B) Part of the marginal cost of production
 - (C) An opportunity cost of producing
 - (D) The explicit cost of the next decision
 - (E) A marginal benefit of producing

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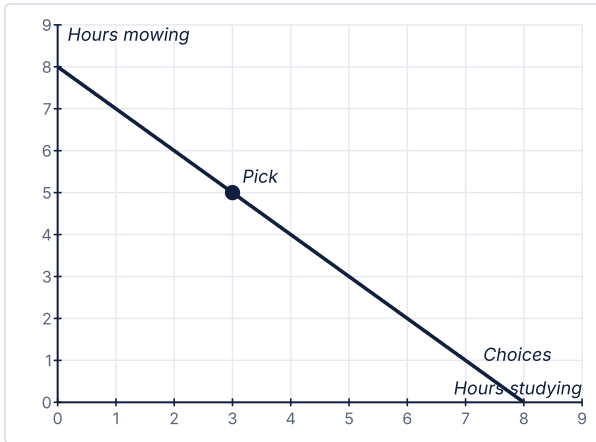
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SET C Apply and Extend

Answer in complete sentences; show your reasoning.

13. Use the graph. Tomas has 8 hours to spend on mowing lawns (earning \$10 per hour) or on his own studying. The graph shows the hours of each he can choose.
- Identify the opportunity cost, in dollars, of one hour of studying.
 - Tomas picks the point shown. How many hours does he study and how much does he earn?
 - A neighbor now offers \$15 per hour. Explain how this incentive changes the opportunity cost of studying and what rational Tomas would likely do.



14. A city council member says: 'The city should spend \$2 million on a new stadium because it will create jobs and everyone deserves a team.' An economist replies: 'The stadium would create 150 jobs, but the same funds spent on road repair would create 220 jobs.'
- Identify one positive and one normative claim in the council member's statement.
 - Using the economist's reply, identify the opportunity cost of the stadium in terms of jobs.
 - Explain why the \$300,000 already spent on stadium design plans should not be counted when deciding whether to continue.

1.2 Production Possibilities Curve

Use the production possibilities curve to show scarcity, efficiency, opportunity cost, and economic growth, and read it from graphs and tables.

The **production possibilities curve (PPC)**, also called the production possibilities frontier, is a model that shows the maximum combinations of two goods an economy can produce in a given time when it uses all its resources fully and efficiently with a given state of technology. It turns scarcity into a picture: because resources are limited, producing more of one good means producing less of the other.

What the PPC assumes

Only two goods are produced (a simplification).

Resources (land, labor, capital, entrepreneurship) are fixed in quantity and quality in the short run.

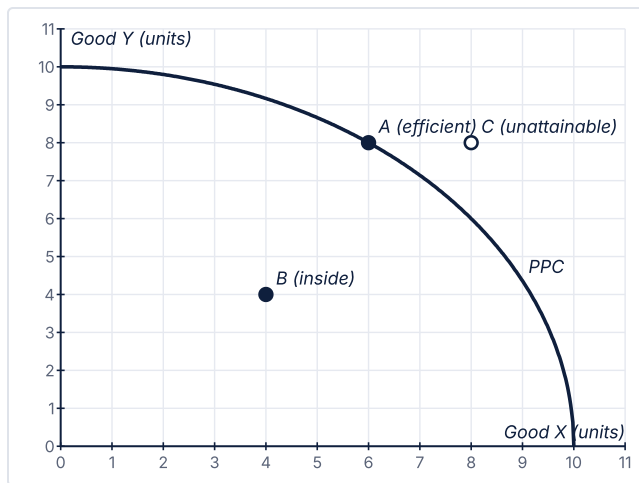
Technology is fixed.

Points on the curve use all resources fully and efficiently.

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Points on the curve (A) are attainable and efficient. Points inside (B) are attainable but waste resources. Points outside (C) cannot be reached with current resources and technology.

Reading the curve. Every point has one of three meanings. A point **on** the curve is attainable and shows productive efficiency. A point **inside** the curve is attainable but means resources are unemployed or misused, which happens during a recession or when workers are in the wrong jobs. A point **outside** the curve is **unattainable** with current resources and technology, though economic growth can make it attainable later.

Efficiency. **Productive efficiency** means producing at the lowest possible cost, which on a PPC means being on the curve: more of one good cannot be made without making less of the other. **Allocative efficiency** means producing the mix of goods that society values most, where the marginal benefit of the last unit of each good equals its marginal cost. Every point on the curve is productively efficient, but only one point is allocatively efficient, the one matching society's preferences. A point inside the curve is productively inefficient (underutilization).

Opportunity cost along the curve. Moving along the PPC from one point to another shows the trade-off. The opportunity cost of one more unit of the good on the x-axis equals the number of units of the y-axis good given up, so it is the absolute slope of the curve (units of Y lost per unit of X gained).

EXAMPLE 1: OPPORTUNITY COST FROM A TABLE

An economy produces computers and bushels of wheat (thousands). Use the table of efficient combinations to find the opportunity cost of each additional thousand computers and state whether opportunity cost is constant or increasing.

Point	Computers	Wheat
A	0	100
B	1	90
C	2	70
D	3	40
E	4	0

SOLUTION

A to B: gain 1 computer, lose $100 - 90 = 10$ wheat. Opportunity cost = 10 wheat.

B to C: lose $90 - 70 = 20$ wheat for 1 computer.

C to D: lose $70 - 40 = 30$ wheat.

D to E: lose $40 - 0 = 40$ wheat.

The opportunity cost rises from 10 to 20 to 30 to 40, so it is increasing, and the PPC is bowed outward.

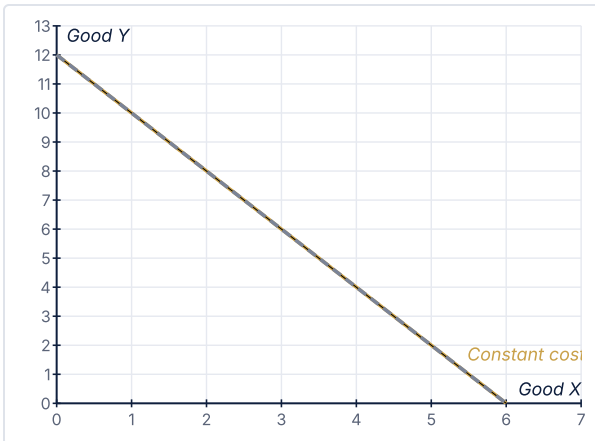
Shape: constant versus increasing opportunity cost. If resources are equally good at making both goods, they can be shifted at a constant rate, and the PPC is a straight line. Most resources are specialized, though. When an economy makes more of a good, it must pull in resources that are less suited to it, such as farmland that is poor for factories. The cost in lost output of the other good climbs, so the PPC bows outward (concave to the origin). This is the **law of increasing opportunity cost**.

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Feature	Straight-line PPC	Bowed-out PPC
Opportunity cost	Constant (slope same everywhere)	Increasing as more X is produced
Resources	Equally adaptable to both goods	Specialized to one good
Example	Two crops grown by identical workers	Corn versus computer chips



A straight-line PPC: each extra unit of X always costs 2 units of Y.

EXAMPLE 2: READING A STRAIGHT-LINE PPC

The straight-line PPC above runs from (0, 12) to (6, 0). (a) What is the opportunity cost of one unit of X? (b) What is the opportunity cost of one unit of Y? (c) Is the combination (3, 7) attainable and efficient?

SOLUTION

- (a) Moving from (0, 12) to (6, 0) gives up 12 units of Y for 6 units of X, so 1 X costs 2 Y.
 (b) The reverse: 1 Y costs $6/12 = 0.5$ X. Opportunity costs of the two goods are reciprocals.
 (c) On the line, $Y = 12 - 2(3) = 6$ when $X = 3$. The point (3, 7) has $Y = 7 > 6$, so it lies outside the curve: unattainable.

Common mistakes

Opportunity cost is not read from a single point; it is measured by moving between points. Do not call a point inside the curve 'efficient' just because it is attainable, and do not say a point on the curve is unattainable. Also, a recession moves the economy to a point inside the PPC; it does not shift the curve itself.

Shifts of the PPC. The curve shifts outward with **economic growth**, which comes from more resources (a larger labor force, more capital or natural resources, more land) or better technology or education (higher productivity). It shifts inward when resources are lost or destroyed, such as a war, a natural disaster, or a shrinking labor force. A change in technology that helps only one good pivots the curve: the intercept for that good moves, while the other intercept stays put. Unemployment or a recession moves the economy off the curve, not the curve.

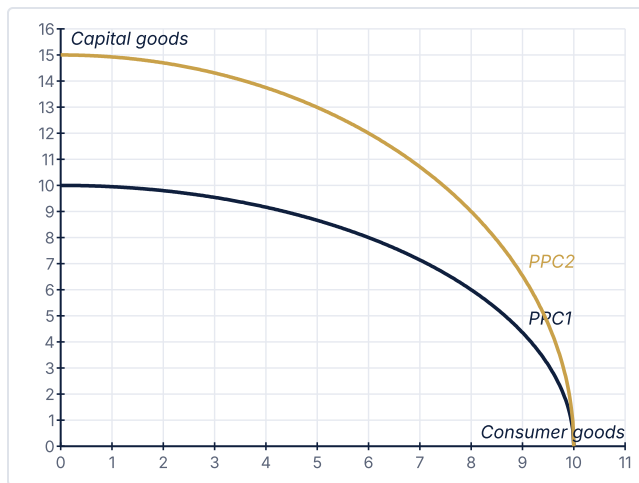
Rules for the PPC

- On the curve = efficient; inside = underutilization (unemployment, waste); outside = unattainable now.
 Outward shift = growth (more resources or better technology); inward shift = lost resources.
 Opportunity cost = units of Y given up per unit of X gained = absolute slope.
 Bowed-out PPC means increasing opportunity cost; straight line means constant opportunity cost.

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New technology in capital-goods production pivots the curve: the capital-goods intercept rises from 10 to 15 while the consumer-goods intercept stays at 10.

EXAMPLE 3: EXPLAINING A SHIFT

A country's government subsidizes education and technical training, and over the decade its workforce becomes more productive. Draw and explain the effect on its PPC for consumer goods and capital goods, and state what happens to the point the country can reach.

SOLUTION

More productive workers raise the quantity of both goods that can be produced with the same hours, so both intercepts move out. The PPC shifts outward (right and up) in a roughly parallel way.

Combinations that were unattainable before, such as one with more of both goods, are now attainable. This is economic growth.

If the country invests more in capital goods today, it grows faster, so its future PPC shifts out more.

Practice

SET A Check Your Understanding

Answer each item in 2 to 4 sentences, showing any calculation.

- On a bowed-out PPC for tanks and tractors, an economy moves from producing 20 tractors and 0 tanks to 18 tractors and 3 tanks, then to 14 tractors and 6 tanks. Find the opportunity cost per tank in each move and explain what it shows.
- Define productive efficiency and allocative efficiency, and state which points of a PPC satisfy each.
- The economy is at a point inside its PPC. Name two possible causes and explain what the economy could do to reach the curve.
- A table shows an economy can make (shirts, cars) as (0, 50), (10, 40), (20, 25), (30, 5). What is the opportunity cost of the first 10 shirts, and what does the pattern of costs reveal about the shape of the PPC?
- Explain why a country's PPC for two goods is a straight line only when resources are equally suited to both goods.
- For each event, state whether the PPC shifts outward, inward, or the economy moves along or off the curve: (a) a discovery of a large oil deposit, (b) a recession raises unemployment, (c) an earthquake destroys factories.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. A point inside an economy's PPC represents
 (A) Attainable production with unemployed or misused resources
 (B) Productive efficiency
 (C) An output that is unattainable with current resources
 (D) Allocative efficiency
 (E) Economic growth
8. A PPC for guns and butter includes the combinations shown. Moving from A to B to C, the opportunity cost of guns

Point	Guns	Butter
A	0	20
B	3	17
C	6	11

- (A) decreases as more guns are produced
 (B) stays constant
 (C) cannot be determined without prices
 (D) increases as more guns are produced
 (E) is zero because both points are on the curve
9. Which event would shift a country's PPC outward?
 (A) A rise in the unemployment rate
 (B) Adoption of a new technology that raises worker productivity
 (C) A decline in consumer spending
 (D) A temporary recession
 (E) A temporary strike that ends
10. A straight-line PPC between pizzas and burgers has intercepts of 30 pizzas and 15 burgers. The opportunity cost of one burger is
 (A) 0.5 pizza (B) 15 pizzas (C) 30 pizzas (D) 1 pizza (E) 2 pizzas
11. The PPC pivots so that the intercept on the capital-goods axis increases but the consumer-goods intercept does not change. The most likely cause is
 (A) An increase in the labor force
 (B) A decline in all resources
 (C) A technological improvement that affects only capital-goods production
 (D) A recession
 (E) A move to a different point on the same PPC
12. An economy is at point A on its PPC. It then moves to a point on the same curve with more capital goods and fewer consumer goods. Which statement is true?
 (A) The PPC shifts inward.
 (B) The economy has become productively inefficient.
 (C) The economy has experienced economic growth immediately.
 (D) The economy has traded consumer goods today for faster growth later.
 (E) Opportunity cost has fallen to zero.

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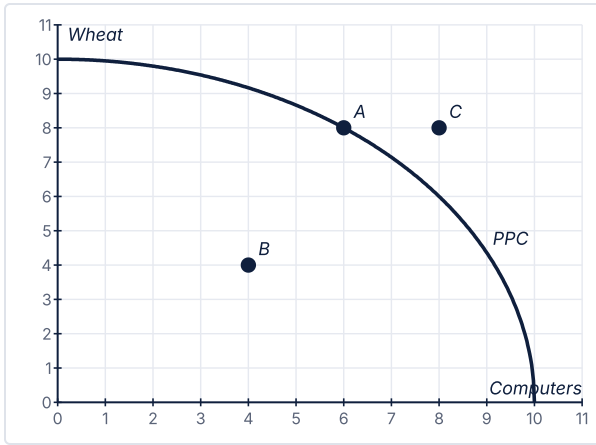
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SET C Apply and Extend

Answer in complete sentences; show your reasoning.

13. The graph shows a PPC for an economy producing wheat and computers (units), with points A, B, and C.
- Which point or points show productive efficiency? Explain.
 - Which point shows underutilization of resources, and give one possible cause?
 - Which point is unattainable? Explain what would make it attainable.
 - Draw (describe) the effect of a new technology that raises computer production only.



14. Country X has a PPC for consumer goods and capital goods. It chooses to produce mostly consumer goods this year, while Country Y, with an identical PPC, chooses mostly capital goods.
- Explain which country is more likely to have a PPC that shifts farther outward in ten years, and why.
 - A recession then strikes Country X. State what happens to the economy's position relative to its PPC.
 - Explain how an outward shift in the PPC differs from a movement from inside the curve to the curve.

1.3 Comparative Advantage, Specialization, and Trade

Distinguish absolute from comparative advantage, compute opportunity costs from output and input tables, and show how specialization and trade create gains.

Why do people and countries trade instead of making everything themselves? Because specialization and trade let each side consume more than it could produce alone. The key idea is not who is better at making something, but who gives up less to make it.

Absolute versus comparative advantage

Absolute advantage: the ability to produce a good using fewer resources (or in less time), or to produce more output with the same resources.

Comparative advantage: the ability to produce a good at a lower opportunity cost than another producer.

Trade is based on comparative advantage. A producer can have an absolute advantage in everything and still gain from trade.

Two ways tables are given. An **output table** lists how much of each good a producer can make with the same resources (for example, in one hour). An **input table** lists how many hours or workers it takes to make one unit. The method differs in direction, so read the table carefully before dividing.

- Output table** Absolute advantage goes to the producer with the larger number. Opportunity cost of good X = (amount of Y given up) / (amount of X gained) = Y output / X output.
- Input table** Absolute advantage goes to the producer with the smaller number (fewer hours). Opportunity cost of X = (hours per unit of X) / (hours per unit of Y).
- Compare** The producer with the lower opportunity cost for a good has the comparative advantage in it. With two goods and two producers, each has the comparative advantage in exactly one good (unless costs are identical).

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EXAMPLE 1: OUTPUT TABLE

In one hour, Alpha can make 12 bushels of wheat or 6 yards of cloth. Beta can make 4 bushels of wheat or 4 yards of cloth. (a) Who has an absolute advantage in each good? (b) Find each country's opportunity cost of wheat and of cloth. (c) Who has the comparative advantage in each good?

Per hour	Wheat	Cloth
Alpha	12	6
Beta	4	4

SOLUTION

- (a) Alpha makes more of both goods, so Alpha has an absolute advantage in wheat and in cloth.
 (b) Alpha: 1 wheat costs $6/12 = 0.5$ cloth; 1 cloth costs $12/6 = 2$ wheat. Beta: 1 wheat costs $4/4 = 1$ cloth; 1 cloth costs 1 wheat.
 (c) Wheat: Alpha $0.5 < \text{Beta } 1$, so Alpha has the comparative advantage in wheat. Cloth: Beta $1 < \text{Alpha } 2$, so Beta has the comparative advantage in cloth, even though Alpha is better at both.

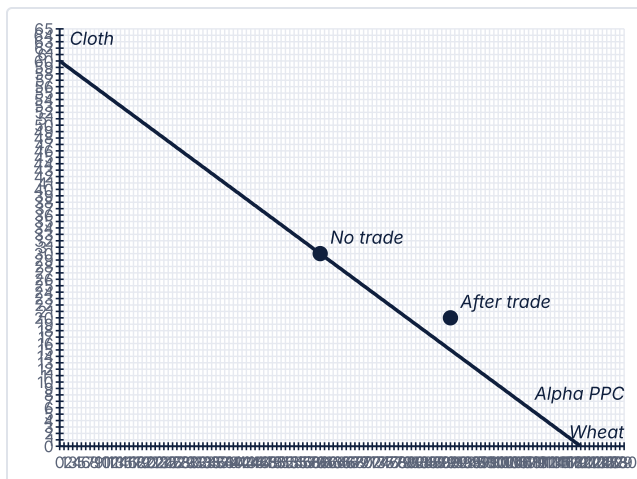
Terms of trade and gains. The **terms of trade** are the rate at which two goods are exchanged. For both sides to gain, the rate must fall between the two countries' opportunity costs. Here a yard of cloth would trade for between 1 wheat (Beta's cost) and 2 wheat (Alpha's cost). Beta will not accept less than 1 wheat per cloth because it could make that itself, and Alpha will not pay more than 2 wheat per cloth because it could make cloth for 2 wheat itself.

Terms of trade rule

Both sides gain only if the exchange rate lies strictly between the two opportunity costs.
 Each producer specializes where its opportunity cost is lower, then trades for the other good.
 After trade, consumption can lie outside a country's own PPC.

EXAMPLE 2: GAINS FROM SPECIALIZATION AND TRADE

Continue with Alpha and Beta, each with 10 hours. Before trade each uses half its hours on each good. After specialization, they trade 20 cloth for 30 wheat (terms of trade: 1 cloth = 1.5 wheat). Show that both gain. The graph shows Alpha's PPC.

**SOLUTION**

Alpha, 10 hours: 120 wheat or 60 cloth. Beta: 40 wheat or 40 cloth.
 No trade: Alpha 5 hours each = 60 wheat and 30 cloth; Beta = 20 wheat and 20 cloth. Total: 80 wheat and 50 cloth.
 Specialize: Alpha makes 120 wheat; Beta makes 40 cloth.
 Trade: Alpha gives 30 wheat and gets 20 cloth, ending with 90 wheat and 20 cloth. Beta gives 20 cloth and gets 30 wheat, ending with 30 wheat and 20 cloth.
 Alpha: 30 more wheat but 10 fewer cloth. At 2 wheat per cloth, 10 cloth are worth 20 wheat, so Alpha nets 10 wheat equivalent. Beta: 10 more wheat and the same cloth (20), so Beta clearly gains.
 Alpha's after-trade point (90, 20) lies outside its PPC (the line gives $60 - 45 = 15$ cloth at 90 wheat), showing that trade lets consumption exceed what the country can produce alone.

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Concept	Question it answers	How to find it
Absolute advantage	Who produces more per hour or uses fewer hours?	Compare raw output or raw input numbers
Comparative advantage	Who gives up less?	Compare opportunity costs
Terms of trade	What exchange rate benefits both?	Choose a rate between the two opportunity costs
Specialization	What should each produce?	Each produces the good with the lower opportunity cost

EXAMPLE 3: INPUT TABLE

It takes Freedonia 3 hours to make a phone and 6 hours to make a jacket. It takes Gondor 5 hours to make a phone and 5 hours to make a jacket. Which country should specialize in what, and what range of trades works?

SOLUTION

Opportunity cost of one phone: Freedonia $3/6 = 0.5$ jacket; Gondor $5/5 = 1$ jacket. Freedonia has the lower cost, so the comparative advantage in phones.

Opportunity cost of one jacket: Freedonia $6/3 = 2$ phones; Gondor $5/5 = 1$ phone. Gondor has the comparative advantage in jackets. Freedonia specializes in phones, Gondor in jackets.

Terms of trade: 1 phone should trade for between 0.5 and 1 jacket (equivalently, 1 jacket for between 1 and 2 phones).

Trade-off graphs. A straight-line PPC reflects constant opportunity cost, and the slope is that cost. The country whose PPC is flatter for good X (a smaller y-axis loss per unit of X) has the comparative advantage in X. Two countries with the same slopes have no comparative advantage and no gains from specialization along these lines. Real countries have increasing opportunity costs, so specialization is usually partial rather than complete.

Common mistakes

Do not confuse absolute and comparative advantage. The country that is better at everything does not make everything; it still specializes where its opportunity cost is lowest. Also, when dividing, put the good you give up on top: opportunity cost of X is Y/X on an output table but hours of X / hours of Y on an input table. Check by confirming the two goods' opportunity costs for one country are reciprocals.

Why specialization is not complete in reality. Differences in resources, climate, skills, and technology create comparative advantage, but transportation costs, shifting costs of resources, and political concerns limit how far countries specialize. Still, the principle explains why a skilled lawyer who types faster than her assistant still hires the assistant: her time is worth more in legal work.

Practice**SET A Check Your Understanding**

Answer each item, showing your calculations.

1. Define absolute advantage and comparative advantage. Can one producer have an absolute advantage in both goods? Can it have a comparative advantage in both? Explain.
2. In one day Maya can knit 6 scarves or bake 12 loaves. Leo can knit 2 scarves or bake 8 loaves. Find the opportunity cost of one scarf for each, and say who has the comparative advantage in scarves.
3. It takes Ava 2 hours to mow a lawn and 1 hour to paint a fence. It takes Ben 6 hours to mow a lawn and 2 hours to paint a fence. Who has the absolute advantage in each task? Who has the comparative advantage in mowing?
4. Using Maya and Leo from item 2, give a range of terms of trade (loaves per scarf) that benefits both, and explain how you found it.
5. A country's PPC is the line from 40 cars on the y-axis to 20 tractors on the x-axis. Compute the opportunity cost of a tractor and of a car.
6. Explain why two countries with identical opportunity costs for both goods have no gains from specialization and trade.

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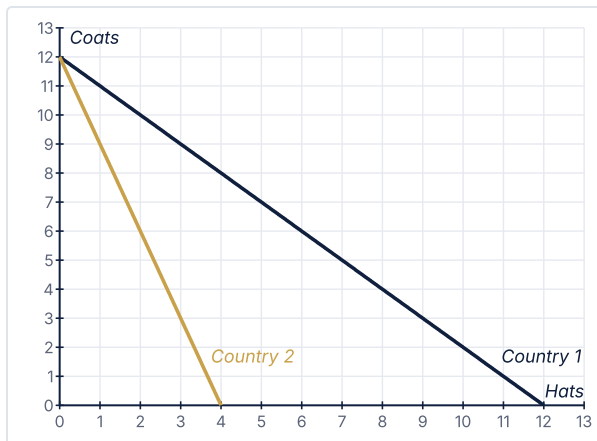
SET B Exam-Style Multiple Choice

Choose the best answer.

7. In one hour, Country P can produce 20 units of corn or 10 units of steel. Country Q can produce 12 units of corn or 8 units of steel. Which statement is correct?

Per hour	Corn	Steel
P	20	10
Q	12	8

- (A) Country P has the comparative advantage in steel.
 (B) Country Q has the comparative advantage in steel.
 (C) Country Q has the absolute advantage in both goods.
 (D) Country P has a comparative advantage in neither good.
 (E) Country Q has the comparative advantage in corn.
8. Using the same data, which terms of trade would benefit both countries?
 (A) 1 steel for 1 corn (B) 1 steel for 2.5 corn (C) 1 steel for 0.5 corn
 (D) 1 steel for 1.8 corn (E) 1 steel for 1.2 corn
9. It takes country A 2 hours to produce a bushel of wheat and 4 hours to produce a unit of cloth. It takes country B 3 hours for wheat and 3 hours for cloth. Country A's opportunity cost of one unit of cloth is
 (A) 0.5 bushel of wheat (B) 1 bushel of wheat (C) 4 bushels of wheat
 (D) 1.33 bushels of wheat (E) 2 bushels of wheat
10. A country can consume at a point outside its own PPC after
 (A) Specializing and trading (B) Reducing unemployment
 (C) Choosing a different point on its PPC (D) Cutting its own production of both goods
 (E) Losing absolute advantage
11. Which statement about a country that has an absolute advantage in producing every good is true?
 (A) It should produce everything domestically.
 (B) It has a comparative advantage in every good.
 (C) It can still gain by specializing and trading.
 (D) It cannot benefit from trade.
 (E) Its opportunity costs are all zero.
12. The graph shows the PPCs of two countries producing coats and hats. Country 1 gives up 1 coat per hat; country 2 gives up 3 coats per hat. Which country has a comparative advantage in hats?



- (A) Country 2 (B) Neither (C) Both
 (D) It cannot be determined (E) Country 1

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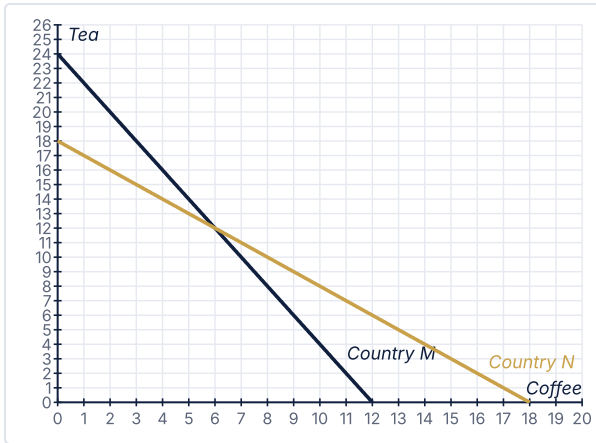
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SET C Apply and Extend

Answer in complete sentences; show your reasoning.

13. Country M and country N each produce coffee and tea. The graph shows their PPCs (thousands of tons).
- Identify which country has the absolute advantage in each good.
 - Calculate each country's opportunity cost of one ton of coffee.
 - Identify the comparative advantage in coffee and in tea, and state what each country should specialize in.
 - Explain whether a trade of 1 ton of coffee for 1.5 tons of tea benefits both.



14. Country R can make 10 laptops or 40 bicycles per month using all its labor. Country S can make 5 laptops or 10 bicycles.
- Which country has the absolute advantage in each good?
 - Calculate the opportunity cost of one laptop for each country, and state who has the comparative advantage in laptops.
 - Explain why Country R, though better at both goods, still gains from trading with S.

1.4 Economic Systems and the Circular Flow

Compare market, command, and mixed economies, explain why property rights matter, and trace money and resources through the circular-flow model.

Every society must answer three questions because of scarcity: **what** to produce, **how** to produce it, and **for whom** to produce it. An **economic system** is the set of institutions and rules a society uses to answer them. Systems differ mainly in who makes the decisions: private individuals through markets, or the government through planning.

Feature	Market economy	Command economy	Mixed economy
Who decides	Households and firms through prices	Central government planners	Both markets and government
Property	Mostly private	Mostly state-owned	Private property with government rules and public goods
Prices	Set by supply and demand	Set or controlled by planners	Mostly market, with some regulation (price controls, taxes)
Strength	Efficiency, innovation, choice	Can pursue social goals quickly	Balances efficiency with equity and stability
Weakness	Inequality, externalities, public goods missing	Shortages, surpluses, little incentive to innovate	Debate over how much government is right
Examples	Close to pure form: none exists; Hong Kong comes near	Former Soviet Union; North Korea	United States, Canada, France, nearly all nations

Economic systems

Market economy: decisions about resources are made by private buyers and sellers responding to prices and the profit motive.

Command economy: a central authority decides what, how, and for whom.

Mixed economy: a blend; every real economy is mixed. The question is how much of each, not whether.

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Property rights. **Private property rights** are the legal rights to own, use, and sell resources and goods. Markets work well only when these rights are protected by courts and contracts. If someone could take what you build, you would have little reason to invest, save, or innovate. Weak property rights are a key reason some poor countries grow slowly, and secure rights are a core ingredient of a market-based economy. Other institutions that make markets work include a stable currency, enforceable contracts, and a legal system.

Incentives under each system. In a market economy, prices and profits signal what consumers want, so firms that serve people well earn rewards. In a command economy, planners must gather information about millions of goods; without price signals, they often misjudge quantities, leading to shortages of some goods and waste of others. Mixed economies keep markets for most goods but use government for public goods (national defense), to correct externalities (pollution), to provide a safety net, and to stabilize the economy.

Common mistakes

Do not describe the United States as a pure market economy; it is mixed. Also, 'command' does not mean 'dictatorship'; it describes how economic decisions are made. And a mixed economy is not a command economy: government taxing and regulating does not mean it plans production.

The circular-flow model. The **circular-flow diagram** shows how money, goods, services, and resources move among the sectors of the economy. Households own the factors of production and sell them to firms; firms make goods and sell them to households. Two markets connect them.

- ◆ **Product (goods and services) market:** firms sell, households buy. Money flows from households to firms as consumer spending; goods and services flow the other way.
- ◆ **Factor (resource) market:** households sell labor, land, capital, and entrepreneurship; firms buy. Money flows from firms to households as wages, rent, interest, and profit (household income); resources flow from households to firms.

Basic flows

Real flows: resources (to firms) and goods and services (to households).

Money flows run opposite: income to households, spending to firms.

In the simple two-sector model, total spending on output = total income = GDP, since every dollar spent becomes someone's income.

Adding more sectors. The simple model leaves out saving, government, and the rest of the world. A fuller model includes **financial markets** (where saving is channeled into investment), **government**, and the **foreign sector**.

Leakages (money leaving the spending stream)	Injections (money added to the spending stream)
Saving (S): income not spent on current consumption	Investment (I): firms' spending on capital goods, funded by borrowing saving
Taxes (T): payments to government	Government spending (G) on goods, services, and transfers
Imports (M): spending on foreign goods	Exports (X): foreign spending on domestic goods

EXAMPLE 1: LEAKAGES AND INJECTIONS

In a certain economy, households earn \$1,000 billion in income. They save \$100 billion, pay \$150 billion in taxes, and spend \$50 billion on imports. Firms invest \$80 billion, the government spends \$150 billion, and exports are \$70 billion. (a) Find total leakages and total injections. (b) Will the flow of spending expand, shrink, or stay stable? (c) How much is spent on domestic goods by households?

SOLUTION

- (a) Leakages = $S + T + M = 100 + 150 + 50 = \$300$ billion. Injections = $I + G + X = 80 + 150 + 70 = \$300$ billion.
 (b) Injections equal leakages, so the circular flow is stable: the economy neither expands nor contracts.
 (c) Household consumption spending on domestic goods = income - saving - taxes - imports = $1,000 - 100 - 150 - 50 = \$700$ billion.

The role of government. Government appears in the circular flow in several ways. It buys goods from the product market (such as roads and defense) and buys resources (such as teachers' labor) in the factor market. It collects taxes from households and firms and makes transfer payments (such as Social Security and unemployment benefits) and subsidies. It also provides **public goods**, regulates, enforces property rights, and uses fiscal policy to influence economic activity. When leakages exceed injections, spending falls and the economy slows; when injections exceed leakages, spending and output tend to rise.

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EXAMPLE 2: WHICH MARKET AND WHICH DIRECTION?

Name the market and the direction of money and resource flows in each event: (a) A cafe hires a barista. (b) A family buys a refrigerator. (c) The city pays a construction firm to repair a bridge. (d) A student takes out a loan, and a bank lends it.

SOLUTION

(a) Factor market: labor flows from the household to the firm; wages (money) flow from the firm to the household.

(b) Product market: the refrigerator flows to the household; consumer spending (money) flows to the firm.

(c) Product market with government as buyer: the firm provides a service; the government pays with tax revenue. This is an injection (G).

(d) Financial market: saving by households is lent out; the loan funds spending. Money from savers (a leakage from consumption) returns to the flow when borrowed for investment or consumption.

EXAMPLE 3: CLASSIFYING AN ECONOMY

Country Z allows people to own businesses and set prices for most goods, but the government runs the railways, taxes heavily to fund health care, and controls the price of rent. Which system does it use, and what evidence supports your choice? What is one market failure a mixed system addresses?

SOLUTION

It is a mixed economy: private ownership and market-set prices for most goods plus government ownership (railways), taxation for public services, and price controls.

Evidence needs both market and government elements. A pure market economy would not have rent controls or state railways; a command economy would not allow private businesses to set prices.

A mixed economy can correct market failures such as externalities (pollution) or underprovision of public goods like national defense.

On the AP exam, circular-flow questions usually test whether you can place a transaction in the right market, identify who is the buyer and seller, or classify an item as a leakage or injection.

Practice**SET A Check Your Understanding**

Answer each item in 2 to 4 sentences, showing any calculation.

1. State the three basic economic questions every society must answer, and explain why scarcity forces them.
2. Explain why private property rights matter for a market economy, and give one example of how weak property rights could reduce investment.
3. Fill in the blanks for the simple circular flow: Households sell _____ in the _____ market and receive _____. They use that income to buy _____ in the _____ market.
4. Classify as a leakage or an injection: (i) a household increases its savings, (ii) a foreign country buys more U.S. soybeans, (iii) the government builds a new highway, (iv) income taxes rise.
5. In an economy, $S = \$60$, $T = \$90$, $M = \$30$, $I = \$50$, $G = \$90$, $X = \$20$. Compute total leakages and injections and predict what will happen to spending.
6. Compare a command economy and a mixed economy in how prices are determined and give one disadvantage of each.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following best describes a mixed economy?
(A) The government makes all decisions about production
(B) There is no private property
(C) Private markets coexist with government that provides public goods and regulates
(D) Prices are set only by supply and demand
(E) Only exports and imports are regulated
8. In the circular-flow model, the flow of wages and salaries goes
(A) Firms to households in the factor market
(B) Households to firms in the product market
(C) Households to firms in the factor market
(D) Firms to households in the product market
(E) Government to firms in the product market
9. Which of the following is a leakage from the circular flow?
(A) Government spending on highways
(B) Investment by firms in new machinery
(C) Exports of agricultural goods
(D) A government subsidy to firms
(E) Household saving
10. Which feature would most likely be weakest in a command economy compared with a market economy?
(A) Government control over what is produced
(B) Incentives to innovate and satisfy consumer demand
(C) Central planning of resource use
(D) Public ownership of resources
(E) Government setting prices
11. Suppose leakages ($S + T + M$) equal \$400 billion and injections ($I + G + X$) equal \$450 billion. The most likely result is
(A) A decrease in spending and output
(B) No change in spending and output
(C) A decrease in household income
(D) An increase in spending and output
(E) An increase in leakages only
12. A town's government builds a library using tax revenue. In the circular flow, this transaction is best described as
(A) Government purchasing goods and services in the product market, financed by taxes
(B) A transfer payment to households
(C) Household saving
(D) An export
(E) A purchase in the factor market with no tax link

SET C Apply and Extend

Answer in complete sentences.

13. Consider the circular-flow model with households, firms, government, financial markets, and the foreign sector.
 - (a) Identify two leakages and two injections.
 - (b) Suppose households save more while firms do not change their investment. Explain the effect on the flow of spending.
 - (c) Explain how the government can use its role in the circular flow to offset the change in (b).
14. Compare a market economy and a command economy.
 - (a) Explain how each determines what is produced.
 - (b) Explain one advantage of a market system over a command system.
 - (c) Explain why every actual economy is described as mixed and name one government function in a mixed economy.

1.5 Demand, Supply, and Market Equilibrium Review

Review the laws of demand and supply, shifters, equilibrium, surpluses and shortages, and the effects of price ceilings and floors.

The supply and demand model explains how prices and quantities are set in competitive markets, and it is used throughout macroeconomics (for example, in labor markets, loanable funds, and foreign exchange). This lesson reviews what you need.

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Law of demand and law of supply

Law of demand: when the price of a good rises, the quantity demanded falls, *ceteris paribus* (all else equal). The demand curve slopes downward.

Law of supply: when the price of a good rises, the quantity supplied rises, *ceteris paribus*. The supply curve slopes upward.

Equilibrium: the price and quantity where quantity demanded equals quantity supplied; the market clears.

A change in the good's own price causes a **change in quantity demanded** or **change in quantity supplied**, a movement along a curve. A change in anything else that affects buyers or sellers causes a **change in demand** or **change in supply**, a shift of the whole curve. This is the most tested distinction in the unit.

Shifter	Demand (buyers)	Supply (sellers)
Tastes and preferences	Increase in popularity shifts demand right	Not applicable
Number of buyers or sellers	More buyers shift demand right	More sellers shift supply right
Income	Normal goods: income up shifts demand right. Inferior goods: income up shifts demand left	Not applicable
Prices of related goods	Substitute price up shifts demand right; complement price up shifts demand left	Prices of goods in competing production: other good's price up shifts supply left
Expectations	Expect higher future price: demand shifts right now	Expect higher future price: supply shifts left now
Input prices and technology	Not applicable	Higher input prices shift supply left; better technology shifts it right
Taxes and subsidies	Not applicable	Taxes shift supply left; subsidies shift it right

A memory aid for demand shifters is **TRIBE**: Tastes, Related goods' prices, Income, Buyers (number of), Expectations. For supply, use **ROTTEN**: Resource (input) prices, Other goods' prices, Technology, Taxes and subsidies, Expectations, Number of sellers.



Equilibrium at price 6 and quantity 4 where $D (P = 10 - Q)$ crosses $S (P = 2 + Q)$.

Surplus and shortage. If the price is above equilibrium, quantity supplied exceeds quantity demanded: a **surplus** (excess supply), and sellers cut prices. If the price is below equilibrium, quantity demanded exceeds quantity supplied: a **shortage** (excess demand), and prices rise. The size of the gap is the quantity supplied minus the quantity demanded, measured horizontally at that price.

EXAMPLE 1: SURPLUS AND SHORTAGE

Using demand $P = 10 - Q$ and supply $P = 2 + Q$, find the equilibrium and the situation when the price is 8 and when it is 4.

SOLUTION

Set demand equal to supply: $10 - Q = 2 + Q$, so $Q = 4$ and $P = 10 - 4 = 6$.

At $P = 8$: $Q_d = 10 - 8 = 2$ and $Q_s = 8 - 2 = 6$. Q_s exceeds Q_d , a surplus of 4 units, so the price falls.

At $P = 4$: $Q_d = 10 - 4 = 6$ and $Q_s = 4 - 2 = 2$. Q_d exceeds Q_s , a shortage of 4 units, so the price rises.

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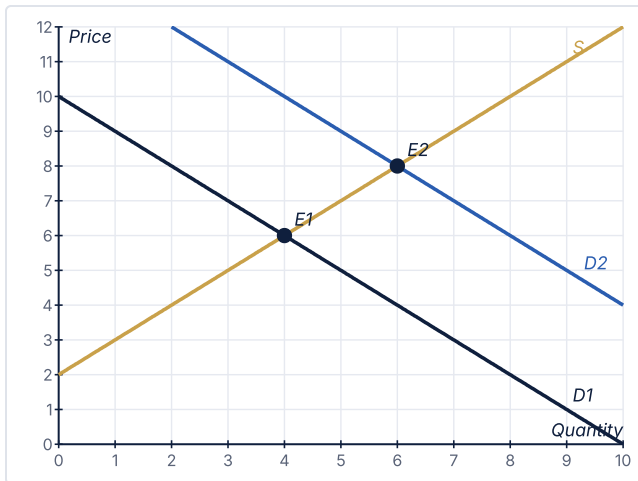
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Four-step method for shifts. (1) Draw the original market. (2) Decide which curve the event shifts (demand or supply). (3) Decide the direction and draw the new curve. (4) Compare the new equilibrium price and quantity with the old. A shift of demand moves price and quantity in the same direction; a shift of supply moves them in opposite directions.

EXAMPLE 2: SHIFT OF DEMAND

Income rises in a market for a normal good. Demand shifts from $P = 10 - Q$ to $P = 14 - Q$, and supply stays $P = 2 + Q$. Find the new equilibrium and describe the change.



SOLUTION

Step 1: Original equilibrium is $Q = 4$, $P = 6$.

Step 2: Income affects buyers, so demand shifts. Step 3: Normal good, so it shifts right.

Step 4: $14 - Q = 2 + Q$ gives $Q = 6$ and $P = 8$.

Price rises from 6 to 8 and quantity rises from 4 to 6. The supply curve is not shifted; the movement along it is an increase in quantity supplied.

Price ceilings and floors. A **price ceiling** is a legal maximum price. It only matters if it is set below the equilibrium price (a binding ceiling), and it causes a shortage. A **price floor** is a legal minimum price. It only matters if it is set above equilibrium (a binding floor), and it causes a surplus. Rent control is a ceiling; the minimum wage and agricultural price supports are floors. A nonbinding limit (a ceiling above equilibrium or a floor below it) has no effect.

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EXAMPLE 3: PRICE CEILING

A city caps the price at 4 in the market with $D: P = 10 - Q$ and $S: P = 2 + Q$. Find the quantity exchanged, the shortage, and one consequence.

**SOLUTION**

At $P = 4$, $Q_s = 4 - 2 = 2$ and $Q_d = 10 - 4 = 6$.

Only 2 units are traded, the smaller of Q_s and Q_d . The shortage is $6 - 2 = 4$ units.

Consequences: waiting lines, black markets, lower quality, or rationing by something other than price. Equilibrium quantity falls from 4 to 2.

Common mistakes

Do not say 'demand increased because the price fell': a price change moves you along the curve. Do not shift both curves when only one is affected. When supply and demand both shift, one of price or quantity is certain and the other is ambiguous. Also, a price ceiling set above equilibrium has no effect.

Both curves shift

Demand up and supply up: Q rises (certain); P ambiguous.

Demand up and supply down: P rises (certain); Q ambiguous.

Demand down and supply up: P falls; Q ambiguous.

Demand down and supply down: Q falls; P ambiguous.

Practice**SET A Check Your Understanding**

Answer each item, showing any calculation.

1. Explain the difference between a change in demand and a change in quantity demanded, using a fall in the price of gasoline as an example.
2. The price of coffee rises. State what happens to the demand for tea (a substitute) and for sugar (a complement), and explain.
3. For $D: P = 12 - Q$ and $S: P = 2 + 2Q$, find the equilibrium price and quantity. Then give the size of the surplus or shortage at a price of 10.
4. State the direction of the shift (and which curve) for each: (a) a new technology lowers production costs, (b) a news report says a product is unsafe, (c) the government subsidizes producers.
5. A binding price floor is set above equilibrium. State the result, who gains, and who loses.
6. A market has demand $P = 10 - Q$ and supply $P = 2 + Q$. A ceiling is set at 8. What is the effect on price and quantity? Explain.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. A market is in equilibrium. A new study finds that a product improves health, increasing its popularity. In the market for the product, the equilibrium price and quantity will
- (A) both increase
(B) price decreases and quantity increases
(C) price increases and quantity decreases
(D) both decrease
(E) price stays the same and quantity increases
8. The graph shows a market with a binding price ceiling at 4. What is the result?



- (A) a surplus of 4 units
(B) a shortage of 6 units
(C) a shortage of 4 units
(D) no change in quantity traded
(E) a surplus of 2 units
9. Which would shift the supply of wheat to the left?
- (A) An increase in consumer income
(B) A drought that damages the harvest
(C) A rise in the price of wheat
(D) A decrease in the price of fertilizer
(E) An improved harvesting technology
10. The price of hamburgers rises. Which is most likely to happen to the demand for hot dogs (a substitute)?
- (A) Demand decreases
(B) Quantity demanded of hot dogs decreases only
(C) Supply of hot dogs increases
(D) Nothing; related goods do not affect demand
(E) Demand increases
11. Both the demand for and the supply of a good increase. Which outcome is certain?
- (A) Equilibrium price rises
(B) Equilibrium price falls
(C) Equilibrium quantity falls
(D) Equilibrium quantity rises
(E) Equilibrium quantity is unchanged
12. A binding price floor in a market results in
- (A) A shortage
(B) Higher quantity traded than at equilibrium
(C) A surplus
(D) No change in the amount sold
(E) A lower price for buyers

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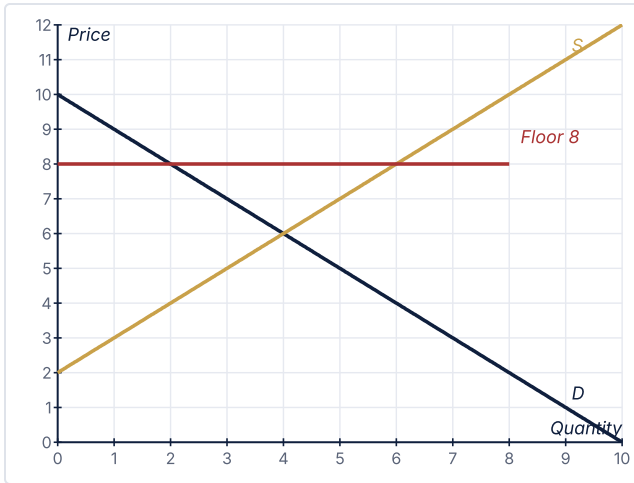
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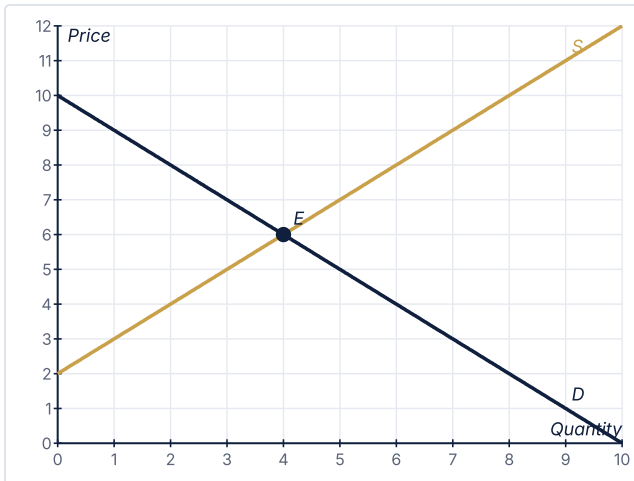
SET C Apply and Extend

Answer in complete sentences.

13. The graph shows the market for apartments in a city. The government sets a minimum price (floor) of 8 on rent, perhaps to help landlords.
- Identify the equilibrium price and quantity.
 - Calculate the quantity demanded, quantity supplied, and the size of the surplus at the floor.
 - Explain one effect of the surplus on landlords and renters.



14. The market for electric scooters is shown at equilibrium. Suppose a city builds many bike lanes (raising demand for scooters) at the same time that the price of batteries, a key input, rises.
- Show which curves shift and in which direction.
 - State what happens to the equilibrium quantity and price, indicating which one is ambiguous and why.
 - Explain why the equilibrium price rises whichever shift is larger, and what determines the direction of the change in quantity.

**1.6 Multiple-Choice Practice: Basic Economic Concepts**

Practice every lesson in the chapter with AP-style questions on scarcity, the PPC, comparative advantage, economic systems, and supply and demand.

Choose the best answer for each item. Read any graph or table carefully before answering, and review the explanations, which show why the best wrong choice fails.

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SET A Core Concepts

Choose the best answer.

- Which statement best describes scarcity?
 - Resources are so rare that they cannot be traded
 - Human wants exceed the resources available to satisfy them
 - Only poor countries lack enough goods
 - Government must ration every good
 - Prices of goods are too high for most people
- Rosa spends Saturday at a free festival instead of working a shift that pays \$70, tutoring for \$50, or sleeping in. The opportunity cost of attending the festival is
 - \$120, the sum of working and tutoring
 - \$50, the tutoring income
 - \$0, because the festival is free
 - The \$70 she could have earned from working
 - \$70 plus the value of sleeping in
- Which of the following is best illustrated by a point inside the production possibilities curve?
 - Full employment of all resources
 - Economic growth
 - An unattainable level of production
 - Productive efficiency
 - A recession with high unemployment
- The PPC between two goods is bowed outward because
 - Resources are not equally productive in making both goods
 - Technology is improving over time
 - Wants are limited
 - The economy has too much capital
 - Resources are unlimited
- In one day, country X can produce 6 cars or 12 TVs, and country Y can produce 3 cars or 9 TVs. Which statement is correct?

Per day	Cars	TVs
X	6	12
Y	3	9

- Country X has the comparative advantage in TVs.
 - Country Y has the absolute advantage in cars.
 - Country Y has the comparative advantage in TVs.
 - Country Y has the comparative advantage in cars.
 - Neither country has a comparative advantage.
- Which of the following is an injection into the circular flow?
 - Household saving
 - Exports
 - Imports
 - Income taxes
 - Consumer spending on foreign goods
 - An increase in the price of tea will most likely cause
 - A decrease in the quantity supplied of tea
 - A decrease in the demand for coffee
 - An increase in the demand for coffee, a substitute
 - A decrease in the supply of tea
 - An increase in the quantity demanded of tea

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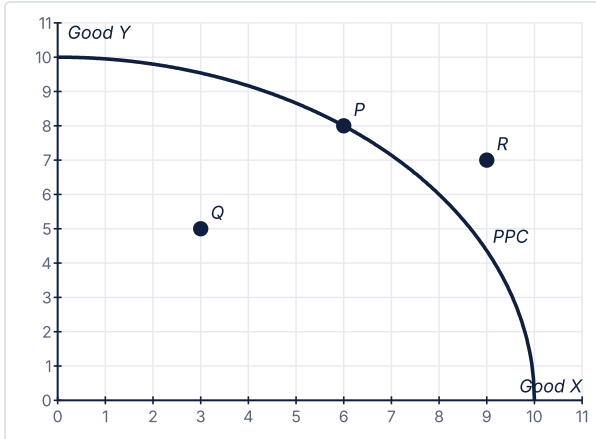
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SET B Applications and Data

Choose the best answer.

8. The graph shows a PPC with three points labeled P, Q, and R. Which statement is correct?



- (A) Point R is unattainable with current resources and technology.
 (B) Point Q is productively efficient.
 (C) Point P is unattainable.
 (D) Point R is attainable but inefficient.
 (E) Point Q is on the PPC.
9. The table shows efficient combinations of pizzas (hundreds) and burgers (hundreds). The opportunity cost of the third hundred pizzas (moving from 2 to 3) is

Pizzas	Burgers
0	60
1	54
2	42
3	24
4	0

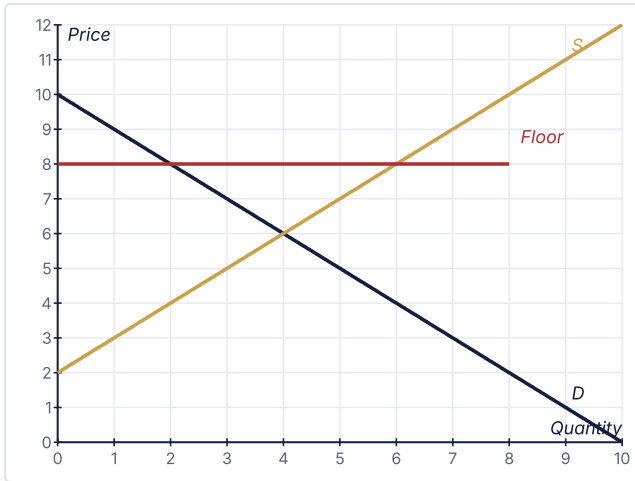
- (A) 24 hundred burgers
 (B) 12 hundred burgers
 (C) 6 hundred burgers
 (D) 42 hundred burgers
 (E) 18 hundred burgers
10. It takes Maria 2 hours to make a shirt and 1 hour to make a hat. It takes Noah 3 hours to make a shirt and 2 hours to make a hat. Which is true?
- (A) Maria has the comparative advantage in shirts.
 (B) Noah has the absolute advantage in hats.
 (C) Noah has the absolute advantage in shirts.
 (D) Noah has the comparative advantage in shirts.
 (E) Maria has no absolute advantage.
11. Maria needs 2 hours per shirt and 1 hour per hat; Noah needs 3 hours per shirt and 2 hours per hat. Which exchange would benefit both?
- (A) 1 shirt for 1.75 hats
 (B) 1 shirt for 1 hat
 (C) 1 shirt for 2.5 hats
 (D) 1 shirt for 1.25 hats
 (E) 1 shirt for 3 hats

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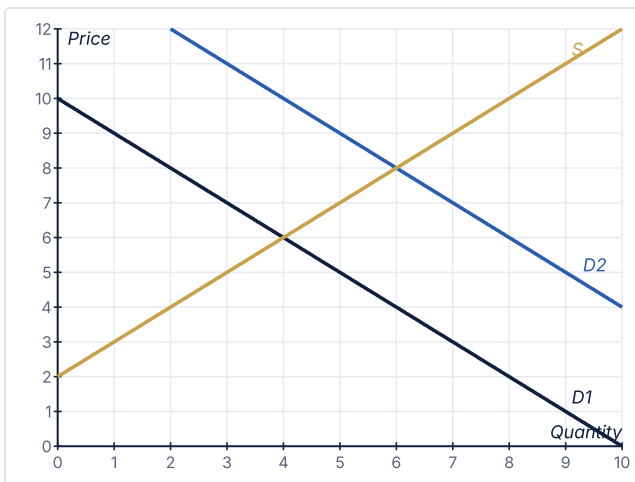
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12. The graph shows a price floor in a market. The surplus created is



- (A) 2 units (B) 6 units (C) 4 units (D) 8 units (E) 0 units
13. The graph shows demand shifting from D1 to D2. Which event could explain it?



- (A) A fall in the price of the good (B) A rise in consumer income for a normal good
 (C) An increase in input costs (D) A technological improvement in production
 (E) A new tax on producers
14. In an economy, saving is \$40 billion, taxes \$60 billion, and imports \$20 billion. Investment is \$30 billion, government purchases \$60 billion, and exports \$20 billion. What is likely to happen to spending?
- (A) It will increase, since injections exceed leakages
 (B) It will stay the same, since both exceed \$100 billion
 (C) It will increase, since taxes exceed saving
 (D) It will decrease, since leakages of \$120 billion exceed injections of \$110 billion
 (E) It will stay the same, since leakages equal injections

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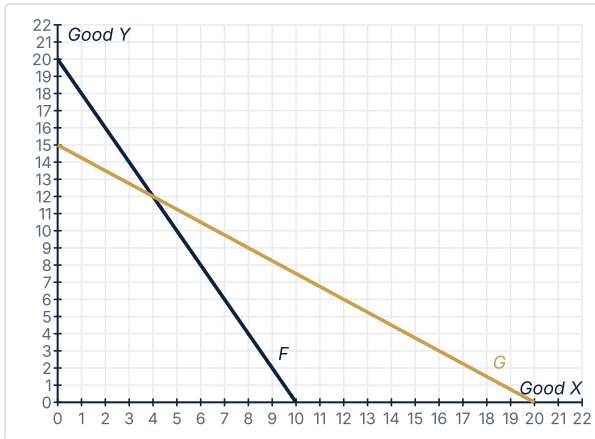
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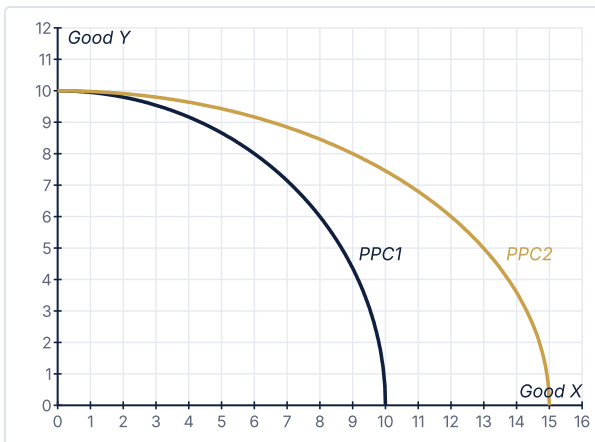
SET C Exam-Level Stretch

Choose the best answer.

15. A fad ends, reducing the popularity of a toy, while cheaper materials lower production costs. What happens in the market for the toy?
- (A) Price rises and quantity falls
 - (B) Quantity rises and the change in price is ambiguous
 - (C) Price and quantity both fall
 - (D) Quantity falls and the change in price is ambiguous
 - (E) Price falls and the change in quantity is ambiguous
16. The graph shows PPCs for two countries, F and G, producing goods X and Y. Which statement is true?



- (A) F has the comparative advantage in X, and G has it in Y.
 - (B) G has the comparative advantage in X, and F has it in Y.
 - (C) G has the comparative advantage in both goods.
 - (D) Neither has a comparative advantage.
 - (E) F has the comparative advantage in both goods.
17. The graph shows a PPC shifting from PPC1 to PPC2, with the Y-intercept unchanged and the X-intercept rising. The most likely cause is



- (A) A decrease in unemployment
- (B) A technological improvement specific to good Y
- (C) A technological improvement specific to good X
- (D) An increase in the number of workers only
- (E) A recession

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18. Which of the following scenarios best describes a command economy?
- (A) A central agency sets production targets and prices for factories
 (B) Households decide what to buy based on prices
 (C) Firms keep profits and decide what to produce
 (D) The government taxes income and provides health care while markets set most prices
 (E) Private owners are free to sell property
19. The table shows quantity demanded and supplied at various prices. A price ceiling of \$4 would result in

Price	Qd	Qs
\$2	80	20
\$4	60	40
\$6	40	60
\$8	20	80

- (A) A surplus of 20 units
 (B) A shortage of 60 units
 (C) A surplus of 40 units
 (D) A shortage of 20 units
 (E) No effect because 4 is below the maximum
20. A firm decides how many workers to hire. The marginal benefit (extra revenue) of the first four workers is \$50, \$40, \$30, and \$20. Each worker costs \$25. It already paid a \$10,000 nonrefundable fee. How many workers should it hire?
- (A) 1 (B) 2 (C) 4 (D) 0 (E) 3

1.7 Free-Response Practice: Basic Economic Concepts

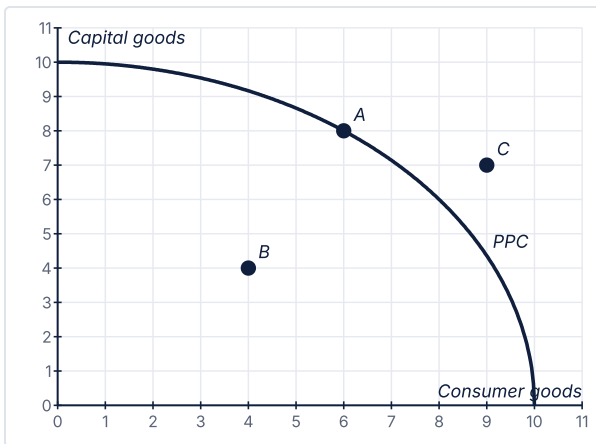
Four free-response questions on the PPC, comparative advantage, the circular flow, and supply and demand.

Each question is worth about 4 to 8 points. Points are earned for correct identification, explanation, calculations, and labeled graphs. Write answers in full sentences, show calculations, and label graph axes and curves.

QUESTION 1 Production Possibilities Curve

The graph shows the production possibilities curve (PPC) for the country of Zeta, which produces consumer goods and capital goods. Each point is a possible combination of output.

1. (a) Identify the point on the graph that shows unemployed resources, and explain your choice.



2. (b) Identify the point that is unattainable with current resources and technology, and state one thing that would make it attainable.
3. (c) Zeta moves from point A (6 consumer goods, 8 capital goods) to the point on the curve with 8 consumer goods and 6 capital goods. Calculate the opportunity cost of each additional consumer good in this move.
4. (d) Suppose Zeta invests heavily in capital goods for ten years. Explain what is likely to happen to its PPC.

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QUESTION 2 Comparative Advantage and Trade

In one week, Lumia can produce 40 tablets or 20 phones. Mirax can produce 30 tablets or 10 phones. Assume constant opportunity costs and that each country uses all resources on one or both goods.

5. (a) Which country has an absolute advantage in tablets? In phones?
6. (b) Calculate each country's opportunity cost of producing one phone.
7. (c) Which country has the comparative advantage in phones? In tablets? Justify your answer using opportunity cost.
8. (d) Give a range of terms of trade (tablets per phone) that benefits both countries and explain your range. Would an exchange of 1 phone for 2.5 tablets benefit both?

QUESTION 3 Circular Flow and Economic Systems

An economy has the following annual flows (in billions of dollars): saving 50, taxes 80, imports 30, investment 40, government purchases 80, and exports 20.

9. (a) In which market do households sell labor to firms? State the direction of the money payment.
10. (b) Identify the leakages and injections listed above, and compute the total of each.
11. (c) Predict what will happen to spending and output, and explain how the government could respond using one policy tool.
12. (d) The country has private firms that set most prices and also a government that provides public education and regulates pollution. Identify the type of economic system and justify your answer.

QUESTION 4 Supply and Demand

The graph shows the market for bicycles in a town, with demand D and supply S .

13. (a) Identify the equilibrium price and quantity.



14. (b) The price of scooters, a substitute, falls. Explain the effect on the demand for bicycles and on the equilibrium price and quantity.
15. (c) The town now sets a maximum price of 4 per bicycle in the original market. Calculate the quantity demanded, the quantity supplied, and the size of the shortage.
16. (d) Explain one likely consequence of the shortage.

Answers Chapter 1: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

1.1 Scarcity, Opportunity Cost, and Choice

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SET A · CHECK YOUR UNDERSTANDING

1. Scarcity is the condition that wants are unlimited but resources are limited. A wealthy person has plenty of money but still a limited amount of time and still cannot buy everything, so each use of money or time forgoes another. Scarcity concerns limited resources relative to wants, not being poor.
2. (i) Capital: human-made good used to produce. (ii) Capital for the same reason. (iii) Entrepreneurship: organizing resources and taking risk. (iv) Land: a natural resource. Remember that money and stocks are not economic capital.
3. Opportunity cost is the value of the next best alternative, not all alternatives. Her alternatives are the movie (valued at \$30) and studying (\$25); the best forgone alternative is the movie worth \$30. So the opportunity cost of babysitting is \$30 in value.
4. No. MB of \$1.50 is below MC of \$2, so the extra slice is not worth it. Rational choice says to buy only up to the unit where $MB \geq MC$; this unit lies past that point.
5. (a) Positive: it states a fact that can be checked against data. (b) Normative: 'ought' expresses a value judgment about what should be, which data alone cannot prove or disprove.
6. No. The \$60 is a sunk cost if the ticket is nonrefundable and cannot be resold. The decision should compare the \$80 wage (the cost of going) with the value of the concert (\$50). Since $80 > 50$, he should work. The ticket price is gone either way.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Opportunity cost counts only the single best forgone alternative. Adding up all alternatives overstates it, and money price is just one possible measure.
8. E. The next best use of the field is corn at \$650. Soybeans are a worse alternative, adding the alternatives overcounts, and a profit does not erase the forgone \$650.
9. A. A delivery truck is a produced good used to make other goods. Stocks, bonds, and savings accounts are financial assets, the most tempting wrong answers because people loosely call them capital.
10. D. The word 'should' signals a value judgment. The others are testable claims about what is, even if some could turn out false. The comparison of two unemployment rates is the tempting choice but remains factual.
11. B. Marginal benefit is at least \$10 for hours 1, 2, and 3, but hour 4 yields only \$6. Practicing 4 hours would add a unit costing more than it brings.
12. A. A sunk cost is already spent and unrecoverable, so it does not change the decision going forward. Including past spending in marginal cost is the common error.

SET C · APPLY AND EXTEND

13. (a) 1 point: Each hour of studying gives up one hour of mowing, which pays \$10, so the opportunity cost is \$10 (the trade-off line has slope -1). (b) 1 point: At the point shown he studies 3 hours and mows 5, earning $5 \times \$10 = \$50$. (c) 1 point: The opportunity cost of studying rises to \$15 per hour because each hour of mowing now earns more. 1 point: A rational person responds to incentives and would study fewer hours and mow more, unless the benefit of studying exceeds \$15.
14. (a) 1 point: Positive: the stadium will create jobs (testable, though it could be false). 1 point: Normative: the city should spend the money, or everyone deserves a team (value judgments). (b) 1 point: The next best use of funds is road repair, so the opportunity cost is the 220 jobs forgone (net 70 jobs more under roads). (c) 1 point: The \$300,000 is a sunk cost, already spent and unrecoverable, so only future costs and benefits matter in the decision to continue.

1.2 Production Possibilities Curve**SET A · CHECK YOUR UNDERSTANDING**

1. First move: lose 2 tractors for 3 tanks, so $2/3$ of a tractor per tank (about 0.67). Second move: lose 4 tractors for 3 tanks, so $4/3$ tractor per tank (about 1.33). The opportunity cost per tank is rising, which is the law of increasing opportunity cost and the reason the PPC bows outward.
2. Productive efficiency means producing with no waste, so no more of one good can be produced without less of the other; every point on the PPC qualifies. Allocative efficiency means producing the combination society values most, where marginal benefit equals marginal cost; only one point on the PPC (the one matching preferences) qualifies.
3. Two causes are unemployment during a recession and misallocated resources (workers or land in the wrong uses). To move toward the curve, the economy needs to put idle resources to work, for example through policies that reduce unemployment, which lets it produce more of both goods without a trade-off.
4. The first 10 shirts cost 10 cars (50 to 40). The next 10 cost 15 cars, and the last 10 cost 20 cars. The opportunity cost of shirts rises, so the PPC is bowed outward (concave), not a straight line.
5. A straight line has a constant slope, meaning one unit of X always costs the same amount of Y. That only happens if resources can switch between goods at no loss of productivity. If resources are specialized, using them for the second good costs more and more output of the first, which bends the curve outward.
6. (a) Outward shift: more natural resources raise potential output. (b) The economy moves to a point inside the curve; the PPC itself does not shift because capacity is unchanged. (c) Inward shift: destroyed capital reduces capacity.

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SET B · EXAM-STYLE MULTIPLE CHOICE

7. A. Inside means attainable but not using all resources efficiently. Points on the curve show productive efficiency, and points outside are unattainable.
8. D. The first 3 guns cost 3 butter; the next 3 cost 6 butter. Rising costs mean increasing opportunity cost. Saying costs are constant is the tempting error, which would require equal losses.
9. B. Better technology increases the maximum output possible. A recession or higher unemployment moves the economy inside the curve without moving the curve.
10. E. Moving from all burgers to all pizzas, 15 burgers are given up for 30 pizzas, so each burger is worth 2 pizzas. Choosing 0.5 reverses the ratio, which is the cost of a pizza in burgers.
11. C. A pivot means only one good's capacity changed. A larger labor force would shift both intercepts outward, so it is the best distractor.
12. D. Moving along the curve is a trade-off, not growth. Investing in capital goods tends to shift the PPC outward later. Growth (a shift) is not immediate, which is why the third choice is tempting but wrong.

SET C · APPLY AND EXTEND

13. (a) 1 point: A (and the curve itself) shows productive efficiency because it lies on the PPC. (b) 1 point: B lies inside the curve, showing underutilization; a cause is unemployment or misallocation of resources. (c) 1 point: C lies outside, so it is unattainable now. 1 point: It becomes attainable with growth, from more resources or better technology that shifts the PPC outward past C. (d) 1 point: The PPC pivots outward, with the computers intercept moving right while the wheat intercept stays the same.
14. (a) 1 point: Country Y, because investment in capital goods raises future productive capacity. 1 point: Country X's consumption today means less capital growth, so its curve shifts out less. (b) 1 point: Country X moves to a point inside its PPC because resources go unemployed; the curve itself does not shift. (c) 1 point: An outward shift raises potential output (more of both goods are attainable). Moving from inside to the curve uses existing idle resources and does not change capacity.

1.3 Comparative Advantage, Specialization, and Trade**SET A · CHECK YOUR UNDERSTANDING**

1. Absolute advantage means producing a good with fewer resources or more output per unit of resources; comparative advantage means producing at a lower opportunity cost. A producer can have an absolute advantage in both goods. It cannot have a comparative advantage in both, because opportunity costs of the two goods are reciprocals: being low in one means being high in the other (unless costs are identical).
2. Maya: 1 scarf costs $12/6 = 2$ loaves. Leo: 1 scarf costs $8/2 = 4$ loaves. Maya's opportunity cost is lower, so Maya has the comparative advantage in scarves (and Leo in bread, at 0.25 scarf per loaf versus Maya's 0.5).
3. Ava has the absolute advantage in both (fewer hours for mowing and painting). Mowing: Ava gives up $2/1 = 2$ fences per lawn; Ben gives up $6/2 = 3$ fences per lawn. Ava's cost is lower, so Ava has the comparative advantage in mowing.
4. The terms of trade must lie between the two opportunity costs: between 2 and 4 loaves per scarf. Maya will not accept fewer than 2 loaves for a scarf (her own cost) and Leo will not pay more than 4 (his own cost). For example, 3 loaves per scarf benefits both.
5. Moving from all cars (40) to all tractors (20) gives up 40 cars for 20 tractors, so a tractor costs 2 cars. A car costs $20/40 = 0.5$ tractor. The two costs are reciprocals, and the slope of the line has absolute value 2.
6. If both countries give up the same amount of one good for the other, no terms of trade can make both better off: any exchange rate would be worse than one side's own rate. Gains from trade arise only from differences in opportunity cost, so identical costs mean no comparative advantage and no gains.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. Steel costs P 2 corn but Q only 1.5 corn, so Q has the lower opportunity cost. P has the absolute advantage in both, which is why choosing P for steel is tempting.
8. D. The rate must lie between 1.5 corn (Q's cost) and 2 corn (P's cost). 1.8 does; 1 and 0.5 are below Q's own cost, and 2.5 exceeds P's cost, so one side would be better off producing alone.
9. E. Cloth takes 4 hours and wheat 2, so $4/2 = 2$ wheat per cloth. Reversing the ratio gives 0.5, which is the cost of wheat in cloth.
10. A. Trade allows consumption beyond the domestic PPC. Reducing unemployment moves to the PPC, not beyond it.
11. C. Comparative advantage depends on opportunity cost, and even a country best at everything has a lower opportunity cost in only some goods. Trade benefits it by freeing resources for what it does best.
12. E. Country 1's opportunity cost of a hat (1 coat) is lower than country 2's (3 coats). The steeper line of country 2 means it sacrifices more coats per hat.

SET C · APPLY AND EXTEND

13. (a) 1 point: M has the absolute advantage in tea (24 versus 18); N has it in coffee (18 versus 12). (b) 1 point: M: $24/12 = 2$ tea per coffee. N: $18/18 = 1$ tea per coffee. (c) 1 point: N has the lower opportunity cost of coffee ($1 < 2$), so N has the comparative advantage in coffee; M's cost of tea is 0.5 coffee versus N's 1, so M has it in tea. 1 point: N specializes in coffee and M in tea. (d) 1 point: Yes. The rate of 1.5 tea per coffee lies between 1 (N's cost) and 2 (M's cost): N gets more tea than it gives up in making coffee, and M pays less than its own cost.
14. (a) 1 point: R has the absolute advantage in both ($10 > 5$ laptops, $40 > 10$ bicycles). (b) 1 point: R: $40/10 = 4$ bicycles per laptop; S: $10/5 = 2$ bicycles per laptop. 1 point: S has the lower cost, so S has the comparative advantage in laptops (and R in bicycles at 0.25 laptop versus 0.5). (c) 1 point: Gains depend on comparative, not absolute, advantage. R specializes in bicycles and trades for laptops at a rate cheaper than its cost of 4 bicycles per laptop (between 2 and 4), obtaining more of both goods than alone.

1.4 Economic Systems and the Circular Flow

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SET A · CHECK YOUR UNDERSTANDING

1. The questions are what to produce, how to produce it, and for whom to produce it. Resources are limited while wants are unlimited, so a society cannot make everything and must decide which goods to make, which production methods to use, and who gets the output.
2. Property rights give people the legal ability to own, use, and sell what they produce, so they can keep the returns on their effort. If a government can seize a factory without compensation, owners will not invest or build it, reducing capital and growth. Secure rights encourage saving, investment, and innovation.
3. Households sell resources (labor, land, capital) in the factor market and receive income (wages, rent, interest, profit). They use that income to buy goods and services in the product market.
4. (i) Leakage: saved income is not spent. (ii) Injection: exports bring in foreign spending. (iii) Injection: government spending adds to demand. (iv) Leakage: taxes remove income from spending.
5. $\text{Leakages} = 60 + 90 + 30 = \$180$; $\text{injections} = 50 + 90 + 20 = \$160$. Leakages exceed injections by \$20, so spending and output tend to decrease. If injections exceeded leakages, they would rise.
6. In a command economy, planners set prices and quantities; in a mixed economy, markets set most prices, with some government controls. A command economy suffers from shortages, surpluses, and weak incentives from missing price signals. A mixed economy may suffer from inefficiency caused by regulation or taxes, and from disagreement over how much government is right.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. A mixed economy has both private decision making and a government role. Saying prices are set only by supply and demand describes a pure market economy, which does not exist.
8. A. Firms pay for labor in the factor market, and households receive the money as income. The reverse direction describes consumer spending in the product market.
9. E. Saving removes income from the spending stream. Government spending, investment, and exports are injections; subsidies also add to spending, which makes that choice tempting but wrong.
10. B. Without profit and price signals, planners have limited information and weaker rewards for innovation. The other options are defining features of a command economy, not weaknesses.
11. D. Injections exceeding leakages add more to the spending stream than they remove, so output tends to rise. Equal flows would mean no change.
12. A. The government is a buyer of output (the construction), and taxes are the matching leakage. A transfer payment would be a payment with no good or service in return.

SET C · APPLY AND EXTEND

13. (a) 1 point: Two leakages from saving, taxes, imports. 1 point: Two injections from investment, government spending, exports. (b) 1 point: Saving is a leakage, so higher saving without higher investment means leakages exceed injections. 1 point: Spending on the product market falls, so firms sell less and income falls. (c) 1 point: The government could raise its spending or cut taxes, adding injections or reducing leakages so that spending recovers.
14. (a) 1 point: In a market economy, consumers and firms respond to prices and profit, so output reflects demand. 1 point: In a command economy, central planners decide quantities and prices. (b) 1 point: Prices carry information and give incentives, which produce efficiency and innovation, while planners often cause shortages or surpluses. (c) 1 point: Every economy blends private markets with government rules. 1 point: Functions include providing public goods, enforcing property rights, correcting externalities, or redistributing income.

1.5 Demand, Supply, and Market Equilibrium Review**SET A · CHECK YOUR UNDERSTANDING**

1. A fall in the price of gasoline is a movement along the demand curve: quantity demanded of gasoline rises (a change in quantity demanded). A change in demand is a shift of the entire curve caused by something other than the good's own price, such as a rise in income. Price changes the quantity, not the demand.
2. Tea demand increases (shifts right) because consumers switch toward the substitute. Sugar demand decreases (shifts left) because coffee and sugar are complements and less coffee is consumed. Related-goods prices shift demand.
3. Set $12 - Q = 2 + 2Q$, so $10 = 3Q$ and $Q = 10/3$ (about 3.33), $P = 12 - 3.33 = 8.67$. At $P = 10$: $Q_d = 12 - 10 = 2$ and $Q_s = (10 - 2)/2 = 4$. Quantity supplied exceeds quantity demanded, a surplus of 2.
4. (a) Supply shifts right because technology lowers costs. (b) Demand shifts left because tastes turn against the product. (c) Supply shifts right because a subsidy reduces cost of production.
5. The price floor causes quantity supplied to exceed quantity demanded, a surplus. Sellers who still sell gain from the higher price; buyers lose because they pay more and buy less. Some sellers also lose because they cannot sell all they want to supply.
6. The equilibrium price is 6, below the ceiling of 8. The ceiling is therefore nonbinding and has no effect: price stays at 6 and quantity at 4.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. A. The study raises demand (tastes), shifting the curve right and increasing both price and quantity. A price decrease with quantity increase would come from a shift of supply.
8. C. At the ceiling price 4, Q_d is 6 and Q_s is 2, so the shortage is $6 - 2 = 4$. A surplus occurs with a price above equilibrium.
9. B. Bad weather raises costs and reduces output at each price, shifting supply left. A rise in wheat's own price causes a movement along supply, which is why it is tempting.
10. E. Higher prices for a substitute push buyers toward hot dogs, shifting demand right.
11. D. Both rightward shifts increase quantity; the price effect depends on which shift is larger. Price changes are ambiguous.

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12. C. A floor above equilibrium raises quantity supplied and lowers quantity demanded, creating a surplus. A shortage comes from a binding ceiling.

SET C · APPLY AND EXTEND

13. (a) 1 point: Equilibrium price 6, quantity 4 ($10 - Q = 2 + Q$). (b) 1 point: At price 8, $Q_d = 2$ and $Q_s = 6$. 1 point: Surplus of 4 units (vacant apartments). (c) 1 point: Landlords are better off if they rent at 8 but some cannot rent all units; renters pay more and fewer rent, so some potential renters are shut out.
14. (a) 1 point: Demand shifts right (more bike lanes raise demand for scooters), and supply shifts left (higher input cost). (b) 1 point: Price rises because both shifts push it up. 1 point: Quantity is ambiguous because the demand shift raises it and the supply shift lowers it; the result depends on the relative sizes. (c) 1 point: Both shifts push price up (higher demand and higher costs), so price rises regardless of size. 1 point: Quantity depends on which shift is larger: if demand shifts more, quantity rises; if supply shifts more, it falls.

1.6 Multiple-Choice Practice: Basic Economic Concepts

SET A · CORE CONCEPTS

- B. Scarcity is the gap between unlimited wants and limited resources, and it affects every society. Saying it is only a problem for poor countries is the common error.
- D. Only the single best alternative counts, which is the \$70 shift. Adding alternatives (\$120) is the tempting overcount, and a free event still has an opportunity cost in time.
- E. Inside the curve means resources are idle or misused, as in a recession. A shift outward would represent growth, which is a common wrong answer.
- A. Specialized resources raise the cost of shifting production, so each extra unit costs more of the other good. Technology improving would shift the curve, not bend it.
- C. X gives up 2 TVs per car; Y gives up 3 TVs per car, so Y's opportunity cost of a TV ($1/3$ car) is lower than X's ($1/2$ car). X has the absolute advantage in both goods, which makes choosing X for TVs tempting.
- B. Exports bring in foreign spending on domestic goods. Saving, imports, and taxes are leakages, so the first of these is the common mix-up.
- C. Tea and coffee are substitutes, so a higher tea price shifts demand for coffee right. A higher tea price raises the quantity supplied of tea and lowers its quantity demanded, so the others are wrong.

SET B · APPLICATIONS AND DATA

- A. R lies outside the curve, so it cannot be produced now. Q lies inside the curve, meaning it is attainable but inefficient, while P is on the curve.
- D. Maria's opportunity cost of a shirt is 2 hats and Noah's is 1.5 hats, so Noah's is lower. Maria has the absolute advantage in both goods, which makes picking her for shirts attractive but wrong.
- C. At the floor of 8, $Q_d = 2$ and $Q_s = 6$, so the surplus is 4. Choosing 6 reads only the quantity supplied.
- D. Leakages are $40 + 60 + 20 = 120$ and injections are $30 + 60 + 20 = 110$. Leakages exceed injections, so spending falls.
- E. Moving from 2 pizzas to 3 reduces burgers from 42 to 24, a loss of 18. The other choices come from using a level of burgers (24, 42) rather than the change.
- A. The rate must lie between 1.5 and 2 hats per shirt. 1.75 does. Rates below 1.5 or above 2 would make one side worse off than producing alone.
- B. Higher income raises demand for a normal good, shifting it right. A fall in the good's own price is only a movement along D_1 .

SET C · EXAM-LEVEL STRETCH

- E. Demand shifts left (lower tastes) and supply shifts right (lower costs). Both lower the price, but they push quantity in opposite directions. Price is the certain change.
- B. F gives up 2 Y per X, while G gives up only 0.75 Y per X, so G has the lower opportunity cost of X. F's reciprocal cost of Y is lower, making F the Y specialist.
- C. Only the X intercept increases, so a change affecting only X is the best explanation. An equal change in labor force would shift both intercepts. A fall in unemployment would move the economy to the curve, not move the curve.
- A. In a command economy planners decide what, how, and for whom. The third scenario is a mixed economy, since government provides services but markets work.
- D. At $P = 4$, $Q_d = 60$ and $Q_s = 40$, so a shortage of 20. The equilibrium is $P = 5$ and $Q = 50$, so the ceiling binds. Quantity traded falls to 40.
- E. Hire while MB is at least MC: workers 1, 2, and 3 ($\$30 > \$25$) are worth it, but worker 4 ($\$20$) is not. The sunk fee is irrelevant to this decision.

1.7 Free-Response Practice: Basic Economic Concepts

QUESTION 1 · PRODUCTION POSSIBILITIES CURVE

- 1 point: Point B. 1 point: It lies inside the PPC, so Zeta is producing less than it could with its resources, which means some resources are unemployed or misused.
- 1 point: Point C lies outside the curve, so it is unattainable. 1 point: Economic growth that shifts the PPC outward, such as more resources, better technology, or more education, would make it attainable.
- 1 point: The move gives up $8 - 6 = 2$ capital goods. 1 point: It gains 2 consumer goods, so the opportunity cost is $2/2 = 1$ capital good per consumer good.
- 1 point: The PPC shifts outward (right and up) because additional capital raises productive capacity. 1 point: The shift lets Zeta produce more of both goods in the future, at the cost of fewer consumer goods today.

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QUESTION 2 · COMPARATIVE ADVANTAGE AND TRADE

5. 1 point: Lumia has the absolute advantage in tablets ($40 > 30$). 1 point: Lumia also has it in phones ($20 > 10$), because it produces more of both goods.
6. 1 point: Lumia: $40/20 = 2$ tablets per phone. 1 point: Mirax: $30/10 = 3$ tablets per phone.
7. 1 point: Lumia has the comparative advantage in phones, since $2 < 3$ tablets. 1 point: Mirax has it in tablets: its cost is $10/30 = 1/3$ phone versus Lumia's $20/40 = 1/2$ phone.
8. 1 point: The range is between 2 and 3 tablets per phone, the two opportunity costs. 1 point: Yes, 2.5 tablets per phone lies in the range, so Lumia receives more tablets than it would give up making a phone, and Mirax pays fewer than its own cost of 3.

QUESTION 3 · CIRCULAR FLOW AND ECONOMIC SYSTEMS

9. 1 point: The factor (resource) market. 1 point: Firms pay wages to households (money flows from firms to households).
10. 1 point: Leakages: saving, taxes, and imports = $50 + 80 + 30 = 160$. 1 point: Injections: investment, government purchases, and exports = $40 + 80 + 20 = 140$.
11. 1 point: Leakages exceed injections by 20, so spending and output tend to fall. 1 point: The government could raise its purchases or cut taxes to add spending.
12. 1 point: A mixed economy. 1 point: It combines market-determined prices with government provision of public goods and regulation.

QUESTION 4 · SUPPLY AND DEMAND

13. 1 point: Price 6. 1 point: Quantity 4 ($10 - Q = 2 + Q$).
14. 1 point: Cheaper scooters lead buyers to substitute away from bicycles, so demand shifts left. 1 point: The equilibrium price falls and equilibrium quantity falls, because supply is unchanged and the market moves down along it.
15. 1 point: At $P = 4$, $Q_d = 10 - 4 = 6$ and $Q_s = 4 - 2 = 2$. 1 point: Shortage = $6 - 2 = 4$.
16. 1 point: Possible consequences: waiting lists or lines, black market trading above the ceiling, lower quality, or rationing by non-price methods.

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Chapter 2: Economic Indicators and the Business Cycle.

8 sections with explanations and worked examples, then 111 practice problems. Answers and full explanations are at the end of the chapter.

2.1 Gross Domestic Product

Learn what GDP measures, how to compute it with the expenditure and income approaches, what it counts and leaves out, and why it is an imperfect gauge of well-being.

Gross domestic product (GDP) is the market value of all final goods and services produced within a country's borders during a given period, usually a quarter or a year. Each phrase matters. **Market value** means output is added up using prices, so cars and haircuts can be combined. **Final** means goods sold to their end users. **Within borders** means location of production counts, not the nationality of the owner. **Given period** makes GDP a flow, like income per year, not a stock like wealth.

Definition of GDP

GDP = the market value of all final goods and services produced within a country in a given period.

Only newly produced, final, legal and market-traded output counts.

Counting only final goods avoids **double counting**. A loaf of bread contains wheat, flour and baking labor, and its price already includes the value of those intermediate inputs. The same total can be reached by adding the **value added** at each stage, which is the sale price of a firm's output minus what it paid for intermediate goods.

EXAMPLE 1: VALUE ADDED

A farmer sells wheat to a miller for \$0.60. The miller sells flour to a baker for \$1.10. The baker sells a loaf to a consumer for \$2.50. How much is added to GDP?

SOLUTION

Value added by the farmer = $\$0.60 - \$0 = \$0.60$ (assume no purchased inputs).

Miller: $\$1.10 - \$0.60 = \$0.50$. Baker: $\$2.50 - \$1.10 = \$1.40$.

Sum of value added = $0.60 + 0.50 + 1.40 = \$2.50$, which equals the final price of the loaf.

GDP rises by \$2.50, not \$4.20 (the sum of all three sales). Counting every sale would double count.

The **expenditure approach** adds up spending on final output by four groups. It is the formula you will use most on the exam.

Expenditure approach

$$GDP = C + I + G + (X - M)$$

C = household consumption; I = gross private domestic investment; G = government purchases of goods and services; $X - M$ = net exports (exports minus imports).

- ◆ **Consumption (C)** is spending by households on durable goods, nondurable goods and services. It is about two-thirds of U.S. GDP.
- ◆ **Investment (I)** is spending by firms on new capital goods (machines, factories, software), new residential housing, and increases in business inventories. Buying stocks, bonds or an existing house is not investment in the GDP sense; it only transfers ownership.
- ◆ **Government purchases (G)** are federal, state and local spending on goods and services, including pay for government workers. **Transfer payments** such as Social Security, unemployment benefits and interest on the debt are not in G because no good or service is produced in exchange.
- ◆ **Net exports (X - M)**: exports are foreign purchases of domestic output, so they are added. Imports are subtracted because they are included in C, I or G but were not produced here. Net exports are negative when a country runs a trade deficit.

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EXAMPLE 2: EXPENDITURE APPROACH

An economy has consumption of \$14,200 billion, gross private investment of \$3,600 billion, government purchases of \$3,900 billion, exports of \$2,500 billion, imports of \$3,100 billion, and Social Security transfers of \$1,300 billion. Find GDP and net exports.

SOLUTION

Net exports = $X - M = 2,500 - 3,100 = -\$600$ billion (a trade deficit).

GDP = $C + I + G + (X - M) = 14,200 + 3,600 + 3,900 - 600 = \$21,100$ billion.

The \$1,300 billion of transfers is ignored because transfers are not purchases of newly produced output.

The **income approach** adds up what is earned producing that output: wages and salaries, rent, interest, and profit, plus small adjustments for depreciation and indirect business taxes. The two approaches match because every dollar spent on output becomes a dollar of income to someone, which is the idea behind the circular flow of income and spending.

Counted in GDP	Not counted in GDP	Reason
Sale of a new car	Sale of a used car (only the dealer's commission counts)	Used goods were counted when first produced
Licensed day care services	Care provided by a grandparent at home	Unpaid nonmarket work has no recorded price
New home construction	Purchase of shares of stock	Stocks are financial assets, not output
Government purchase of a road	Social Security payment	Transfers do not buy production
Haircut paid in cash and reported	Illegal drug sales or unreported cash work	Underground economy is not measured
Flour sold to a baker as an input	Value of the flour counted again in bread	Intermediate goods are counted only once

GDP is often divided by population to get **GDP per capita**, a better guide to average living standards than total GDP. A large country can have a big GDP and still be poor per person. GDP can rise while GDP per capita falls if population grows faster than output.

EXAMPLE 3: GDP PER CAPITA

Country Z has a GDP of \$840 billion and 24 million people. Next year GDP rises 3% and population rises 4%. Find GDP per capita now, and the direction of change.

SOLUTION

Per capita GDP = $\$840,000,000,000 / 24,000,000 = \$35,000$.

Next year GDP = $840 \times 1.03 = \$865.2$ billion; population = $24 \times 1.04 = 24.96$ million.

New per capita GDP = $865.2 \text{ billion} / 24.96 \text{ million} = \text{about } \$34,663$, a decline.

Total GDP rose, but average output per person fell.

GDP is a rough indicator of well-being. It leaves out leisure time, unpaid household work, environmental quality, income inequality, health, safety and the value of new varieties and technology. Some of what it counts, like spending to clean up a disaster, is a repair cost, not a gain. The **underground economy** (illegal or unreported activity) is excluded, so GDP understates true production, especially in countries where informal work is common. Still, GDP per capita correlates strongly with life expectancy, education and other measures of living standards.

Common mistakes

(1) Including transfer payments in G. (2) Counting used goods or stock purchases as investment. (3) Forgetting to subtract imports. (4) Treating a rise in total GDP as proof of higher living standards without checking population and prices. (5) Saying a good made abroad by a U.S. firm counts in U.S. GDP; location of production decides.

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Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. Classify each as included or excluded from this year's U.S. GDP and explain: (a) a new refrigerator bought by a household, (b) a used textbook sold on a website, (c) a Social Security check, (d) steel sold to a refrigerator maker.
2. An economy has $C = \$900$, $I = \$250$, $G = \$300$, exports = \$180 and imports = \$230 (all in billions). Calculate net exports and GDP.
3. A tailor buys cloth for \$40 and sells a finished suit for \$130. What is the tailor's value added? If the cloth maker's inputs cost \$15, what is the cloth maker's value added?
4. Explain why a firm's purchase of a new delivery truck is investment, but a household's purchase of shares in that firm is not.
5. Country Q's GDP is \$600 billion with 20 million people; Country R's GDP is \$900 billion with 45 million people. Find GDP per capita for each and say which has the higher average output per person.
6. Give two reasons GDP understates well-being differences or total production, and one activity that GDP counts that arguably reduces well-being.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following is included in the current year's U.S. GDP?
(A) Purchase of 100 shares of a software company
(B) A homeowner's sale of her house built ten years ago
(C) Construction of a new apartment building
(D) A monthly unemployment benefit payment
(E) Wheat sold by a farmer to a flour mill
8. In an economy, consumption is \$700, investment is \$150, government purchases are \$200, transfer payments are \$90, exports are \$60 and imports are \$80. GDP equals
(A) \$1,030 (B) \$1,040 (C) \$1,050 (D) \$1,060 (E) \$1,120
9. Which change would directly increase U.S. GDP in the current year?
(A) A U.S. household buys a Japanese car produced last year in Japan
(B) The federal government raises Social Security benefits
(C) A family buys a used boat
(D) A U.S. firm increases its inventories of unsold goods it produced this year
(E) An investor buys government bonds
10. Which statement about value added is correct?
(A) It equals total sales revenue of a firm
(B) It counts intermediate goods at each stage
(C) It is greater than the final price of the good
(D) It excludes wages paid to workers
(E) It sums to the value of final goods across all stages of production
11. GDP per capita rises if
(A) Nominal GDP and population grow at the same rate
(B) GDP grows faster than population
(C) Population grows faster than GDP
(D) Imports rise by more than exports
(E) The underground economy shrinks
12. Which of the following is most likely to cause GDP to overstate improvement in living standards?
(A) A rise in unpaid volunteer work
(B) Growth in the underground economy
(C) Higher spending to repair damage from a hurricane
(D) A shorter work week with the same pay
(E) More varieties of products at the same prices

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SET C Apply and Extend

Write a complete response with calculations and explanation.

13. The table shows data for an economy (billions of dollars).
- Calculate GDP using the expenditure approach.
 - Calculate net exports and state whether there is a trade surplus or deficit.
 - Suppose imports rise by \$100 billion with no other change to the components listed. Explain why GDP does or does not fall by \$100 billion, and give the new value.

Component	Value
Consumption	8,400
Gross private investment	2,100
Government purchases	2,500
Government transfer payments	1,200
Exports	1,500
Imports	1,800

14. Country A has GDP of \$300 billion and 10 million people. Country B has GDP of \$450 billion and 30 million people. Over a year, A's GDP grows 2% and its population grows 0.5%; B's GDP grows 6% and its population grows 4%. (a) Compute each country's initial GDP per capita. (b) Compute each country's GDP per capita after one year. (c) A critic says GDP per capita is a poor measure of well-being. Give one reason and one example.

2.2 Real vs Nominal GDP and Growth

Learn how price indexes remove inflation from economic data so you can compute real GDP, growth rates, doubling times and fair per-person comparisons.

Nominal GDP is output valued at the prices of the year in which it is produced. Because prices change, nominal GDP can rise even if the economy makes exactly the same amount of stuff. **Real GDP** values output at constant prices from a chosen **base year**, so changes in real GDP reflect only changes in quantities. Economists use real GDP to measure growth and nominal GDP to measure the current dollar size of the economy.

To convert, we need a **price index**, a number that tracks the average price level relative to a base year set at 100. A price index of 120 means prices are 20% higher than in the base year. Two main indexes appear on the AP exam: the **GDP deflator**, which covers all goods and services produced domestically, and the Consumer Price Index (CPI), covered in a later lesson.

Core formulas

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\text{Price index}} \times 100$$

$$\text{Growth rate} = \frac{\text{Value}_{\text{new}} - \text{Value}_{\text{old}}}{\text{Value}_{\text{old}}} \times 100$$

EXAMPLE 1: DEFLATING NOMINAL GDP

Nominal GDP is \$20,000 billion in Year 1 (GDP deflator 100) and \$21,945 billion in Year 2 (GDP deflator 105). Find real GDP in each year, the growth rate of nominal GDP, the growth rate of real GDP, and the inflation rate.

SOLUTION

Real GDP, Year 1 = $20,000 / 100 \times 100 = \$20,000$ billion.

Real GDP, Year 2 = $21,945 / 105 \times 100 = \$20,900$ billion.

Nominal growth = $(21,945 - 20,000) / 20,000 = 9.725\%$, about 9.7%.

Real growth = $(20,900 - 20,000) / 20,000 = 4.5\%$.

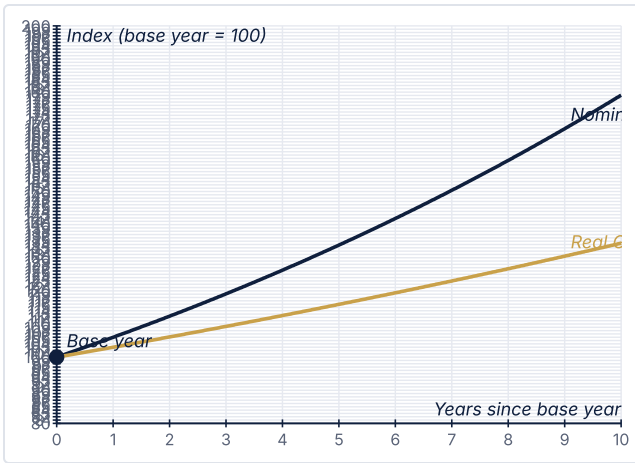
Inflation (change in deflator) = $(105 - 100) / 100 = 5\%$. Note that nominal growth is about real growth plus inflation: $4.5\% + 5\%$ is roughly 9.7%.

Another way to see the gap between the two series is on a graph. In the base year the two are identical, because prices that year are the prices used to value real output. Afterward, whenever there is inflation, nominal GDP rises faster than real GDP.

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Nominal GDP (grows 6% a year) rises faster than real GDP (3% a year). The gap is inflation. The two series are equal in the base year.

Real GDP is built from quantities valued at base-year prices. Suppose a tiny economy makes only pizzas and books. We value Year 2 quantities at Year 1 (base) prices and compare.

EXAMPLE 2: REAL GDP FROM PRICES AND QUANTITIES

Base year (2020): 100 pizzas at \$8 and 20 books at \$25. In 2024: 120 pizzas at \$10 and 25 books at \$28. Find nominal GDP in both years, real GDP in 2024 using 2020 prices, the 2024 GDP deflator, and real growth.

Year	Pizzas (price)	Books (price)
2020	100 (\$8)	20 (\$25)
2024	120 (\$10)	25 (\$28)

SOLUTION

Nominal 2020 = $100 \times 8 + 20 \times 25 = 800 + 500 = \$1,300$.

Nominal 2024 = $120 \times 10 + 25 \times 28 = 1,200 + 700 = \$1,900$.

Real 2024 = $120 \times 8 + 25 \times 25 = 960 + 625 = \$1,585$ (2024 quantities, 2020 prices).

Deflator 2024 = $1,900 / 1,585 \times 100 = \text{about } 119.9$, so prices rose about 20% since 2020.

Real growth = $(1,585 - 1,300) / 1,300 = \text{about } 21.9\%$, much less than the nominal growth of 46.2%.

Growth rates show how fast an economy expands. Because small differences compound, economists use the **rule of 70**: the number of years for a variable to double is about 70 divided by its annual percentage growth rate. At 2% growth, output doubles in 35 years; at 7%, in 10 years. The rule works for any steadily growing quantity, including prices, so 3.5% inflation doubles the price level in 20 years.

Rule of 70 and per-capita growth

Years to double $\approx \frac{70}{\text{annual growth rate in percent}}$

Growth of real GDP per capita is approximately real GDP growth minus population growth.

EXAMPLE 3: DOUBLING TIME AND PER-CAPITA GROWTH

Country M's real GDP grows 3.5% a year; Country N's grows 1.4%. Population grows 1.5% a year in M. (a) How long does each take to double real GDP? (b) Approximate M's per-capita growth.

SOLUTION

M doubles in $70 / 3.5 = 20$ years.

N doubles in $70 / 1.4 = 50$ years, so over 100 years M's output would be 32 times as large as its start and N's only 4 times (five doublings versus two).

M's per-capita growth is about $3.5\% - 1.5\% = 2.0\%$. Exact: $1.035/1.015 - 1 = 1.97\%$.

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Concept	Measures	Uses	Watch out
Nominal GDP	Output at current prices	Size of the economy in current dollars	Rises with inflation even if output is flat
Real GDP	Output at base-year prices	Growth and recessions	Level depends on base year
GDP deflator	Average price of all domestic output	Converting nominal to real; inflation	Not the same as the CPI
Real GDP per capita	Real output per person	Living-standard comparisons	Ignores distribution

The **choice of base year** changes the level of real GDP, because different years have different prices. It has a much smaller effect on measured growth rates. A very old base year can overweight goods that have become cheap, such as computers, so statistical agencies update the base and now use chain-weighting, which moves the weights forward each year. When comparing countries, convert to a common currency and divide by population so you compare real GDP per person.

Common mistakes

(1) Dividing by 100 instead of multiplying by it when deflating: $\text{real GDP} = \text{nominal} / \text{index} \times 100$. (2) Reading a rise in nominal GDP as growth; always check inflation. (3) Using the rule of 70 with a decimal growth rate (use 3.5, not 0.035). (4) Calling a falling inflation rate a falling price level: prices still rise during disinflation. (5) Computing growth using the new value in the denominator.

Practice

SET A Check Your Understanding

Show calculations where appropriate.

- The cost of a fixed basket of goods is \$250 in the base year and \$285 this year. Compute the price index and the percentage price increase.
- Nominal GDP is \$5,400 billion and the GDP deflator is 120. Find real GDP in base-year dollars.
- Real GDP rises from \$4,500 billion to \$4,635 billion. What is the growth rate?
- Nominal GDP rises 7% while the GDP deflator rises 4%. Estimate the exact real growth rate.
- At a steady 2.5% growth rate, how long does it take real GDP to double? To quadruple?
- Real GDP grows 4% while population grows 1.5%. Estimate and compute exactly the growth of real GDP per capita. Also explain whether a different base year would change this growth rate much.

SET B Exam-Style Multiple Choice

Choose the best answer.

- An economy's nominal GDP rises 6% and its GDP deflator rises 6%. Real GDP

(A) rises 12%
(B) rises 6%
(C) is unchanged
(D) falls 6%
(E) rises 3%
- Nominal GDP is \$3,150 billion and the GDP deflator is 126. Real GDP is

(A) \$ 2,500 billion
(B) \$ 3,150 billion
(C) \$ 3,969 billion
(D) \$ 2,800 billion
(E) \$ 3,024 billion
- The table gives price index values. Between Year 2 and Year 3 the inflation rate is closest to

Year	Price index
1	100
2	110
3	115.5

- (A) 3%
(B) 5%
(C) 8%
(D) 10%
(E) 15%

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10. A country's real GDP growth is 5% per year. Using the rule of 70, real GDP doubles in about
 (A) 7 years (B) 10 years (C) 14 years (D) 35 years (E) 70 years
11. Which statement about the choice of base year is correct?
 (A) It changes the level of real GDP but not the level of nominal GDP
 (B) It changes the level of nominal GDP but not real GDP
 (C) It has no effect on any statistic
 (D) It changes the rate of inflation in the current year only
 (E) It makes real GDP equal to nominal GDP in every year
12. Real GDP per capita rises when
 (A) nominal GDP rises faster than the population
 (B) real GDP rises more slowly than the population
 (C) inflation exceeds population growth
 (D) real GDP rises faster than the population
 (E) the GDP deflator rises

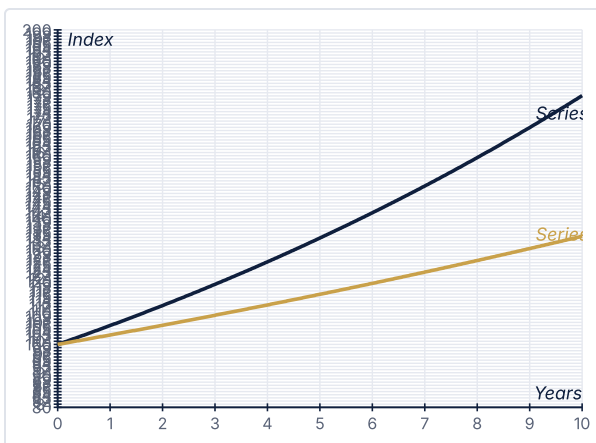
SET C Apply and Extend

Write a complete response with calculations and explanation.

13. The table shows data for an economy (billions of dollars).
 (a) Calculate real GDP for each year.
 (b) Calculate the growth rate of nominal GDP and of real GDP from Year 2 to Year 3.
 (c) Nominal GDP rose from Year 1 to Year 2, yet real GDP did not grow. Explain what happened to the price level.

Year	Nominal GDP	GDP deflator
1	8,000	100
2	8,320	104
3	8,748	108

14. The graph shows two index series for the same economy. Time 0 is the base year.
 (a) Identify which curve is real GDP and explain how you know.
 (b) Estimate the annual rate of inflation implied by the gap.
 (c) Use the rule of 70 to find how long real GDP takes to double.
 (d) Explain why choosing a different base year would not change the real growth rate by much.



2.3 The Business Cycle

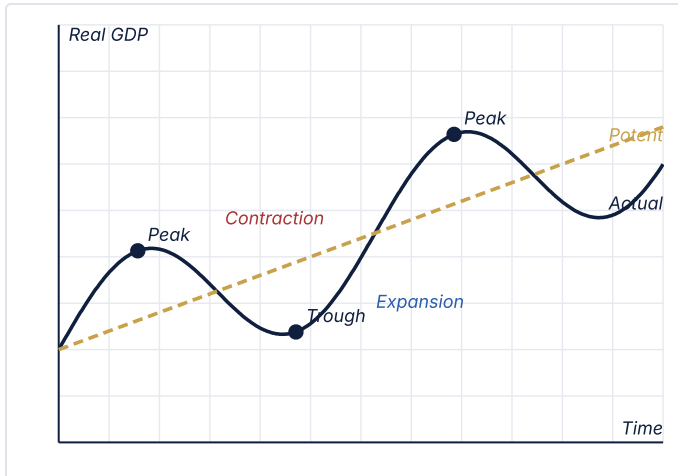
Learn the phases of the business cycle, how potential output and output gaps describe where an economy stands, which indicators signal turning points, and what causes fluctuations.

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In the long run, real GDP in market economies grows, driven by more workers, more capital and better technology. In the short run, growth is uneven. Output speeds up, slows down and sometimes falls. These recurring swings in real GDP around its long-run trend are the **business cycle**. Cycles are irregular: they differ in length and size, so the word 'cycle' does not mean a fixed pattern.



The business cycle: real GDP fluctuates around a rising trend. Peaks and troughs mark the turning points.

Phases of the business cycle

Expansion: real GDP rises, employment grows, unemployment falls. It runs from a trough to the next peak.

Peak: the high point of real GDP before a downturn begins.

Contraction (recession): real GDP falls, unemployment rises. It runs from a peak to a trough.

Trough: the low point of real GDP, after which recovery starts.

A common rule of thumb defines a **recession** as two or more consecutive quarters of falling real GDP. In the United States, the National Bureau of Economic Research (NBER) officially dates recessions by looking at a broad set of measures, including employment and income, so its calls can differ from the rule of thumb. A **depression** is an unusually deep and long contraction, such as the 1930s, when real GDP fell by roughly a quarter and unemployment reached about 25%. Since World War II, U.S. expansions have averaged several years while recessions have averaged under a year, though the 2007 to 2009 recession lasted 18 months.

EXAMPLE 1: READING PHASES FROM DATA

Real GDP changes each quarter by +0.6%, +0.2%, -0.4%, -0.7%, -0.1%, +0.5%, +0.8% (Quarters 1 to 7). Starting from an index of 100 before Quarter 1, identify the peak, the trough, the recession and when the previous high is regained.

SOLUTION

Compute the index: 100.6, 100.8, 100.4, 99.7, 99.6, 100.1, 100.9.

The peak is the end of Quarter 2 (index 100.8), the highest level before output falls.

Output falls in Quarters 3, 4 and 5, three consecutive quarters of decline, so by the rule of thumb the economy is in recession.

The trough is the end of Quarter 5 (index 99.6), the lowest level; Quarter 6 starts the expansion.

Output exceeds the old peak of 100.8 only in Quarter 7 (100.9), so the full recovery takes until then.

Potential output (also called full-employment output) is the level of real GDP the economy produces when resources, especially labor, are fully employed at the natural rate of unemployment. It is shown by the long-run aggregate supply curve in the AD-AS model and by the trend line in the graph above. The gap between actual and potential output is the **output gap**.

Output gaps

$$\text{Output gap (\%)} = \frac{\text{Actual real GDP} - \text{Potential real GDP}}{\text{Potential real GDP}} \times 100$$

Negative gap (**recessionary gap**): actual < potential, unemployment above its natural rate.

Positive gap (**inflationary gap**): actual > potential, unemployment below its natural rate, upward pressure on wages and prices.

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EXAMPLE 2: CALCULATING THE OUTPUT GAP

Potential GDP is \$20,000 billion. Actual real GDP is \$19,400 billion. Find the gap in dollars and as a percent. Then find actual GDP if a boom produces a +1.5% gap.

SOLUTION

Gap in dollars = $19,400 - 20,000 = -\$600$ billion.

Gap in percent = $-600 / 20,000 \times 100 = -3.0\%$, a recessionary gap; unemployment is above the natural rate.

For a +1.5% gap, actual GDP = $20,000 \times 1.015 = \$20,300$ billion, an inflationary gap that cannot last because wages and prices rise.

Economists use **indicators** to judge where the economy is headed. Leading indicators change before the economy turns, coincident indicators move together with the economy, and lagging indicators change after turning points.

Type	Examples	Why
Leading	Stock prices, building permits, new orders for equipment, consumer expectations, yield curve	Reflect expectations and plans that precede output
Coincident	Industrial production, employment, personal income, real sales	Move with current output
Lagging	Unemployment rate, inflation (CPI), duration of unemployment, bank prime lending rate	Firms and prices adjust slowly after output changes

What causes fluctuations? Because wages and prices are sticky in the short run, shifts in spending or costs change output and employment before prices fully adjust. Typical sources are changes in **aggregate demand** (a fall in consumer or business confidence, a financial crisis, tighter money, a drop in exports), changes in **aggregate supply** (an oil price spike or a productivity boom), and policy changes. Investment is especially volatile because firms' spending depends on uncertain expectations, so it drives much of the swing in total output. A fall in AD below potential causes a recessionary gap; the later lesson on aggregate demand and supply develops the graphs.

Recessions also differ in cause and speed. The 2007 to 2009 downturn grew out of a housing and financial crisis and was followed by a slow recovery. The brief 2020 recession began when public health measures abruptly cut spending and production, and it was among the deepest but shortest on record. Policymakers watch the output gap in real time because the right response to a recessionary gap (stimulate demand) is the opposite of the response to an inflationary gap (restrain demand).

Common mistakes

(1) Placing the unemployment peak at the trough of GDP: unemployment is a lagging indicator and often peaks after output begins to recover. (2) Thinking a recession means prices fall; the definition is about real output. (3) Confusing a slowdown in growth (still positive) with a contraction. (4) Treating potential output as a ceiling that cannot be exceeded: actual GDP can run above it temporarily, creating inflationary pressure. (5) Calling any rise in unemployment 'cyclical'; only the part above the natural rate is.

Practice**SET A Check Your Understanding**

Answer each question using complete sentences or calculations.

- Put these in order starting from a trough: peak, expansion, contraction, trough. Which phase is a recession?
- Potential output is \$9,500 billion and actual real GDP is \$9,300 billion. Compute the output gap in percent. Is this a recessionary or inflationary gap, and how does unemployment compare with the natural rate?
- Classify each as a leading, coincident or lagging indicator: (a) building permits, (b) the unemployment rate, (c) industrial production, (d) stock market index.
- Real GDP changes by -0.3% in one quarter and -0.9% in the next. Does the rule of thumb call this a recession? Why might the official NBER dating still disagree?
- Explain why investment spending is more volatile than consumption over the business cycle, and why that matters for fluctuations.
- Distinguish a recession from a depression and give one measurable difference.

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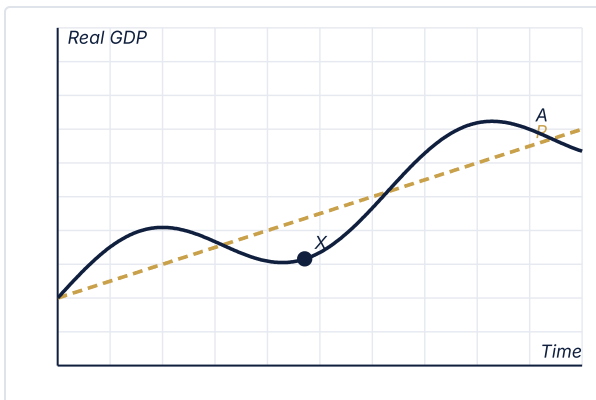
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SET B Exam-Style Multiple Choice

Choose the best answer.

7. The trough of a business cycle is the point at which
 - (A) unemployment is lowest
 - (B) real GDP is at its lowest level and recovery begins
 - (C) inflation is highest
 - (D) potential output equals nominal GDP
 - (E) the contraction begins
8. Which statement is true about a recession?
 - (A) It requires falling prices
 - (B) It always lasts at least two years
 - (C) It is a period of falling real GDP
 - (D) It is the phase after the trough
 - (E) It lowers potential output permanently
9. An economy's actual real GDP is above potential output. In the short run, which is most likely?
 - (A) Unemployment above the natural rate
 - (B) Falling wages
 - (C) Cyclical unemployment is positive
 - (D) Unemployment below the natural rate and upward pressure on prices
 - (E) Deflation
10. Which is a leading indicator?
 - (A) The unemployment rate
 - (B) Consumer price inflation
 - (C) The prime lending rate
 - (D) Industrial production
 - (E) New building permits
11. The graph shows actual real GDP (A) and potential output (P). At the labeled point X, the economy is



- (A) in a recessionary gap with unemployment above its natural rate
 - (B) in an inflationary gap with unemployment below its natural rate
 - (C) at full employment
 - (D) in an inflationary gap with unemployment above its natural rate
 - (E) in a recession with negative potential output
12. Which change is most likely to begin a contraction?
 - (A) A sharp rise in consumer and business confidence
 - (B) A rise in export demand
 - (C) A fall in aggregate demand from a financial crisis
 - (D) A fall in the price of oil, a key input
 - (E) A technology boom that raises productivity

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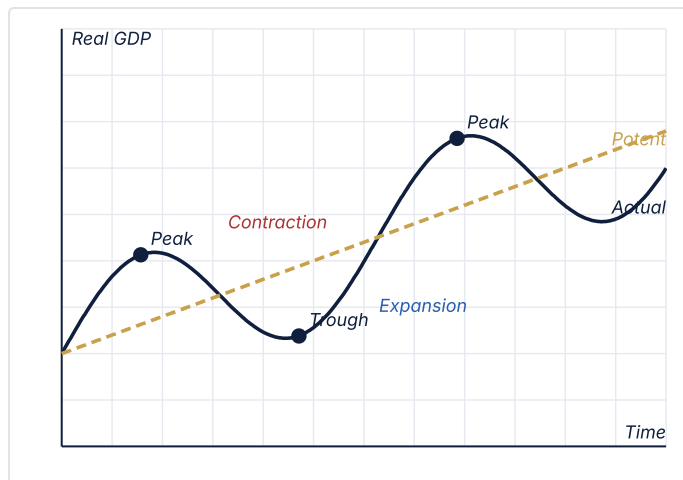
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SET C Apply and Extend

Write a complete response with explanation.

13. Use the graph below.

- Identify the phase of the cycle between Time 2 and Time 4.5 and between Time 5 and Time 7.
- At the trough, is the economy in a recessionary or inflationary gap? Explain the relationship between unemployment and the natural rate.
- Explain whether the unemployment rate would reach its highest level before, at, or after the trough, and name the type of indicator this makes it.



The business cycle: real GDP fluctuates around a rising trend. Peaks and troughs mark the turning points.

14. An economy has potential output of \$12,500 billion. The table shows actual real GDP over four years.

- Compute the output gap in percent for each year.
- Identify the year of the largest gap and state which gap it is.
- Explain why a leading indicator such as stock prices might have fallen before Year 2.

Year	Actual real GDP
1	12,750
2	12,500
3	12,000
4	12,375

2.4 Unemployment

Learn how the unemployment rate and labor force participation rate are measured, the types of unemployment, what the natural rate and full employment mean, and why the official numbers are imperfect.

The government measures unemployment with a monthly household survey. It starts with the **working-age population**: civilians age 16 or older who are not in an institution such as a prison. Each person is placed in one of three groups. The **employed** have a job (including part-time work). The **unemployed** have no job, are available for work and have actively looked for work in the past four weeks (or are waiting to be recalled from a layoff). Everyone else, including full-time students, retirees and people caring for family, is **not in the labor force**.

Unemployment and participation formulas

Labor force = employed + unemployed

Unemployment rate = $\frac{\text{Unemployed}}{\text{Labor force}} \times 100$

Labor force participation rate = $\frac{\text{Labor force}}{\text{Working-age population}} \times 100$

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EXAMPLE 1: COMPUTING THE RATES

The working-age population is 250 million; 148 million people are employed and 12 million are unemployed. Find the labor force, unemployment rate, participation rate, and the number not in the labor force.

SOLUTION

Labor force = 148 + 12 = 160 million.
Unemployment rate = $12 / 160 \times 100 = 7.5\%$. The denominator is the labor force, not the whole population.
Participation rate = $160 / 250 \times 100 = 64\%$.
Not in the labor force = 250 - 160 = 90 million.

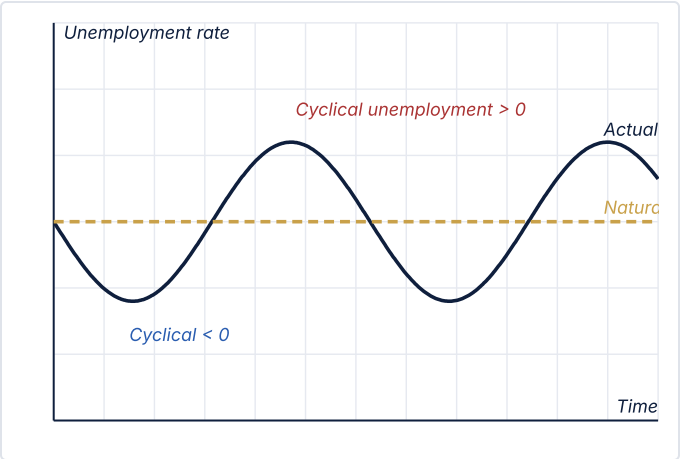
Economists divide unemployment into types because the cause, and therefore the right policy, differs.

Type	Cause	Example	Policy fit
Frictional	Normal time needed to search and match workers with jobs	A graduate looking for a first job; a worker who quit to find a better one	Better job information; shorter search
Structural	Mismatch of skills or location with available jobs, or lasting changes in industries	A coal miner displaced by a closed mine; workers replaced by automation	Retraining, relocation help, education
Seasonal	Regular yearly changes in demand	Ski instructors in summer, farm workers after harvest	Usually treated as part of the natural rate
Cyclical	Downturn in the business cycle: output is below potential	A factory worker laid off during a recession	Fiscal and monetary stimulus

The **natural rate of unemployment** is the sum of frictional and structural unemployment: the rate that exists when the economy is at its potential output. It is not zero, because a dynamic economy always has people moving between jobs and industries. **Full employment** means there is no cyclical unemployment: the unemployment rate equals the natural rate. In the United States this is typically estimated at roughly 4% to 5%, and it can drift over time with demographics, labor-market institutions and how efficiently workers and jobs find each other.

Natural rate and cyclical unemployment

Natural rate = frictional + structural unemployment.
Cyclical unemployment = actual rate - natural rate (negative in a boom, positive in a recession).
Full employment: actual rate = natural rate, output = potential output.



The actual unemployment rate moves opposite to output over the cycle. The gap between it and the natural rate is cyclical unemployment.

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EXAMPLE 2: CYCLICAL UNEMPLOYMENT

The labor force is 160 million. The actual unemployment rate is 6.4% and the natural rate is 5.0%. Find cyclical unemployment as a rate and as a number of people. How does the output gap compare with potential?

SOLUTION

Cyclical rate = 6.4% - 5.0% = 1.4 percentage points.

Number = 0.014 × 160 million = 2.24 million people.

Because the actual rate exceeds the natural rate, actual output is below potential: a recessionary gap.

Official measures have flaws. **Discouraged workers** want a job but have stopped searching because they believe none are available. They are counted as out of the labor force, not unemployed, so the unemployment rate understates labor-market weakness. The reverse flaw also exists: people working in the underground economy or pretending to search may be counted as unemployed.

Underemployment (part-time workers who want full-time work, or highly skilled workers in low-skill jobs) is counted as employed. For these reasons, analysts also watch broader measures and the participation rate.

EXAMPLE 3: DISCOURAGED WORKERS

Using Example 1's data, 3 million of the unemployed give up searching and leave the labor force. Compute the new unemployment rate and participation rate. Did the labor market improve?

SOLUTION

Unemployed = 12 - 3 = 9 million. Labor force = 148 + 9 = 157 million.

Unemployment rate = $9 / 157 \times 100 = 5.7\%$, down from 7.5%.

Participation rate = $157 / 250 \times 100 = 62.8\%$, down from 64%.

No job was created. Employment stayed at 148 million, so the fall in the rate reflects a smaller labor force, not a stronger economy.

Unemployment carries real costs. Individuals lose income, suffer stress, and may lose skills and job contacts, which makes it harder to get hired later. The economy loses the output the idle workers could have produced, government tax revenue falls while spending on benefits rises, and long spells of joblessness can weigh on future growth. Some frictional unemployment, however, has a benefit: it gives workers time to find better matches, which raises productivity.

Common mistakes

(1) Dividing unemployed by the population instead of the labor force. (2) Treating retirees, students or discouraged workers as unemployed. (3) Believing the natural rate is zero or that full employment means no one is jobless. (4) Counting seasonal and frictional unemployment as cyclical. (5) Reading a falling unemployment rate as proof that jobs were created: check the participation rate.

Practice**SET A Check Your Understanding**

Show calculations where appropriate.

1. A country has a working-age population of 200 million, a labor force of 130 million and 120 million employed. Calculate the number unemployed, the unemployment rate and the participation rate.
2. Classify each case as frictional, structural, seasonal, cyclical or not unemployed: (a) a lifeguard in winter, (b) a recently laid-off auto worker during a recession, (c) a software tester whose job was replaced by new technology and whose skills do not match open jobs, (d) a full-time student, (e) a nurse who quit and is interviewing for a better job.
3. The actual unemployment rate is 7.0% and the natural rate is 4.8%. Compute cyclical unemployment and say whether output is above or below potential.
4. Explain why the unemployment rate can fall even if no new jobs are created.
5. Why is the natural rate of unemployment greater than zero?
6. Give two costs of cyclical unemployment, one for individuals and one for the economy.

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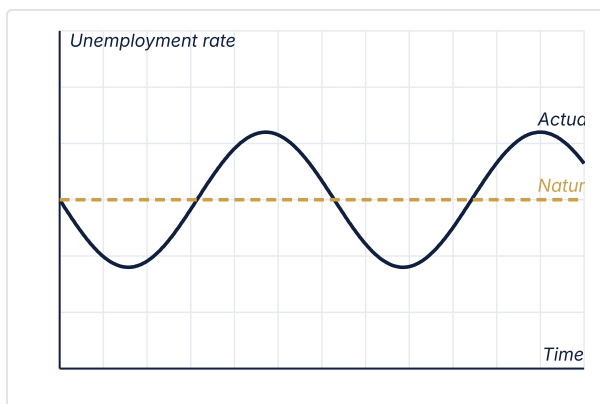
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SET B Exam-Style Multiple Choice

Choose the best answer.

7. A worker who is laid off because a recession has reduced demand for cars is
 - (A) frictionally unemployed
 - (B) structurally unemployed
 - (C) seasonally unemployed
 - (D) cyclically unemployed
 - (E) not in the labor force
8. The working-age population is 200 million, the labor force is 130 million and 120 million are employed. The unemployment rate is closest to
 - (A) 5.0%
 - (B) 6.0%
 - (C) 7.7%
 - (D) 8.3%
 - (E) 10.0%
9. Which of the following is counted as unemployed?
 - (A) A retiree who does not want to work
 - (B) A full-time student not looking for work
 - (C) A discouraged worker who stopped searching six months ago
 - (D) A parent staying home with children by choice
 - (E) A person who has been without a job, wants one, and has searched actively this month
10. When the economy is at full employment,
 - (A) the unemployment rate is zero
 - (B) cyclical unemployment is zero
 - (C) frictional unemployment is zero
 - (D) structural unemployment is zero
 - (E) the labor force participation rate is 100 percent
11. Discouraged workers cause the official unemployment rate to
 - (A) understate labor-market weakness
 - (B) be exactly accurate
 - (C) overstate unemployment
 - (D) rise because they are counted as unemployed
 - (E) equal the natural rate
12. In the graph, at the time when the actual rate is above the natural rate, the economy is most likely



- (A) in a recessionary gap
- (B) in an inflationary gap
- (C) at potential output
- (D) in an expansion beyond the previous peak
- (E) at full employment

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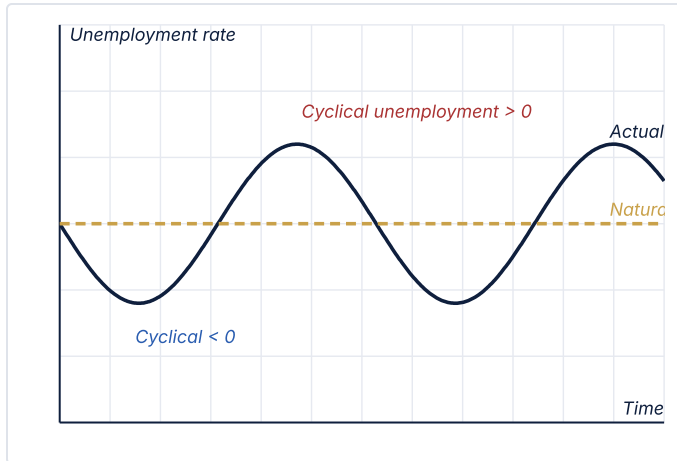
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SET C Apply and Extend

Write a complete response with calculations and explanation.

13. Use the graph.

- (a) During which part of the cycle does the actual unemployment rate exceed the natural rate (identify by time: 0 to 3, 3.2 to 6.2, 6.3 to 9.4)?
- (b) Explain what happens to cyclical unemployment and to the output gap at that time.
- (c) Suppose the natural rate falls because workers and jobs match more efficiently. Describe the effect on the potential output and the actual rate at full employment.



The actual unemployment rate moves opposite to output over the cycle. The gap between it and the natural rate is cyclical unemployment.

14. The table shows labor data in millions for an economy.

- (a) Compute the unemployment rate and participation rate for each year.
- (b) Explain why the Year 2 unemployment rate fell although employment did not rise.
- (c) State one reason the official rate can understate labor underuse.

Year	Working-age population	Employed	Unemployed
1	200	120	10
2	200	120	6

2.5 Inflation and the Consumer Price Index

Learn how the CPI is built, how to compute inflation and real values, how the CPI differs from the GDP deflator, and who gains or loses when prices change.

Inflation is a sustained rise in the overall price level; the **inflation rate** is the percentage change in a price index from one period to the next. The most widely quoted measure is the **Consumer Price Index (CPI)**, which tracks the cost of a fixed **market basket** of goods and services that a typical urban household buys, including food, housing, transportation, medical care and clothing. Statistical agencies survey prices of the same items each month. The basket's cost in a chosen **base period** is set to an index of 100.

CPI and inflation formulas

$$\text{CPI} = \frac{\text{Cost of basket in current year}}{\text{Cost of basket in base year}} \times 100$$

$$\text{Inflation rate} = \frac{\text{CPI}_{\text{this year}} - \text{CPI}_{\text{last year}}}{\text{CPI}_{\text{last year}}} \times 100$$

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EXAMPLE 1: BUILDING A CPI

A fixed basket has 4 pizzas, 10 movie tickets and 2 textbooks. Base-year prices are \$12, \$10 and \$80. Current prices are \$14, \$11 and \$90. Find the CPI and the inflation rate over the period.

Item	Quantity	Base price	Current price
Pizza	4	\$12	\$14
Movie ticket	10	\$10	\$11
Textbook	2	\$80	\$90

SOLUTION

Base cost = $4(12) + 10(10) + 2(80) = 48 + 100 + 160 = \$308$.

Current cost = $4(14) + 10(11) + 2(90) = 56 + 110 + 180 = \$346$.

CPI = $346 / 308 \times 100 = \text{about } 112.3$.

Inflation over the period = $(112.3 - 100) / 100 = \text{about } 12.3\%$.

Three words describe price-level movements. **Disinflation** means the inflation rate falls but is still positive: prices keep rising, more slowly. **Deflation** means the price level actually falls (negative inflation), which tends to be harmful because it discourages spending and raises the real burden of debt. **Hyperinflation** is extremely rapid inflation, often defined as more than 50% per month, which destroys money's usefulness as a store of value, as in Germany in 1923 and Zimbabwe in the 2000s.

The CPI has known **biases** that cause it to overstate the true rise in the cost of living. **Substitution bias**: because the basket is fixed, the CPI ignores that consumers shift toward goods whose relative prices have fallen. **New product and quality bias**: new goods enter slowly, and a better product at the same price is hard to count as a lower price. A related issue is **outlet substitution**, where shoppers move to discount stores. Government agencies adjust for these but cannot remove them entirely. **Core CPI** excludes food and energy because their prices are volatile and often reflect temporary shocks.

Feature	CPI	GDP deflator
Goods covered	Fixed basket bought by consumers	All final goods produced domestically
Imports	Included if consumers buy them	Excluded (not produced here)
Investment and government goods	Not included	Included
Basket weights	Fixed in a base period	Change each year with current output
Typical use	Indexing wages, benefits; cost of living	Converting nominal GDP to real GDP

Inflation changes how we should read money values. A **nominal** value is in current dollars; a **real** value is adjusted for price changes. Dividing by the price index converts nominal wages into purchasing power. For interest rates, the **real interest rate** is approximately the nominal rate minus the inflation rate. Lenders and borrowers agree on a nominal rate using *expected* inflation, so the real rate they actually earn depends on the inflation that occurs.

Real values

$$\text{Real wage} = \frac{\text{Nominal wage}}{\text{CPI}} \times 100$$

Real interest rate $\approx$ nominal interest rate – inflation rate (expected inflation for the ex ante rate, actual for the ex post rate).

EXAMPLE 2: REAL WAGES

A worker earns \$30 per hour when the CPI is 120 (base = 100). Two years later she earns \$33 and the CPI is 132. Did her purchasing power change?

SOLUTION

Real wage then = $30 / 120 \times 100 = \$25$.

Real wage now = $33 / 132 \times 100 = \$25$.

The nominal wage rose 10% and prices rose 10%, so the real wage is unchanged.

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EXAMPLE 3: REAL INTEREST AND WINNERS

A bank makes a 7% fixed-rate loan expecting 4% inflation. Actual inflation turns out to be 6%. Find the expected and the actual real rate, and say who gains.

SOLUTION

Expected real rate = 7% - 4% = 3%.

Actual real rate = 7% - 6% = 1%.

The lender receives less purchasing power than planned. The borrower, who repays in dollars worth less, gains: unexpected inflation redistributes wealth from lenders to borrowers.

Group	Unexpected inflation	Reason
Fixed-rate borrowers (mortgage holders)	Gain	Repay with cheaper dollars
Lenders and savers earning fixed interest	Lose	Real return falls
People on fixed incomes (some pensions)	Lose	Purchasing power erodes
Workers whose wages lag prices	Lose	Real wage falls
Workers with COLAs or indexed contracts	Protected	Pay adjusts with the CPI

In the United States, inflation was high in the 1970s, fell sharply in the early 1980s, and for decades afterward stayed near 2%, the Federal Reserve's stated target. It rose to roughly 9% in 2022 before easing, a reminder that price stability cannot be taken for granted. In the Great Depression the price level fell by about a quarter.

Common mistakes

(1) Calling a fall in the inflation rate 'deflation': that is disinflation. (2) Calculating inflation from the CPI of the base year rather than the previous year. (3) Forgetting to divide by the CPI when finding real wages. (4) Saying the GDP deflator includes imports. (5) Assuming all inflation hurts everyone: debtors can gain, and fully expected inflation can be built into contracts.

Practice

SET A Check Your Understanding

Show calculations where appropriate.

1. A basket costs \$200 in the base year and \$231 this year. Compute the CPI.
2. The CPI rises from 180 to 189. Find the inflation rate.
3. Last year inflation was 5%. This year it is 3%. Is this deflation, disinflation or neither? What happened to the price level?
4. A worker's wage is \$24 when the CPI is 120. Later the wage is \$26.40 and the CPI is 132. Compute real wages in base-year dollars both times and comment.
5. A mortgage has a fixed 6% nominal rate. If inflation is 2%, compute the real rate. If inflation unexpectedly becomes 4%, who gains and by how much (in real-rate points)?
6. Explain substitution bias and say whether it makes the CPI overstate or understate inflation.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. The price index was 125 last year and 130 this year. The inflation rate is closest to

Year	Price index
Last year	125
This year	130

- (A) 25% (B) 3% (C) 5% (D) 4% (E) 30%
8. Which statement distinguishes the CPI from the GDP deflator?
- (A) The CPI includes the prices of all goods produced domestically
(B) The GDP deflator includes prices of imported consumer goods
(C) Both use a fixed basket of goods
(D) The deflator ignores government purchases
(E) The CPI is based on a fixed basket of consumer purchases, and the deflator covers all domestic output
9. Disinflation occurs when
- (A) the price level falls
(B) the inflation rate falls but remains positive
(C) real GDP falls
(D) the price level is constant
(E) inflation is above 50% per month
10. A retiree receives a fixed nominal pension of \$2,000 per month. If inflation is unexpectedly high for several years, the retiree
- (A) loses purchasing power (B) is unaffected
(C) gains because the pension is nominal (D) earns a higher real interest rate
(E) gets a cost-of-living raise automatically
11. If nominal interest is 8% and inflation is 3%, the approximate real interest rate is
- (A) 3% (B) 8% (C) 5% (D) 11% (E) 24%
12. The CPI tends to overstate inflation because it
- (A) does not fully capture consumers' substitution and quality improvements
(B) ignores housing costs
(C) is based on a variable basket that changes every month
(D) includes the prices of investment goods
(E) excludes imports

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SET C Apply and Extend

Write a complete response with calculations and explanation.

13. The CPI basket contains 10 gallons of milk, 20 loaves of bread and 5 movie tickets. Prices are shown. The base year is 2022.
- Compute the CPI for 2024.
 - Compute the percentage rise in the cost of the basket.
 - Suppose consumers respond to the price changes by buying less milk and more bread. Explain how this affects the accuracy of the CPI.

Item	2022 price	2024 price
Milk (gallon)	\$3.00	\$3.60
Bread (loaf)	\$2.50	\$2.75
Movie ticket	\$10.00	\$12.00

14. A union contract gives workers a nominal wage in three years while the CPI changes.
- Compute inflation in Years 2 and 3.
 - Compute the real wage (base-year dollars) each year.
 - In which year does workers' purchasing power fall, and what contract feature could protect them?

Year	CPI	Nominal wage
1	125	\$25.00
2	130	\$26.00
3	143	\$27.30

2.6 Costs of Inflation and Economic Indicators in Practice

Learn the economic costs of inflation, why expected and unexpected inflation differ, how to link unemployment to lost output, and how to read data tables and recognize stagflation.

Many people think inflation is harmful because prices go up, but if wages and incomes rose by the same percentage, buying power would be unchanged. The real harm comes from how inflation interferes with the economy's ability to coordinate decisions and from the way it redistributes wealth. Economists separate **anticipated inflation**, which people expect and can plan for, from **unanticipated inflation**, which catches them by surprise.

Costs of inflation

Menu costs: resources used to change prices, such as reprinting menus and catalogs, reprogramming systems and re-advertising.

Shoe-leather costs: time and effort spent holding less cash and making more trips to the bank to avoid the loss of purchasing power.

Redistribution: unexpected inflation transfers wealth from lenders to borrowers and from people on fixed incomes to those who set prices.

Uncertainty and distorted price signals: relative price changes are harder to read, discouraging long-term saving, lending and investment.

EXAMPLE 1: A MENU COST ESTIMATE

A grocery store has 4,000 items. Relabeling each item costs \$0.25. Under low inflation prices are changed twice a year. Under high inflation they are changed 12 times a year. Compute the annual menu cost in each case and the extra cost.

SOLUTION

Low inflation: $4,000 \times \$0.25 \times 2 = \$2,000$.

High inflation: $4,000 \times \$0.25 \times 12 = \$12,000$.

Extra cost = \$10,000 a year for one store. Multiplied across the economy, resources are used to adjust prices instead of producing goods.

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Expected inflation is far less damaging than unexpected inflation. If both sides expect 4% inflation, lenders can add it to the interest rate and workers can negotiate matching raises, so real values are protected. When inflation is unexpected, those agreements fail. Higher inflation also interacts with tax rules: if tax brackets are not indexed, rising nominal incomes push households into higher brackets (**bracket creep**) even though real income is flat, and taxes on nominal interest and capital gains can tax investors on inflation itself.

Situation	Anticipated inflation	Unanticipated inflation
Fixed-rate loan	Rate includes expected inflation; real return as planned	Borrower gains; lender loses
Wage contracts	Raises match expected price rise	Real wages fall if inflation exceeds the raise
Planning and investment	Manageable	Greater risk, shorter planning horizons
Main costs	Menu and shoe-leather	Redistribution, uncertainty, and the above

Now turn to reading data. The link between unemployment and output is often summarized by **Okun's law**: when unemployment is above the natural rate, real GDP falls below potential by a larger percentage. A common rule of thumb is that every 1 percentage point of cyclical unemployment is accompanied by about a 2 percent shortfall in output. This is an empirical regularity, not an exact law, and the coefficient can vary.

Okun-style rule of thumb

Output gap (%) ≈ -2× (actual unemployment rate – natural rate)
Dollar loss = output gap (%) × potential GDP.

EXAMPLE 2: OUTPUT LOST TO UNEMPLOYMENT

The unemployment rate is 8.5%, the natural rate is 5%, and potential GDP is \$18,000 billion. Use a coefficient of 2 to estimate the output gap and the lost output.

SOLUTION

Cyclical unemployment = 8.5 - 5.0 = 3.5 percentage points.
Output gap = -2 × 3.5 = -7%.
Lost output = 0.07 × 18,000 = \$1,260 billion, so actual GDP is about \$16,740 billion.

When you read an indicator table, look at direction and size. Do not compare levels across series with different units. Ask: Is real GDP growing or shrinking? Is unemployment above or below its usual level? Is the inflation rate rising or falling? Remember the lag pattern: unemployment and inflation often turn after output does.

EXAMPLE 3: READING AN INDICATOR TABLE

Classify each year, and decide whether any year shows stagflation.

Year	Real GDP growth (%)	Unemployment (%)	Inflation (%)
1	3.5	4.8	2.0
2	1.0	5.5	4.5
3	-1.8	7.2	7.0
4	-0.5	8.6	5.1
5	3.0	7.9	3.2

SOLUTION

Year 1: solid expansion, low unemployment, low inflation, roughly full employment.
Year 2: growth slows while inflation rises: a warning sign.
Year 3: output falls, unemployment jumps and inflation is highest. This is stagflation.
Year 4: still contracting but inflation is falling (disinflation); unemployment peaks, as a lagging indicator.
Year 5: recovery with growth returning; unemployment and inflation still elevated but easing.

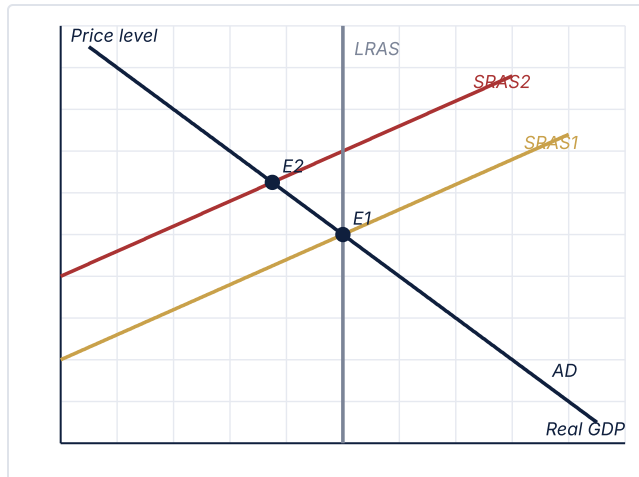
Stagflation is the combination of stagnant output (rising unemployment) and rising inflation. It is typically caused by a negative supply shock that raises costs of production, such as the oil price spikes of the 1970s. It is a policy dilemma: stimulating demand to fight the recession would add to inflation, while restraining demand to fight inflation would deepen the recession.

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Also be careful with revisions and timing. Initial estimates of GDP, employment and prices are revised as more complete surveys arrive, so a single month can mislead. Analysts therefore compare several indicators together, look at trends over a few quarters, and ask whether each series is leading, coincident or lagging before drawing a conclusion about the state of the economy.



A negative supply shock shifts SRAS left (SRAS1 to SRAS2): the price level rises and real GDP falls below potential. This is stagflation.

Exam tip

When asked for the cost of inflation, name the specific cost (menu, shoe-leather, redistribution, uncertainty) and say whether inflation is expected. For stagflation, show a leftward shift of short-run aggregate supply and state that the price level rises while real GDP falls. A demand shift cannot produce stagflation.

Practice

SET A Check Your Understanding

Answer fully, with calculations where needed.

1. Define menu costs and shoe-leather costs, and give one example of each for an economy with 30% annual inflation.
2. The unemployment rate is 8.5%, the natural rate is 5.0% and potential GDP is \$18,000 billion. Use an Okun coefficient of 2 to estimate the output gap and dollar loss.
3. Why is unanticipated inflation generally more costly than anticipated inflation?
4. A lender makes a 5% fixed-rate loan expecting 3% inflation. Inflation turns out to be 6%. Compute the expected and actual real rates and say who benefits.
5. The data show falling real GDP, rising unemployment and rising inflation in the same year. Name this situation and its most likely source.
6. Explain bracket creep and why indexing the tax code reduces it.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following is an example of a shoe-leather cost of inflation?
- (A) A restaurant reprinting its menus
 (B) A consumer making extra trips to the bank to hold less cash
 (C) A worker receiving a raise smaller than inflation
 (D) A lender earning a negative real return
 (E) A government indexing tax brackets
8. A fixed-rate lender is hurt most by
- (A) inflation that is higher than expected
 (B) inflation that matches expectations
 (C) inflation that is lower than expected
 (D) deflation
 (E) stable prices
9. Which event is most likely to cause stagflation?
- (A) A rise in consumer confidence
 (B) An increase in government spending
 (C) A sharp increase in oil prices
 (D) A tax cut for households
 (E) An increase in the money supply
10. If the natural rate is 5%, actual unemployment is 7%, and the Okun coefficient is 2, the output gap is
- (A) -2% (B) -5% (C) +2% (D) +4% (E) -4%
11. The table shows macroeconomic data. Which year is best described as disinflation with recession?

Year	Real GDP growth (%)	Unemployment (%)	Inflation (%)
1	3.5	4.8	2.0
2	1.0	5.5	4.5
3	-1.8	7.2	7.0
4	-0.5	8.6	5.1
5	3.0	7.9	3.2

- (A) Year 1 (B) Year 2 (C) Year 3 (D) Year 4 (E) Year 5
12. Which cost is associated mainly with high inflation rather than low inflation?
- (A) Menu costs and shoe-leather costs are larger
 (B) Redistribution from borrowers to lenders
 (C) Output growth always rises
 (D) Real interest rates are always negative
 (E) The unemployment rate becomes zero

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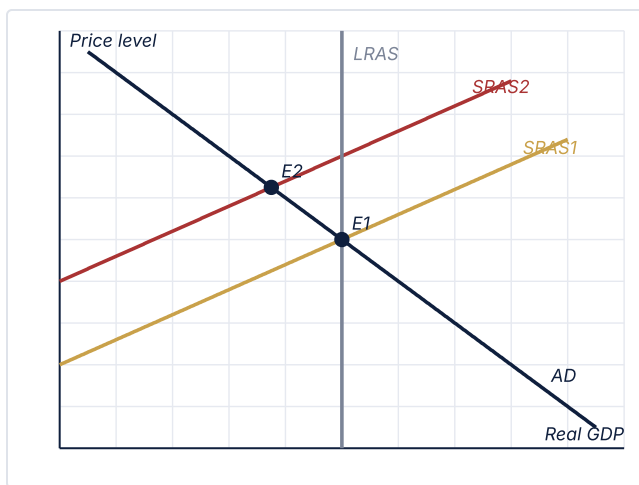
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SET C Apply and Extend

Use the data or graph and answer fully.

13. The graph shows an economy starting at E1 on LRAS, then moving to E2.
- Identify the event that moves the economy from E1 to E2.
 - State the changes in the price level, real GDP and the unemployment rate relative to the natural rate.
 - Explain why policymakers face a dilemma.



A negative supply shock shifts SRAS left (SRAS1 to SRAS2): the price level rises and real GDP falls below potential. This is stagflation.

14. An economy has potential GDP of \$10,000 billion and a natural rate of 5%. Data for two years are in the table. Use an Okun coefficient of 2.
- Estimate the output gap (percent and dollars) for each year.
 - In which year is real GDP closer to potential? Explain.
 - Year 2 inflation is higher than expected. Explain one redistribution effect.

Year	Unemployment (%)	Inflation (%)	Expected inflation (%)
1	8	3	3
2	6	6	3

2.7 Multiple-Choice Practice: Economic Indicators and the Business Cycle

Practice with 20 AP-style multiple-choice questions covering GDP, real and nominal values, the business cycle, unemployment, and inflation.

Choose the best answer for each question. Use the explanations to find out why the correct choice is right and why the most tempting wrong choice fails.

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SET A Core Concepts

Choose the best answer.

1. Which of the following is included in this year's U.S. GDP?
(A) Sale of a used car from one household to another
(B) Purchase of Treasury bonds by a pension fund
(C) Construction of a new home by a builder
(D) Social Security payments to retirees
(E) Resale of a 1990s painting at auction
2. An economy has $C = \$500$, $I = \$120$, $G = \$150$, exports = \$80 and imports = \$100 (billions). GDP equals
(A) \$ 770 (B) \$ 650 (C) \$ 850 (D) \$ 830 (E) \$ 750
3. Nominal GDP is \$4,400 billion and the GDP deflator is 110. Real GDP is
(A) \$ 4,840 billion (B) \$ 4,000 billion (C) \$ 4,290 billion
(D) \$ 4,400 billion (E) \$ 3,600 billion
4. Real GDP grows steadily at 2% per year. According to the rule of 70, real GDP doubles in about
(A) 14 years (B) 20 years (C) 28 years (D) 35 years (E) 70 years
5. The trough of a business cycle is the point at which
(A) real GDP is at its lowest level before it starts to rise
(B) unemployment is always at its highest
(C) the economy is at potential output
(D) inflation is at its lowest
(E) real GDP is at its highest level before it falls
6. A welder is permanently displaced by automation and her skills do not match open jobs. She is
(A) frictionally unemployed (B) cyclically unemployed (C) structurally unemployed
(D) seasonally unemployed (E) not in the labor force
7. The CPI rises from 200 to 210. The inflation rate is
(A) 2.5% (B) 5% (C) 10% (D) 21% (E) 50%

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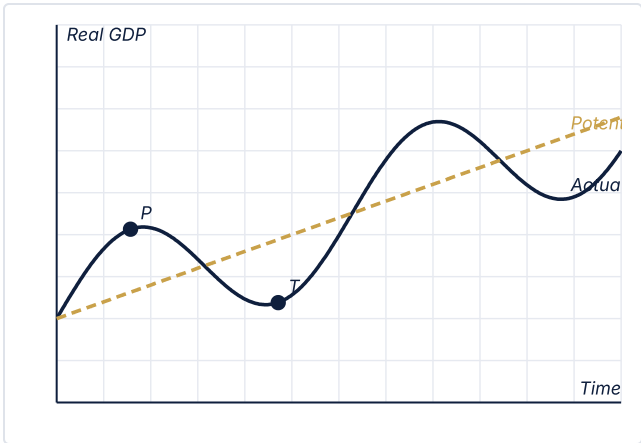
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SET B

Applications and Data

Choose the best answer. Use the data or graph when provided.

8. In an economy the working-age population is 250 million, 150 million are employed and 10 million are unemployed. The unemployment rate is closest to
- (A) 4.0% (B) 5.0% (C) 6.7% (D) 7.5% (E) 6.3%
9. In the graph, the economy moves from point P to point T. Which is most likely true during this movement?



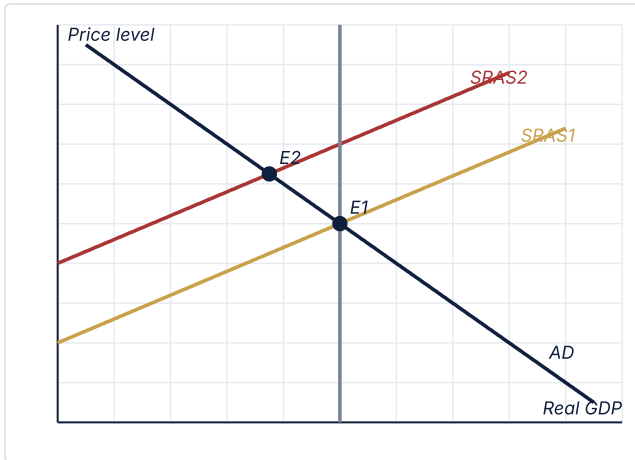
- (A) Unemployment rises and real GDP falls
- (B) Unemployment falls and real GDP rises
- (C) Inflation is accelerating because actual GDP exceeds potential
- (D) Cyclical unemployment decreases
- (E) The economy is in an expansion
10. The table shows nominal GDP and the GDP deflator. Real GDP growth from Year 1 to Year 2 is closest to
- | Year | Nominal GDP | GDP deflator |
|------|-------------|--------------|
| 1 | 2,000 | 100 |
| 2 | 2,226 | 106 |
- (A) 3.0% (B) 4.0% (C) 6.0% (D) 5.0% (E) 11.3%
11. A fixed basket costs \$80 in the base year and \$92 in the current year. The CPI in the current year is
- (A) 92 (B) 108 (C) 115 (D) 120 (E) 80
12. A bank makes a fixed 8% loan while expecting 3% inflation. Actual inflation is 6%. The actual real interest rate earned is
- (A) 5% (B) 2% (C) 11% (D) 3% (E) -2%
13. Unemployment is 9%, the natural rate is 5%, potential GDP is \$15,000 billion and the Okun coefficient is 2. Estimated lost output is
- (A) \$ 150 billion (B) \$ 300 billion (C) \$ 600 billion
- (D) \$ 900 billion (E) \$ 1,200 billion

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14. In the graph the economy moves from E1 to E2. This is best described as



- (A) stagflation caused by a negative supply shock
- (B) a demand-pull inflation
- (C) the effect of an increase in aggregate demand
- (D) a movement along the AD curve due to a tax cut
- (E) an expansion above potential

SET C Exam-Level Stretch

Choose the best answer.

15. A sharp rise in the price of imported consumer electronics will raise the
 - (A) CPI and the GDP deflator equally
 - (B) neither the CPI nor the GDP deflator
 - (C) GDP deflator only
 - (D) CPI more than the GDP deflator
 - (E) GDP deflator more than the CPI
16. Five million unemployed workers become discouraged and stop searching. The unemployment rate and labor force participation rate
 - (A) both rise
 - (B) the unemployment rate rises and participation falls
 - (C) both fall
 - (D) the unemployment rate falls and participation rises
 - (E) are unchanged
17. Nominal GDP rises 6%, the GDP deflator rises 4%, and population rises 3%. Real GDP per capita
 - (A) rises about 3%
 - (B) falls about 1%
 - (C) rises about 2%
 - (D) rises about 7%
 - (E) falls about 4%
18. Quarterly real GDP growth was -1.2%, -0.6%, +0.4%, +0.9% in Quarters 1 to 4, and unemployment was 6.0%, 7.1%, 7.6%, 7.4%. Which is best supported?
 - (A) Unemployment peaked after output began recovering
 - (B) Unemployment peaked at the trough of output
 - (C) The economy was in expansion all year
 - (D) Unemployment is a leading indicator
 - (E) Potential output fell in Quarter 3
19. Because the CPI overstates the true rise in the cost of living, indexing Social Security and tax brackets to it will
 - (A) decrease government spending on benefits relative to true costs
 - (B) leave government outlays and tax revenue unaffected
 - (C) raise real wages
 - (D) make fixed-income retirees worse off
 - (E) raise benefit payments faster than the true cost of living and reduce real tax revenue

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20. Which group is most likely to gain from unexpected inflation?

- (A) A retiree with a fixed pension
- (B) A bank holding fixed-rate loans
- (C) A worker with a fixed-wage contract
- (D) A homeowner with a fixed-rate mortgage
- (E) A saver holding a fixed-rate certificate of deposit

2.8 Free-Response Practice: Economic Indicators and the Business Cycle —

Four free-response questions with scoring points, in the style of the AP Macroeconomics exam.

Each question has several parts. Write calculations and explanations, then compare your response to the scoring points, which show where points are earned. Label graphs and show formulas.

QUESTION 1 GDP Calculations

The table gives data for Country X in Year 1 (billions of dollars).

1. (a) Calculate GDP using the expenditure approach.
- (b) Explain why the \$900 billion of transfer payments is not included in your answer.
- (c) Year 1 population is 150 million. Calculate GDP per capita.
- (d) In Year 2, nominal GDP is \$9,540 billion and the GDP deflator is 106 (Year 1 deflator = 100). Calculate real GDP in Year 2 and the real growth rate, and explain what happened to nominal GDP relative to real GDP.

Component	Amount
Consumption	6,000
Gross private investment	1,500
Government purchases	1,800
Transfer payments	900
Exports	1,100
Imports	1,400

QUESTION 2 Unemployment

The working-age population of an economy is 220 million. There are 132 million employed and 8 million unemployed.

2. (a) Calculate the labor force, the unemployment rate and the labor force participation rate.
3. (b) Identify the type of unemployment (frictional, structural or cyclical) for each: (i) a new graduate searching for a first job, (ii) a bank teller whose position was eliminated by online banking and who lacks other skills, (iii) a factory worker laid off during a recession.
4. (c) Suppose 2 million of the unemployed become discouraged and stop searching. Calculate the new unemployment rate and participation rate, and explain whether the labor market has improved.
5. (d) The natural rate is 4.5%. Using the original data, calculate cyclical unemployment and state whether the economy is above or below potential output.

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QUESTION 3 Inflation and Its Effects

A market basket contains 20 gallons of gasoline, 10 restaurant meals and 4 shirts. The table shows prices in the base year and the current year.

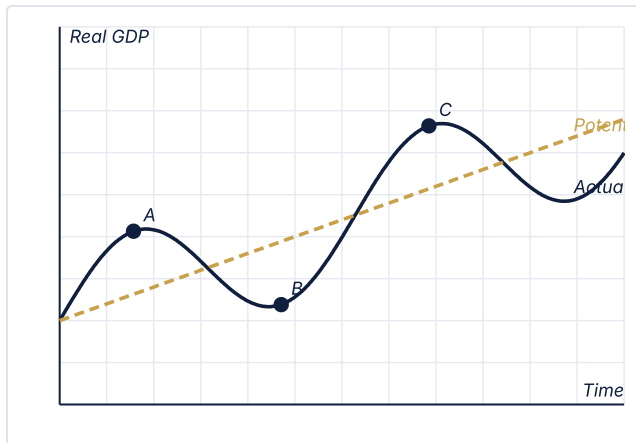
6. (a) Calculate the CPI in the current year and the percentage increase in the cost of the basket.
- (b) A worker earns \$21.20 per hour in the current year. Calculate her real wage in base-year dollars.
- (c) Explain who gains and who loses if inflation was higher than both sides expected when a fixed-rate loan was made.
- (d) Explain one reason the CPI might overstate the true change in the cost of living.

Item	Base price	Current price
Gasoline (gallon)	\$3.00	\$3.60
Restaurant meal	\$12.00	\$13.20
Shirt	\$20.00	\$22.00

QUESTION 4 The Business Cycle

The graph shows actual real GDP and potential output over time. Points A, B and C are labeled.

7. (a) Identify the phase of the business cycle at each of points A and B, and the phase between A and B.
- (b) At point B, state whether there is a recessionary or inflationary gap and how the unemployment rate compares with the natural rate.
- (c) Name one leading indicator that would likely fall before point A and explain why.
- (d) Explain how a sudden fall in business investment could move the economy from point A toward point B.

**Answers Chapter 2: Answers and Explanations**

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

2.1 Gross Domestic Product**SET A · CHECK YOUR UNDERSTANDING**

1. (a) Included: a newly produced final good, a consumption purchase. (b) Excluded: a used book was counted when first produced and sold; only any seller's fee for service would count. (c) Excluded: a transfer payment does not buy current production. (d) Excluded: steel is an intermediate good; its value is already in the price of the refrigerator.
2. Net exports = $180 - 230 = -\$50$ billion. GDP = $900 + 250 + 300 + (-50) = \$1,400$ billion. The trade deficit lowers the total because imports are included in C, I and G but were not made domestically.
3. Tailor's value added = $130 - 40 = \$90$. Cloth maker's value added = $40 - 15 = \$25$. Value added is output value minus the cost of intermediate goods bought from other firms.
4. A truck is a newly produced capital good that raises the firm's productive capacity, so buying it is investment. Buying shares only moves ownership of an asset from one person to another and produces nothing new, so it is a financial transaction outside GDP. The company may use the money to invest, and that later spending is what counts.
5. Q: $600 \text{ billion} / 20 \text{ million} = \$30,000$. R: $900 \text{ billion} / 45 \text{ million} = \$20,000$. Country R has the larger GDP but Country Q has higher output per person, so Q's average living standard is likely higher.

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6. Unreported or illegal work, and unpaid household work, are not measured, so GDP understates production. GDP also ignores leisure, environmental quality and inequality, so it cannot rank well-being exactly. Examples of counted spending that may reduce well-being: cleanup after an oil spill, or extra security spending after a crime wave.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. A new apartment building is residential investment, produced this year. A share purchase (A) is a financial transfer, resale of an old house (B) is not new production, unemployment benefits (D) are a transfer, and wheat sold to a mill (E) is an intermediate good counted in the final product.
8. A. Net exports = $60 - 80 = -20$. GDP = $700 + 150 + 200 - 20 = \$1,030$. Adding the transfers (D, \$1,120) is the tempting error, and ignoring imports gives \$1,050 (not listed).
9. D. Unsold output produced this year is counted as inventory investment. Buying a foreign car (A) adds to C but is offset by imports, Social Security (B) is a transfer, a used boat (C) was counted earlier, and bond purchases (E) are financial.
10. E. Summing value added at each stage equals the final value, so no double counting occurs. Sales revenue (A) and intermediate goods (B) would double count, value added cannot exceed the final price (C), and wages are part of value added (D).
11. B. Per capita GDP is GDP divided by population, so it rises only when output grows faster than population. If both grow equally (A), the ratio is unchanged, and the faster population growth in C lowers it.
12. C. Repair spending is counted as output but only restores what was lost, so it overstates gains in well-being. Unpaid work (A) and underground growth (B) cause understatement rather than overstatement, and E is a real improvement that GDP misses.

SET C · APPLY AND EXTEND

13. (a) GDP = $8,400 + 2,100 + 2,500 + (1,500 - 1,800) = \$12,700$ billion (1 point). Transfers are not included (1 point). (b) Net exports = $1,500 - 1,800 = -\$300$ billion, a trade deficit (1 point). (c) If imports rise by 100 and the other components stay as listed, GDP falls by \$100 billion to \$12,600 billion, because imports enter the formula with a negative sign (1 point). In real life higher imports usually accompany higher C, I or G, which would offset this; the decline is only mechanical (1 point).
14. (a) A: $300 \text{ billion} / 10 \text{ million} = \$30,000$; B: $450 \text{ billion} / 30 \text{ million} = \$15,000$ (1 point). (b) A: $306 \text{ billion} / 10.05 \text{ million} = \$30,448$; B: $477 \text{ billion} / 31.2 \text{ million} = \$15,288$ (1 point each). B's per capita GDP grows about 1.9% while A's grows about 1.5%, so B closes part of the gap although total GDP grew faster in both. (c) GDP per capita ignores distribution of income, so average income can rise while most people gain nothing; it also omits leisure, unpaid work and environmental damage (1 point for a reason, 1 for a valid example).

2.2 Real vs Nominal GDP and Growth

SET A · CHECK YOUR UNDERSTANDING

1. Price index = $285 / 250 \times 100 = 114$. Prices rose 14% since the base year. The index is just the ratio of current basket cost to base cost times 100.
2. Real GDP = $5,400 / 120 \times 100 = \$4,500$ billion. Dividing by the deflator removes the 20% price increase and returns output to base-year prices.
3. Growth = $(4,635 - 4,500) / 4,500 = 135 / 4,500 = 3.0\%$. Use the old value as the denominator.
4. Real growth = $1.07 / 1.04 - 1 = 2.88\%$, which is a bit under the approximation $7\% - 4\% = 3\%$. Real growth is below nominal growth because part of the nominal increase is inflation.
5. Doubling takes $70 / 2.5 = 28$ years. Quadrupling needs two doublings, so 56 years. The rule works because of compounding at a constant percentage rate.
6. Approximately $4\% - 1.5\% = 2.5\%$. Exactly, $1.04 / 1.015 - 1 = 2.46\%$. A different base year changes the level of real GDP, but growth rates change only slightly, because both years are revalued with the same set of prices.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Real growth is about nominal growth minus inflation, so $6\% - 6\%$ gives roughly zero. Choice B confuses nominal with real growth.
8. A. Real GDP = $3,150 / 126 \times 100 = \$2,500$ billion. Choice B ignores the deflator, and C multiplies instead of dividing.
9. B. Inflation = $(115.5 - 110) / 110 = 5\%$. Choice D uses the 10% from Year 1 to Year 2, and 15.5% is the total over both periods.
10. C. $70 / 5 = 14$ years. Choice A would be the answer at 10% growth.
11. A. Nominal GDP uses each year's own prices, so it does not depend on the base year; real GDP is measured in base-year prices, so its level does. Choice E is true only in the base year itself.
12. D. Per-capita real GDP is real GDP divided by population, so it rises only if real output grows faster than population. Choice A fails because rising nominal GDP may just be inflation.

SET C · APPLY AND EXTEND

13. (a) Real GDP = nominal / deflator $\times 100$: Year 1 = \$8,000; Year 2 = $8,320 / 104 \times 100 = \$8,000$; Year 3 = $8,748 / 108 \times 100 = \$8,100$ (1 point for method, 1 for values). (b) Nominal growth Year 2 to 3 = $(8,748 - 8,320) / 8,320 = 5.1\%$; real growth = $(8,100 - 8,000) / 8,000 = 1.25\%$ (1 point each). (c) Year 2: nominal rose from 8,000 to 8,320 (4%) while real GDP was unchanged at 8,000; the entire nominal increase was inflation of 4% (1 point).
14. (a) Series Y is real GDP, because real GDP grows more slowly than nominal GDP when there is inflation (1 point). (b) Series X grows about 6% and Y about 3%, so inflation is about 3% per year (1 point; exact $1.06 / 1.03 - 1 = 2.9\%$). (c) $70 / 3 =$ about 23 years (1 point). (d) Both years are revalued using the same price set, so quantity changes are weighted somewhat differently but the overall quantity growth stays similar; the level of real GDP is what changes (1 point).

2.3 The Business Cycle

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SET A · CHECK YOUR UNDERSTANDING

1. The order is trough, expansion, peak, contraction, then trough again. A recession is the contraction phase from a peak to a trough, when real GDP is falling.
2. $\text{Gap} = (9,300 - 9,500) / 9,500 \times 100 = -2.1\%$. This is a recessionary gap because actual output is below potential. Unemployment is above its natural rate, so cyclical unemployment is positive.
3. (a) Leading, since permits come before construction. (b) Lagging, since firms hire back slowly after a recovery begins. (c) Coincident, since it moves with output. (d) Leading, since stock prices reflect expectations about future profits.
4. Yes, two consecutive quarters of decline meet the rule of thumb. The NBER, however, looks at a broad set of data including employment, income and sales and judges depth, breadth and duration, so it might date a recession differently or wait for revised data.
5. Firms base investment on expected future profit and borrowing conditions, which can change quickly; households smooth consumption using income expectations. Small changes in confidence therefore swing investment sharply, and since investment is a component of AD, it amplifies fluctuations in GDP.
6. A recession is a significant decline in real GDP lasting at least a couple of quarters; a depression is far deeper and longer. For example, real GDP fell about a quarter and unemployment reached near 25% in the 1930s, much larger than the 2007 to 2009 recession.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. The trough is the lowest real GDP, ending a contraction; unemployment usually peaks around or after it (A is wrong), and the contraction begins at the peak (E).
8. C. A recession is defined by falling real GDP. Choice A is wrong because prices need not fall, and D describes expansion.
9. D. Output above potential means labor is used beyond normal capacity, so unemployment is below the natural rate and wages and prices tend to rise. Choice C is wrong because cyclical unemployment is negative in a boom.
10. E. Permits come before construction output. The unemployment rate (A), inflation (B) and prime rate (C) are lagging, and industrial production (D) is coincident.
11. A. At X the actual curve lies below the potential line, a recessionary gap, so unemployment exceeds its natural rate. Choice B reverses the gap sign.
12. C. A drop in AD lowers output and starts a recession. Choices A, C, D and E would raise output; falling oil prices (D) and productivity gains (E) are positive supply shocks.

SET C · APPLY AND EXTEND

13. (a) Time 2 to 4.5: contraction (real GDP falling from the peak); Time 5 to 7: expansion (1 point each). (b) At the trough, actual output is below the trend, a recessionary gap; unemployment is above the natural rate, so cyclical unemployment is positive (1 point). (c) Unemployment, a lagging indicator, often reaches its highest level shortly after the trough because firms are slow to hire back (1 point).
14. (a) Gaps: Year 1 = $250/12,500 = +2.0\%$; Year 2 = 0.0% ; Year 3 = $-500/12,500 = -4.0\%$; Year 4 = $-125/12,500 = -1.0\%$ (2 points for correct values). (b) Year 3 has the largest gap in size, a recessionary gap of -4.0% , with unemployment well above the natural rate (1 point). (c) Stock prices reflect expected future profit, so investors would sell as they anticipated weak demand; a fall in stock prices tends to occur before output declines (1 point).

2.4 Unemployment**SET A · CHECK YOUR UNDERSTANDING**

1. Unemployed = $130 - 120 = 10$ million. Unemployment rate = $10 / 130 = 7.7\%$. Participation rate = $130 / 200 = 65\%$. The rate uses the labor force as its base.
2. (a) Seasonal (usually part of the natural rate). (b) Cyclical. (c) Structural, since skills do not match available jobs. (d) Not unemployed; a student not seeking work is out of the labor force. (e) Frictional, since the person is searching for a better match.
3. Cyclical unemployment = $7.0\% - 4.8\% = 2.2$ percentage points. Because the actual rate exceeds the natural rate, the economy is in a recessionary gap and output is below potential.
4. If unemployed people become discouraged and stop searching, they leave the labor force. Both unemployment and the labor force shrink, so the rate falls though employment did not change.
5. A healthy economy always has workers entering the labor force, changing jobs and moving between industries (frictional), and shifts in demand that leave skills mismatched (structural). Search takes time, so some unemployment persists at potential output.
6. For individuals: lost income and possible erosion of skills. For the economy: lost output, since resources are idle and actual GDP falls below potential, and lower tax revenue with higher benefit payments.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. D. Unemployment caused by weak aggregate demand is cyclical. Structural (B) would apply if skills no longer matched jobs.
8. C. Unemployed = 10 million; rate = $10 / 130 = 7.7\%$. Choice D (8.3%) divides by 120, the number employed; choice E ignores the labor force base.
9. E. The unemployed must be jobless, available, and actively searching. Discouraged workers (C) have stopped searching and are out of the labor force.
10. B. Full employment means only frictional and structural unemployment remain. Choices C and D are wrong because both are positive parts of the natural rate.
11. A. Discouraged workers are excluded from the labor force, so the rate looks lower than true slack. Choice D is wrong because they are not counted as unemployed.
12. A. Actual above natural means cyclical unemployment is positive and output is below potential. Choice B reverses the relationship.

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SET C · APPLY AND EXTEND

13. (a) Between about Time 3.2 and 6.2 the actual curve is above the dashed natural-rate line (1 point). (b) Cyclical unemployment is positive and actual output is below potential, a recessionary gap (1 point). (c) A lower natural rate raises potential output, since more of the labor force is productively used, and full employment would occur at a lower unemployment rate (1 point).
14. (a) Year 1: labor force 130, rate = $10/130 = 7.7\%$, participation = $130/200 = 65\%$. Year 2: labor force 126, rate = $6/126 = 4.8\%$, participation = $126/200 = 63\%$ (2 points). (b) Employment stayed at 120, but 4 million unemployed left the labor force (probably discouraged), shrinking both the numerator and denominator (1 point). (c) Discouraged workers and involuntary part-time workers are not counted as unemployed, so slack is greater than the rate shows (1 point).

2.5 Inflation and the Consumer Price Index**SET A · CHECK YOUR UNDERSTANDING**

- CPI = $231 / 200 \times 100 = 115.5$. Prices are 15.5% above the base year.
- Inflation = $(189 - 180) / 180 \times 100 = 5.0\%$. The index is the base for the next calculation, so use the earlier year in the denominator.
- Disinflation: the inflation rate fell but is still positive. The price level kept rising, only more slowly. Deflation would require a negative rate.
- First: $24 / 120 \times 100 = \$20$. Later: $26.40 / 132 \times 100 = \$20$. Real wages are unchanged; the 10% pay raise only kept up with a 10% rise in prices.
- Real rate = $6\% - 2\% = 4\%$. With inflation of 4% the real rate is 2%. The borrower gains 2 percentage points and the lender loses 2, because unexpected inflation shifts value from lenders to borrowers.
- Substitution bias arises because the CPI basket is fixed, while consumers switch toward goods that become relatively cheaper. The fixed basket then overweights goods that rose in price, so the CPI overstates the increase in the true cost of living.

SET B · EXAM-STYLE MULTIPLE CHOICE

- D. Inflation = $(130 - 125) / 125 = 4\%$. Choice C (5%) is the tempting error of reporting the index change of 5 points as a percent.
- B. Disinflation is a slowdown in the inflation rate. Choice A describes deflation.
- C. Real rate = $8\% - 3\% = 5\%$. Choice D adds inflation instead of subtracting it.
- E. The CPI uses a fixed basket of what consumers buy; the deflator measures all domestic final output. Choice B is false because imports are not in the deflator.
- A. A fixed nominal payment buys less when prices rise. Choice C confuses nominal gains with real purchasing power.
- A. A fixed basket cannot reflect substitution toward cheaper goods or quality gains, so measured inflation exceeds true cost-of-living increases. Choice E would be wrong because the CPI includes imported goods consumers buy.

SET C · APPLY AND EXTEND

13. (a) Base cost = $10(3.00) + 20(2.50) + 5(10) = 30 + 50 + 50 = \$130$. 2024 cost = $10(3.60) + 20(2.75) + 5(12) = 36 + 55 + 60 = \$151$. CPI = $151 / 130 \times 100 = 116.2$ (2 points). (b) The basket cost rose $(151 - 130) / 130 = 16.2\%$ (1 point). (c) The CPI keeps the 2022 quantities, so it ignores the switch from milk to cheaper-in-relative-terms bread; it therefore overstates the rise in the cost of living (1 point, substitution bias).
14. (a) Year 2: $(130 - 125) / 125 = 4.0\%$; Year 3: $(143 - 130) / 130 = 10.0\%$ (1 point each). (b) Real wages = $25/125 \times 100 = \$20.00$; $26/130 \times 100 = \$20.00$; $27.30/143 \times 100 = \$19.09$ (1 point). (c) Year 3: nominal wage rose 5% but prices rose 10%, so the real wage fell about 4.5% (1 point). A cost-of-living adjustment (COLA) tying pay to the CPI would protect them (1 point).

2.6 Costs of Inflation and Economic Indicators in Practice**SET A · CHECK YOUR UNDERSTANDING**

- Menu costs are the costs of changing posted prices, such as reprinting a restaurant menu monthly. Shoe-leather costs are the time and effort of avoiding inflation losses, such as making several trips to the bank per week to hold little cash. Both rise with the inflation rate.
- Cyclical unemployment = 3.5 points, so the gap is $-2 \times 3.5 = -7\%$. Lost output = $0.07 \times 18,000 = \$1,260$ billion. The estimate shows why unemployment is costly to the whole economy, not just those without jobs.
- When inflation is anticipated, people build it into wages, interest rates and contracts, so real values are protected. When it is unanticipated, contracts set in nominal terms misprice real returns, wealth is redistributed arbitrarily and planning becomes riskier, discouraging long-term saving and investment.
- Expected real rate = $5\% - 3\% = 2\%$. Actual real rate = $5\% - 6\% = -1\%$. The borrower benefits and the lender loses, because the loan is repaid in dollars that buy less than expected.
- This is stagflation, usually caused by a negative supply shock such as a spike in oil prices, which shifts short-run aggregate supply to the left, raising prices and reducing output.
- Bracket creep happens when inflation raises nominal incomes into higher tax brackets though real income is unchanged, so the tax burden rises. Indexing the brackets to inflation adjusts the thresholds so that only real income gains move households into higher brackets.

SET B · EXAM-STYLE MULTIPLE CHOICE

- B. Holding less cash and visiting the bank more often is the classic shoe-leather cost. Reprinting menus (A) is a menu cost.
- A. A negative supply shock raises costs and reduces output at once. Choices A, B, D and E raise aggregate demand, which raises prices and output together.
- A. Unexpectedly high inflation lowers the real value of the repayment to a fixed-rate lender. Choice C would help the lender, and anticipated inflation (B) is already priced in.
- E. Cyclical unemployment = $7 - 5 = 2$ points; gap = $-2 \times 2 = -4\%$. Choice A forgets to multiply by the coefficient.

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11. D. In Year 4 output still falls (-0.5%) while the inflation rate falls from 7.0 to 5.1. Year 3 is stagflation because inflation rises as output drops.

SET C · APPLY AND EXTEND

13. (a) A negative supply shock, such as an increase in input costs, shifts SRAS left from SRAS1 to SRAS2 (1 point). (b) The price level rises from 5 to 6.25, real GDP falls from 5 to 3.75, and unemployment rises above the natural rate (2 points). (c) A policy to raise AD would restore output but raise prices further; a policy to lower AD would reduce inflation but worsen the recession (1 point).
14. (a) Year 1: gap = $-2 \times (8 - 5) = -6\%$, or -\$600 billion. Year 2: gap = $-2 \times (6 - 5) = -2\%$, or -\$200 billion (2 points). (b) Year 2 is closer to potential, because the smaller unemployment gap implies a smaller output shortfall (1 point). (c) Year 2 inflation exceeds the expected 3%, so fixed-rate lenders and fixed-income households lose purchasing power while borrowers gain (1 point).

2.7 Multiple-Choice Practice: Economic Indicators and the Business Cycle

SET A · CORE CONCEPTS

1. C. New residential construction is current production and counts as investment. The used car (A) and painting (E) were produced earlier, and bonds (B) and Social Security (D) are financial or transfer flows.
3. B. Real GDP = $4,400 / 110 \times 100 = 4,000$. Choice A multiplies by 1.10 instead of dividing.
5. A. The trough marks the end of the contraction and the start of expansion. Choice E describes the peak.
7. B. $(210 - 200) / 200 = 5\%$. Choice C reports the 10-point rise as a percent.
2. E. GDP = $500 + 120 + 150 + (80 - 100) = 750$. Choice A leaves out net exports, and C adds exports without subtracting imports.
4. D. $70 / 2 = 35$ years. Choice A would be correct at 5% growth.
6. C. A lasting mismatch of skills with available jobs is structural unemployment. Choice B would apply only if the job loss were due to weak demand in a downturn.

SET B · APPLICATIONS AND DATA

8. E. Labor force = 160 million, so the rate = $10 / 160 = 6.3\%$. Choice C divides by employed workers only, and A divides by the whole population.
10. D. Real GDP in Year 2 = $2,226 / 106 \times 100 = 2,100$, so growth = $100 / 2,000 = 5.0\%$. Choice E is nominal growth, which includes inflation.
12. B. $8\% - 6\% = 2\%$, below the 5% the lender planned. Choice A is the expected real rate.
14. A. SRAS shifts left, raising the price level and lowering real GDP below potential, which is stagflation. Choice C would raise both output and prices.
9. A. P is a peak and T a trough, so the economy contracts, output falls and unemployment rises. Choice C is wrong because at T actual output is below potential.
11. C. CPI = $92 / 80 \times 100 = 115$. Choice A reports the basket cost rather than the index.
13. E. The gap is $2 \times 4 = 8\%$, and $0.08 \times 15,000 = 1,200$. Choice D uses a 6% gap, from forgetting one point.

SET C · EXAM-LEVEL STRETCH

15. D. Imported consumer goods are in the CPI basket but not in the deflator, which covers only domestically produced output. Choice A ignores this.
17. B. Real GDP rises about 2%, population 3%, so per capita real GDP falls about 1%. Choice C forgets to subtract population growth.
19. E. An upward-biased index raises benefits and widens tax brackets too much. Choice D is wrong because retirees are better protected, not worse.
16. C. They leave the labor force, lowering both the numerator and denominator of the unemployment rate and lowering participation. Choice E ignores the change in the labor force.
18. A. Output bottomed at the end of Quarter 2, but unemployment kept rising to Quarter 3, showing it is a lagging indicator. Choice D reverses this.
20. D. The homeowner repays the loan in dollars worth less. Choice B is the opposite, since the lender loses real value.

2.8 Free-Response Practice: Economic Indicators and the Business Cycle

QUESTION 1 · GDP CALCULATIONS

1. (a) 1 point: GDP = $C + I + G + (X - M) = 6,000 + 1,500 + 1,800 + (1,100 - 1,400) = \$9,000$ billion, with net exports of -\$300 billion shown. (b) 1 point: Transfer payments are not payments for newly produced goods or services; they move income from one group to another, so including them would count no additional output. (c) 1 point: $\$9,000 \text{ billion} / 150 \text{ million} = \$60,000$. (d) 1 point for real GDP = $9,540 / 106 \times 100 = \$9,000$ billion; 1 point for growth = 0% since real GDP equals Year 1; 1 point for explaining that nominal GDP rose 6% entirely because of a 6% rise in the price level, so output did not grow.

QUESTION 2 · UNEMPLOYMENT

2. 1 point: labor force = $132 + 8 = 140$ million. 1 point: unemployment rate = $8 / 140 = 5.7\%$. 1 point: participation rate = $140 / 220 = 63.6\%$.
3. 1 point for all three correct: (i) frictional, a normal job search; (ii) structural, skills do not match available jobs; (iii) cyclical, caused by weak demand in a downturn.
4. 1 point: unemployed = 6 million, labor force = 138 million, rate = $6 / 138 = 4.3\%$; participation = $138 / 220 = 62.7\%$. 1 point: the labor market has not improved; employment is unchanged at 132 million and the fall in the rate reflects a smaller labor force.
5. 1 point: cyclical unemployment = $5.7\% - 4.5\% = 1.2$ percentage points. 1 point: positive cyclical unemployment means output is below potential (a recessionary gap).

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QUESTION 3 · INFLATION AND ITS EFFECTS

6. (a) 1 point: base cost = $20(3) + 10(12) + 4(20) = \$260$; current cost = $20(3.60) + 10(13.20) + 4(22) = \$292$. 1 point: $CPI = 292 / 260 \times 100 = 112.3$, a 12.3% increase. (b) 1 point: real wage = $21.20 / 112.3 \times 100 = \text{about } \$18.88$. (c) 1 point: the borrower gains because the loan is repaid with dollars of lower purchasing power. 1 point: the lender loses because the real interest rate earned is lower than planned. (d) 1 point: substitution bias (the fixed basket ignores consumers shifting away from goods whose prices rose) or quality/new-product bias, which makes the measured inflation larger than the true rise in the cost of living.

QUESTION 4 · THE BUSINESS CYCLE

7. (a) 1 point: A is a peak and B is a trough. 1 point: between A and B the economy is in a contraction (recession). (b) 1 point: recessionary gap, since actual real GDP is below potential. 1 point: unemployment is above the natural rate, so cyclical unemployment is positive. (c) 1 point: for example building permits, stock prices, or consumer expectations, with an explanation that it reflects expected future demand and so changes before output does. (d) 1 point: investment is a component of aggregate demand, so a fall in I reduces AD. 1 point: with sticky wages and prices, firms cut output and employment, so real GDP falls below potential.

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Chapter 3: National Income and Price Determination.

9 sections with explanations and worked examples, then 163 practice problems. Answers and full explanations are at the end of the chapter.

3.1 Aggregate Demand

Learn why the aggregate demand curve slopes downward, what components make it up, which events shift it, and how the multiplier magnifies a shift.

Aggregate demand (AD) shows the total quantity of real GDP that households, firms, the government, and foreign buyers want to purchase at each possible price level in an economy, during a given period, holding everything else constant. The graph puts the **aggregate price level** (measured by an index such as the GDP deflator or the CPI) on the vertical axis and **real GDP** (total output, adjusted for price changes) on the horizontal axis. The curve slopes downward: a higher price level goes with a smaller quantity of real GDP demanded, and a lower price level goes with a larger quantity demanded.



The aggregate demand curve slopes downward: as the price level falls, the quantity of real GDP demanded rises.

Aggregate demand identity

$AD = C + I + G + (X - M)$, where C is consumption, I is gross private investment, G is government purchases of goods and services, and $X - M$ is net exports (exports minus imports).

AD is about total spending on domestically produced final goods and services at different price levels.

Why does AD slope downward? Be careful here. The AD curve is not a market demand curve for one good. In a single market, a price rise makes buyers switch to substitutes. In the whole economy there is no outside substitute for 'everything', because the price level measures the average price of all goods. So the slope of AD comes from three different effects that link the price level to spending.

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- 1 Wealth effect (real balances effect)** When the price level rises, the purchasing power of money, bonds, and other fixed-dollar assets falls. Households feel poorer in real terms, so they cut consumption (C). A lower price level does the opposite: savings buy more, so consumers spend more.
- 2 Interest-rate effect** A higher price level means households and firms need more money to buy the same goods. Greater demand for money, with a fixed money supply, pushes up the nominal interest rate. Higher interest rates discourage borrowing for investment (I) and for interest-sensitive consumption such as cars and homes. A lower price level reduces money demand, lowers interest rates, and raises I and C.
- 3 Exchange-rate (foreign trade) effect** A higher domestic price level makes domestic goods more expensive compared with foreign goods. Exports (X) fall and imports (M) rise, so net exports fall. A lower domestic price level makes domestic goods a bargain, which raises exports and lowers imports.

Effect	Price level rises (move up the AD curve)	Spending component that changes
Wealth effect	Real value of savings falls, so people save more and spend less	Consumption (C)
Interest-rate effect	Money demand rises, interest rates rise, borrowing falls	Investment (I), and some C
Exchange-rate effect	Domestic goods look pricier than foreign goods	Net exports (X - M)

Notice that government spending (G) is not on this list. G is set by legislators and does not respond automatically to the price level, so it shifts AD only when policy changes.

Components of AD. Consumption is the largest component, roughly two-thirds of U.S. GDP. It includes spending on durable goods (cars, appliances), nondurable goods (food, clothing), and services (health care, haircuts). Gross private investment is spending by firms on new capital (machines, factories, software), new residential construction, and changes in business inventories. Purchasing stocks and bonds is not investment in the GDP sense. Government purchases include federal, state, and local spending on goods and services, such as highways, teachers' salaries, and military equipment. **Transfer payments** (Social Security, unemployment benefits) are not included in G because no good or service is produced in exchange. Net exports equal exports minus imports. When the net export figure is negative, the country runs a trade deficit.

Movement along AD versus a shift of AD

A change in the price level causes a movement along a fixed AD curve (the wealth, interest-rate, and exchange-rate effects). A change in anything else that affects spending at every price level shifts the whole AD curve. A rightward shift means AD increases; a leftward shift means AD decreases.

Determinants (shifters) of AD. Anything that changes C, I, G, or net exports at a given price level shifts AD. Group them by component so you can reason quickly on the exam.

Component	Shifts AD right (increase)	Shifts AD left (decrease)
Consumption	Stock or housing wealth rises; optimism about the future; lower income taxes; low household debt	Wealth falls; pessimism; higher income taxes; heavy household debt
Investment	Lower real interest rates; optimistic business expectations; new technology; low taxes on business profits; low excess capacity	Higher real interest rates; pessimistic expectations; high business taxes; large unused capacity
Government spending	Higher federal, state, or local purchases	Cuts in government purchases
Net exports	Foreign income rises; domestic currency depreciates; foreign tariffs fall	Foreign recession; domestic currency appreciates; trade barriers abroad

Two details trip up students. First, a change in **wealth** shifts AD (a stock market boom raises C at every price level), whereas the **wealth effect** describes the price-level reaction along the curve. Second, a fall in the exchange value of the dollar (depreciation) makes U.S. goods cheaper abroad and foreign goods costlier here, which raises net exports and shifts AD right. An appreciation does the reverse.

The multiplier effect on AD. Spending is someone else's income. If the government spends \$10 billion on a bridge, workers and suppliers receive \$10 billion in income, and they spend a fraction of it, which becomes income for others, and so on. Each round is smaller than the last, but the total change in spending is larger than the first injection. The size of the magnification depends on the **marginal propensity to consume (MPC)**, the fraction of an extra dollar of income that is spent. The simple spending multiplier is $\frac{1}{1-MPC}$. When we draw the AD curve, the horizontal shift at a given price level equals the multiplier times the initial change in autonomous spending.

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Multiplier shift of AD

Horizontal shift of AD = $\frac{1}{1-MPC} \times \Delta$ (autonomous spending), at an unchanged price level.

The actual rise in equilibrium real GDP is smaller than this shift whenever the price level rises, because the economy slides up the SRAS curve.

EXAMPLE 1: CLASSIFY THE EVENT

For each event, state which AD component is affected and whether AD shifts right, shifts left, or only moves along the curve.

- (i) Stock prices fall 25 percent.
- (ii) The Federal Reserve lowers interest rates.
- (iii) The price level falls by 3 percent with nothing else changed.
- (iv) A major trading partner enters a deep recession.

SOLUTION

- (i) Household wealth falls, so consumption falls at every price level. This is a change in wealth, not in the price level, so AD shifts left.
- (ii) Lower interest rates make borrowing cheaper, so investment (and interest-sensitive consumption) rises. AD shifts right.
- (iii) A change in the price level is the one cause that moves us along AD. The quantity of real GDP demanded rises through the wealth, interest-rate, and exchange-rate effects. No shift.
- (iv) A foreign recession lowers foreign income, so foreign buyers purchase fewer of our exports. Net exports fall and AD shifts left.

EXAMPLE 2: SIZE OF THE AD SHIFT

The government raises purchases by \$50 billion. The MPC is 0.8, and the price level is held at its initial value. By how much does AD shift, and why will equilibrium real GDP rise by less than that if SRAS slopes upward?

SOLUTION

$$\text{Multiplier} = \frac{1}{1-0.8} = \frac{1}{0.2} = 5.$$

Horizontal shift of AD = $5 \times \$50 \text{ billion} = \$250 \text{ billion}$ at every price level.

The shift is the increase in real GDP demanded at the old price level. Once AD shifts right, the price level rises along the upward-sloping SRAS curve. The higher price level triggers the wealth, interest-rate, and exchange-rate effects, which push the economy back along the new AD curve, so the equilibrium rise in real GDP is less than \$250 billion.

EXAMPLE 3: EXCHANGE-RATE CHAIN

Explain how a depreciation of the U.S. dollar changes U.S. aggregate demand.

SOLUTION

A weaker dollar means each dollar buys less foreign currency.

U.S. goods become cheaper to foreign buyers, so exports rise. Foreign goods become more expensive for Americans, so imports fall.

Net exports ($X - M$) rise, and since net exports are a component of AD, AD shifts right.

Common mistakes

- (1) Shifting AD when the price level changes. A price-level change is a movement along AD. (2) Using the micro explanation of substitution and income effects for the AD slope. Use wealth, interest-rate, and exchange-rate effects. (3) Counting transfer payments, stock purchases, or used goods as part of G or I. (4) Forgetting that net exports can shift AD both ways: a stronger dollar lowers net exports. (5) Saying that the multiplier tells you the change in equilibrium GDP. It tells you the horizontal AD shift; the final GDP change is smaller if prices rise.

Exam tip

On an FRQ, draw the new curve as AD2 to the right or left of AD1, label both axes, and state the cause in words, such as 'consumption rises because wealth rose'.

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Practice

SET A Check Your Understanding

Answer each question in two to four sentences.

1. Describe the wealth effect and explain how it contributes to the downward slope of AD.
2. Trace the interest-rate effect of a decrease in the price level, in order, from money demand to the change in investment.
3. Explain the exchange-rate (foreign trade) effect of a rise in the domestic price level on net exports.
4. A student writes: 'AD slopes down because consumers substitute cheaper goods for expensive ones.' Explain what is wrong with this claim.
5. Name the AD component that changes and the direction of the AD shift for each: (a) businesses expect strong sales next year; (b) Congress cuts federal highway spending; (c) households take on more debt and cut spending to repay it.
6. Is a Social Security payment to a retiree counted in G? Explain what happens to AD when Social Security payments rise.
7. The MPC is 0.75 and autonomous investment rises by \$20 billion. Calculate the horizontal shift in AD at the initial price level.
8. A country's currency appreciates. Explain the effect on net exports and on AD, and state the direction of the shift.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. Which of the following explains why the aggregate demand curve slopes downward?
(A) Consumers substitute between goods as relative prices change
(B) Higher prices raise the real value of household savings
(C) A lower price level lowers interest rates and raises investment
(D) A lower price level makes imports more expensive
(E) The government cuts spending when prices fall
10. Which of the following events shifts the aggregate demand curve to the right?
(A) A rise in household wealth caused by a stock market boom
(B) A fall in the price level
(C) An increase in the foreign exchange value of the domestic currency
(D) A rise in interest rates
(E) A decline in business confidence
11. A rise in the price level reduces net exports mainly because
(A) the central bank raises the money supply
(B) consumers' real wealth rises
(C) foreign incomes fall
(D) the domestic currency automatically depreciates
(E) domestic goods become more expensive relative to foreign goods
12. The marginal propensity to consume is 0.9. An increase in government purchases of \$10 billion will shift the aggregate demand curve to the right by
(A) \$9 billion
(B) \$100 billion
(C) \$90 billion
(D) \$10 billion
(E) \$1 billion
13. Which of the following is included in the government purchases (G) component of aggregate demand?
(A) Unemployment benefit payments
(B) Interest payments on the national debt
(C) Social Security payments
(D) Salaries paid to public school teachers
(E) Medicare reimbursements to patients
14. Which change would shift AD to the left?
(A) The Federal Reserve lowers interest rates
(B) A major trading partner has a boom in income
(C) Business firms expect lower future profits
(D) The domestic currency depreciates
(E) Income taxes fall

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SET C Apply and Extend

Write a complete response. Graphs should be labeled.

15. Suppose the economy starts at a price level of 100 on AD1. Draw and explain the effect on AD of each event separately, using the language of AD components.
- (a) Consumer confidence rises sharply.
 - (b) Foreign economies fall into recession.
 - (c) The price level rises from 100 to 110.



Reference graph: AD1 and a candidate shifted curve AD2.

16. The marginal propensity to consume is 0.6. The government increases purchases by \$30 billion and, at the same time, businesses become pessimistic and cut investment by \$10 billion. (a) Calculate the multiplier. (b) Calculate the net horizontal shift of AD at the initial price level. (c) State the direction of the shift. (d) Explain why equilibrium real GDP will not change by exactly the amount you calculated.
17. A student claims: 'If the price level rises, AD shifts left because people can afford less.' Evaluate this claim. In your answer, identify the correct term for what happens, name two effects that explain it, and give one example of something that really would shift AD left.

3.2 Short-Run Aggregate Supply

Learn why the short-run aggregate supply curve slopes upward, what shifts it, and how supply shocks and productivity change production costs.

Short-run aggregate supply (SRAS) shows the total quantity of real GDP that firms are willing to produce at each possible price level when at least some input prices, especially nominal wages, are fixed. It is drawn on the same axes as aggregate demand: price level on the vertical axis and real GDP on the horizontal axis. The SRAS curve slopes **upward**: a higher price level goes with a larger quantity of real GDP supplied.

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The short-run aggregate supply curve slopes upward.

What does 'short run' mean in macroeconomics? It is not a fixed number of months. The short run is the period during which the prices of some inputs, mainly the nominal wage, do not adjust fully to a change in the price level. The **long run** is the period long enough for all wages and prices to adjust. This idea explains almost everything about the SRAS curve, so make sure you can state it in your own words.

Why SRAS slopes upward. Imagine the price level for all output rises by 5 percent while the nominal wage and other input prices stay put. Each firm sees the price of what it sells go up and the cost of what it buys stay the same, so profit per unit rises. Firms produce more and hire more workers. The economy therefore moves up along SRAS to a larger real GDP. If the price level falls and costs do not, profits are squeezed and firms cut output. The reason costs lag behind is **stickiness**.

- 1 Sticky nominal wages** Many workers are covered by labor contracts or implicit agreements that fix the nominal wage for a year or more. Employers also hesitate to cut pay because of morale and turnover. When the price level rises, the fixed nominal wage buys less, so the real wage ($\frac{\text{nominal wage}}{\text{price level}}$) falls and hiring becomes more attractive.
- 2 Sticky prices (menu costs)** Changing prices costs money: new catalogs, reprinting menus, renegotiating contracts. Some firms keep prices the same after demand changes, so the average price level adjusts slowly and output responds first.
- 3 Fixed input contracts** Rent, long-term supplier contracts, and some raw material prices are set in advance. Until these are renegotiated, higher output prices widen profit margins.

Core idea of SRAS

In the short run, output prices can change faster than input prices. A higher price level raises profit per unit, so firms produce more. Movement along SRAS is caused only by a change in the price level. A shift of SRAS is caused by a change in per-unit production costs at every price level.

What shifts SRAS? Anything that changes the cost of producing a unit of output at a given price level moves the curve. A useful shortcut is the unit cost relationship:

Unit cost of production

Unit cost = $\frac{\text{Input price}}{\text{Productivity}}$, for example unit labor cost = $\frac{\text{nominal wage}}{\text{output per worker-hour}}$.

If unit cost rises at every price level, SRAS shifts left (decreases). If unit cost falls, SRAS shifts right (increases).

Determinant	Shifts SRAS right (increase)	Shifts SRAS left (decrease)
Input prices (wages, energy, raw materials)	Fall in nominal wages or oil prices	Rise in wages, oil, or commodity prices
Productivity and technology	Better technology, more output per worker	Fall in productivity (for example, loss of skilled workers)
Expected inflation	Lower expected inflation, so workers accept smaller wage increases	Higher expected inflation, so workers demand bigger raises

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Determinant	Shifts SRAS right (increase)	Shifts SRAS left (decrease)
Business taxes, subsidies, regulation	Lower business taxes, production subsidies, deregulation	Higher business taxes, costly new regulation
Exchange rate (imported inputs)	Domestic currency appreciates, so imported inputs cost less	Domestic currency depreciates, so imported inputs cost more
Supply shocks	Positive supply shock (for example, a bumper harvest, a new low-cost energy source)	Negative supply shock (for example, a disaster, an oil embargo)

A **supply shock** is a sudden, unexpected event that changes production costs for many firms at once. A **negative supply shock** (for example, a sharp rise in oil prices after a conflict disrupts the supply of crude oil) raises costs and shifts SRAS left. A **positive supply shock** (for example, a technological breakthrough or a sharp fall in energy prices) lowers costs and shifts SRAS right. Supply shocks matter because they push the price level and real GDP in opposite directions, a pattern you will use in the next lessons.



A leftward shift (SRAS2) shows a decrease in short-run supply, as from an oil price spike. A rightward shift (SRAS1) shows an increase, as from a productivity gain.

Productivity and nominal wages together. Wages alone do not decide the shift; productivity matters just as much. If wages rise 5 percent but output per worker also rises 5 percent, unit labor cost does not change and SRAS does not shift. Only when wages grow faster than productivity do per-unit costs go up. Likewise, a price level increase by itself does not shift SRAS because it is the cause of movement along the curve.

Real wages and employment. Short-run supply depends on the real wage the firm pays. With a given nominal wage, a higher price level lowers the real wage. Firms hire more labor, employment rises, and output increases. This links SRAS to the labor market: during a short-run expansion above full employment, unemployment falls below its natural rate; during a downturn, it rises above it.

Shape of SRAS. At very low output, firms with plenty of idle capacity can raise output without much increase in unit costs, so the curve is relatively flat. Near full capacity, bottlenecks and overtime pay make costs rise sharply, so the curve becomes steep. On the AP exam you will normally draw a simple upward-sloping line, but the idea of flat and steep ranges helps explain why a demand increase has a bigger effect on real GDP when the economy is weak and a bigger effect on prices when it is strong.

EXAMPLE 1: CLASSIFY THE SUPPLY EVENT

Decide whether each event shifts SRAS right, shifts SRAS left, or moves along SRAS.

- (i) A hurricane destroys refineries, doubling gasoline prices.
- (ii) The price level rises 4 percent with nominal wages fixed.
- (iii) A new software system lifts output per worker by 10 percent.
- (iv) The government imposes a costly new safety rule on all manufacturers.

SOLUTION

- (i) Energy is an input for almost every firm, so unit costs rise at every price level. SRAS shifts left (a negative supply shock).
- (ii) A change in the price level is a movement along SRAS toward larger output, not a shift.
- (iii) Productivity up means unit cost down at every price level. SRAS shifts right.
- (iv) Compliance raises per-unit costs, so SRAS shifts left.

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EXAMPLE 2: UNIT LABOR COST

A firm pays a nominal wage of \$24 per hour, and each worker produces 6 units per hour. Next year the wage rises to \$27 and output per worker rises to 7.5 units per hour. What happens to unit labor cost, and how should this firm's cost change affect the SRAS curve?

SOLUTION

Year 1 unit labor cost = $\frac{24}{6} = \$4.00$ per unit.

Year 2 unit labor cost = $\frac{27}{7.5} = \$3.60$ per unit.

Unit labor cost fell by 10 percent even though wages rose by 12.5 percent, because productivity rose by 25 percent.

If many firms in the economy see this pattern, per-unit costs fall at every price level and SRAS shifts right.

EXAMPLE 3: REAL WAGE AND HIRING

A union contract fixes the nominal wage at \$30 per hour for the next year. The price index rises from 100 to 106. Calculate the change in the real wage (in base-year dollars) and explain the effect on short-run output.

SOLUTION

Real wage before = $\frac{30}{100} \times 100 = \$30.00$.

Real wage after = $\frac{30}{106} \times 100 \approx \$28.30$.

The real wage fell about 5.7 percent. Labor is cheaper in real terms, so firms hire more workers and expand output. This is a movement up along SRAS, consistent with sticky wages.

Common mistakes

(1) Shifting SRAS when the price level changes; the price level moves you along the curve. (2) Forgetting that SRAS depends on productivity: higher wages do not shift SRAS if productivity rises equally. (3) Treating a rise in consumer spending as an SRAS shifter; it is a demand-side shifter. (4) Mixing up the direction: higher costs shift SRAS left (a decrease), even though the curve moves 'up'. (5) Believing the short run is a specific length of time; it is defined by sticky input prices.

Exam tip

Use the unit-cost test on every supply question: ask 'did the cost of producing a unit change at each price level?' If yes, SRAS shifts; if the only change is the price of output, you are moving along SRAS. Remember: a cost increase moves SRAS left (and up).

Practice**SET A Check Your Understanding**

Answer each question in two to four sentences.

1. Define short-run aggregate supply and state what is held constant along the curve.
2. Explain how sticky nominal wages cause SRAS to slope upward.
3. Explain the role of menu costs in explaining why SRAS slopes upward.
4. State the direction of the SRAS shift for each: (a) a fall in world oil prices; (b) a rise in the minimum wage that raises costs for most firms; (c) an invention that doubles output per worker.
5. A firm pays \$20 per hour and workers produce 5 units per hour. Calculate the unit labor cost. If the wage rises to \$22 and productivity is unchanged, calculate the new unit labor cost.
6. Explain why a rise in expected inflation shifts SRAS to the left.
7. Distinguish between a movement along SRAS and a shift of SRAS. Give one cause of each.
8. Explain why a depreciation of the domestic currency can shift SRAS to the left for a country that imports many raw materials.

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SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. Which of the following best explains why the short-run aggregate supply curve slopes upward?
(A) Wages and other input prices adjust slowly when the price level changes
(B) Consumers substitute domestic goods for imports as prices rise
(C) Firms always operate at full employment
(D) Money demand falls when the price level rises
(E) Technology improves whenever output rises
10. A sharp increase in the price of crude oil is most likely to cause
(A) a rightward shift of SRAS
(B) a leftward shift of SRAS
(C) a rightward shift of AD
(D) a movement down along SRAS
(E) no change because oil is only one input
11. Which of the following would shift the SRAS curve to the right?
(A) An increase in the price level
(B) A rise in consumer confidence
(C) A rise in nominal wages not matched by productivity
(D) An increase in labor productivity
(E) An increase in government purchases
12. Workers' nominal wages are fixed by contract for the year. If the price level unexpectedly rises, in the short run
(A) real wages rise and output falls
(B) real wages fall and firms increase output
(C) real wages are unchanged
(D) firms cut output because profits fall
(E) SRAS shifts left
13. A firm's nominal wage rises 6 percent while output per worker rises 6 percent. What happens to the firm's unit labor cost?
(A) It rises by 6 percent
(B) It falls by 6 percent
(C) It rises by 12 percent
(D) It is unchanged
(E) It cannot be determined without the price level
14. Which statement about the short run in macroeconomics is correct?
(A) It is any period less than one year
(B) It is a period in which nominal input prices do not fully adjust to changes in the price level
(C) It is a period in which no input quantities can change
(D) It is a period during which the economy is always at full employment
(E) It is the period when the price level cannot change

SET C Apply and Extend

Write a complete response. Graphs should be labeled.

15. Draw a correctly labeled SRAS graph. On it, show the effect of a new law that requires all firms to give workers a large mandatory pay raise with no change in productivity. Identify the determinant, the direction of the shift, and explain the reasoning in terms of unit costs.
16. Explain, using sticky wages, why a firm in a union contract is more likely to expand output after an unexpected rise in the price level than after a rise in the price level that was fully anticipated and built into new wage contracts.
17. Two economies have identical SRAS curves. In Economy X, wages rise 4 percent and productivity rises 1 percent. In Economy Y, wages rise 4 percent and productivity rises 6 percent. (a) Approximate the change in unit labor cost in each. (b) State the SRAS shift direction in each. (c) Explain which economy is more likely to experience lower inflation and why.

3.3 Long-Run Aggregate Supply and Equilibrium

Learn why LRAS is vertical at potential output, how AD and SRAS determine equilibrium, how to recognize and graph recessionary and inflationary gaps, and how the economy self-corrects.

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Long-run aggregate supply (LRAS) shows the real GDP the economy can produce when all prices and wages have had time to adjust fully. The LRAS curve is a **vertical line** at the economy's **potential output** (also called full-employment output, Y_f). Potential output is the level of real GDP produced when the economy uses its resources at their normal, sustainable intensity and unemployment equals the **natural rate of unemployment**, which is the sum of frictional and structural unemployment, with zero cyclical unemployment.

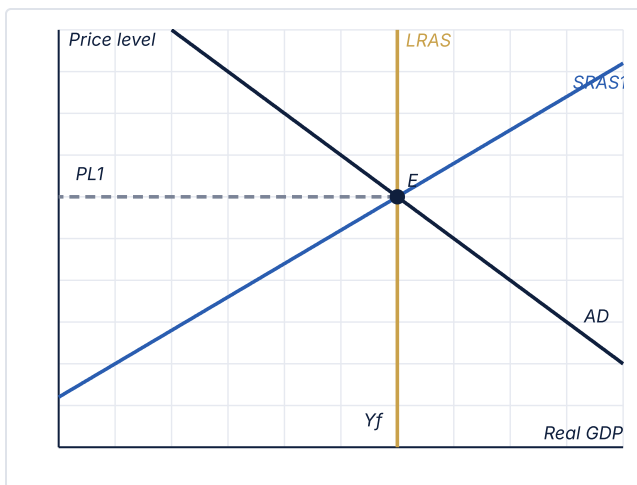
Why is LRAS vertical? In the long run, a change in the price level is matched by an equal change in wages and other input prices. The real wage and firms' profit per unit return to their starting levels, so firms have no reason to change output because of the price level. Output is determined by real factors only: the quantity and quality of labor, capital, natural resources, entrepreneurship, technology, and institutions. The price level is on the vertical axis, but it does not influence where the LRAS line sits on the horizontal axis.

LRAS at potential output

LRAS is vertical at potential (full-employment) real GDP, Y_f .

Anything that raises the economy's productive capacity (more or better resources, new technology, better institutions) shifts LRAS right, which is long-run economic growth. The same factors shift the production possibilities curve outward.

Short-run equilibrium occurs where the AD curve intersects the SRAS curve. At that point the quantity of real GDP demanded equals the quantity supplied and the price level is stable. **Long-run macroeconomic equilibrium** occurs when AD, SRAS, and LRAS all intersect at one point. Then actual output equals potential output, and the economy has no cyclical unemployment.



Long-run equilibrium: AD, SRAS, and LRAS meet at E, where output equals potential output Y_f .

The short-run equilibrium does not have to be at potential output. If AD shifts, the intersection with SRAS can fall to the left or to the right of LRAS. The distance between actual and potential output is an **output gap**.

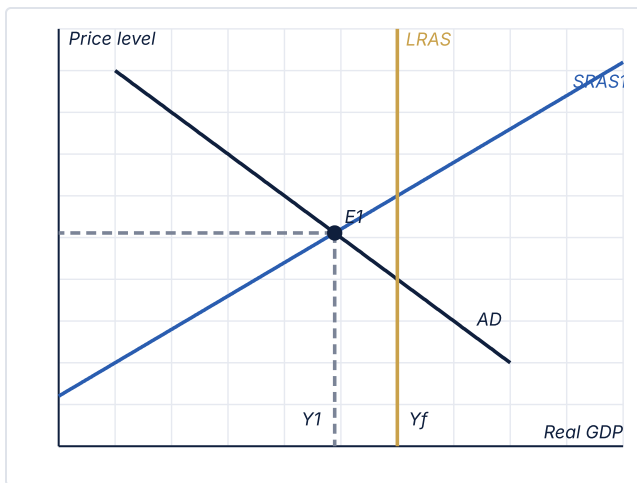
Feature	Recessionary gap	Long-run equilibrium	Inflationary gap
Actual output vs potential	$Y < Y_f$	$Y = Y_f$	$Y > Y_f$
Unemployment vs natural rate	Above (cyclical unemployment positive)	Equal (cyclical = 0)	Below (negative cyclical)
Where AD-SRAS intersects	Left of LRAS	On LRAS	Right of LRAS
Pressure on wages and input prices	Downward (slowly)	None	Upward
Self-correction	SRAS shifts right	None needed	SRAS shifts left

Recessionary gap. A **recessionary gap** exists when the short-run equilibrium real GDP is below potential output. Firms have unused capacity, workers are laid off, and unemployment exceeds the natural rate. The size of the gap is the horizontal distance $Y_f - Y$. For example, if potential output is \$2,000 billion and real GDP is \$1,900 billion, the recessionary gap is \$100 billion. Economists often express it as a percentage of potential: $\frac{Y - Y_f}{Y_f} \times 100 = -5\%$ here, a negative output gap.

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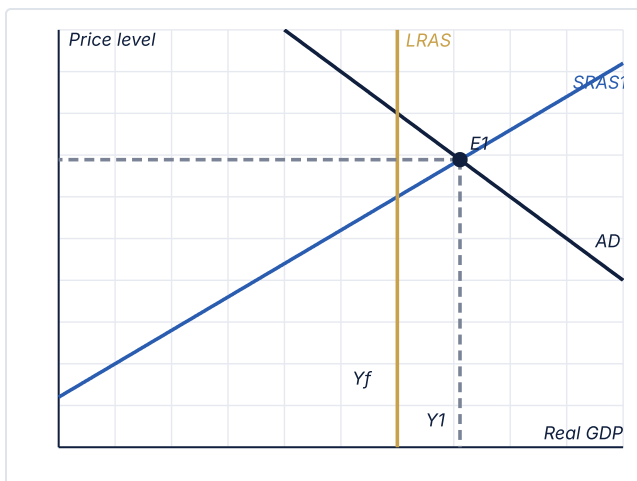
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Recessionary gap: equilibrium E1 is at an output Y_1 to the left of potential output Y_f .

Inflationary gap. An **inflationary gap** exists when short-run equilibrium real GDP is above potential output. The economy is operating beyond its sustainable capacity, with overtime, scarce labor, and very high capacity use. Unemployment is below the natural rate (negative cyclical unemployment). The gap is $Y - Y_f$. It is a temporary situation because input prices will rise.



Inflationary gap: equilibrium E1 is to the right of potential output Y_f .

Output gaps

Recessionary gap: $Y < Y_f$, unemployment above the natural rate, pressure on wages and prices to fall.

Inflationary gap: $Y > Y_f$, unemployment below the natural rate, pressure on wages and prices to rise.

Output gap in percent = $\frac{Y - Y_f}{Y_f} \times 100$ (negative for a recession, positive for an overheated economy).

Long-run self-correction. The AD-AS model says that gaps eventually close without government action because nominal wages and other input prices adjust. The process is the same in reverse in the two cases.

- 1 **Recessionary gap closes** High cyclical unemployment and idle capacity put downward pressure on nominal wages and input prices. As contracts expire, unit costs fall, so SRAS shifts right. The price level falls and real GDP rises along the AD curve until output returns to Y_f .
- 2 **Inflationary gap closes** Tight labor markets and scarce inputs push nominal wages and input prices up. Unit costs rise, so SRAS shifts left. The price level rises and real GDP falls along AD until output returns to Y_f .
- 3 **Speed matters** Wages are more flexible upward than downward, so an inflationary gap tends to correct faster than a recessionary gap. A recessionary gap may take years, which is the reason many economists support stabilization policy.

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Self-correction of a recessionary gap: falling wages shift SRAS right from SRAS1 to SRAS2, lowering the price level and returning output to Y_f at E2.

Long-run changes in LRAS. Economic growth shifts LRAS to the right. Causes include an increase in the labor force (immigration, higher participation), more capital goods through investment, better education and training (human capital), new technology, more natural resources, and better institutions such as secure property rights. A decrease in LRAS follows a destruction of capital by war or disaster, or a permanent loss of resources. A change in the natural rate of unemployment (for example, from stronger job-matching technology) also moves potential output.

EXAMPLE 1: IDENTIFY THE GAP

An economy has potential output of \$3,000 billion and a short-run equilibrium real GDP of \$3,150 billion. The natural rate of unemployment is 5 percent, and actual unemployment is 3.8 percent. Identify the gap, state its size, and describe what will happen to wages and SRAS in the long run.

SOLUTION

Actual output \$3,150 billion exceeds potential \$3,000 billion, so this is an inflationary gap of \$150 billion (a positive output gap of 5 percent).

Unemployment at 3.8 percent is below the natural rate of 5 percent, which is consistent with output above potential.

Labor and inputs are scarce, so nominal wages and input prices rise. Unit costs rise and SRAS shifts left.

The price level rises and real GDP falls back along AD to \$3,000 billion.

EXAMPLE 2: SELF-CORRECTION OF A RECESSION

After a drop in AD, an economy has equilibrium price level 108 and real GDP of \$4,700 billion. Potential output is \$5,000 billion. Describe the gap, the long-run adjustment, and the final change in the price level compared with the short-run equilibrium.

SOLUTION

Real GDP is below potential by \$300 billion, so there is a recessionary gap. Unemployment is above the natural rate.

With slack in labor markets, nominal wages fall or grow more slowly than productivity, lowering unit costs and shifting SRAS right.

The price level falls from 108 as SRAS shifts, and real GDP rises along the new AD curve until it reaches \$5,000 billion.

In the new long-run equilibrium, real GDP equals potential output and the price level is lower than 108, though not necessarily lower than its starting level before AD fell.

EXAMPLE 3: GROWTH SHIFT

A country invests heavily in education and adopts new technology. Show and explain the effect on LRAS, and state what happens to potential output.

SOLUTION

Better human capital and technology raise productivity, expanding the economy's productive capacity.

LRAS shifts right from LRAS1 to LRAS2, so potential output rises.

With SRAS shifting right as well (lower unit costs), the long-run price level can fall, or if AD also grows, real GDP rises with stable prices. The outward shift of the PPC is the matching idea.

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Common mistakes

(1) Drawing LRAS as upward sloping or at a price level; it is vertical at Y_f . (2) Mixing up the gaps: a recessionary gap means output is below potential ($Y < Y_f$) and unemployment is above the natural rate. (3) Shifting AD to close a gap when asked about self-correction; self-correction happens by SRAS shifting, not AD. (4) Saying the long-run price level always returns to its initial value; it depends on the shifts. (5) Labeling the gap on the vertical axis; gaps are measured in real GDP on the horizontal axis.

Exam tip

Before shading or labeling a gap, draw LRAS first, then AD and SRAS meeting at the starting point. Move one curve only. Label Y_f on the horizontal axis and the equilibrium output to its left (recession) or right (inflation). In self-correction, SRAS moves, AD stays put, and the end point must lie on LRAS.

Practice**SET A Check Your Understanding**

Answer each question in two to four sentences.

1. State the shape of the LRAS curve and explain why it has that shape.
2. List three changes that would shift LRAS to the right.
3. Define a recessionary gap in terms of output and the unemployment rate. Where is short-run equilibrium relative to LRAS?
4. Define an inflationary gap and state how unemployment compares to the natural rate.
5. Potential output is \$1,200 billion and equilibrium real GDP is \$1,140 billion. Calculate the size of the gap in dollars and as a percent of potential output, and identify its type.
6. Describe the self-correction mechanism for an inflationary gap, naming the curve that shifts and the direction.
7. Explain why a recessionary gap may take longer to correct on its own than an inflationary gap.
8. Explain the difference between short-run equilibrium and long-run macroeconomic equilibrium.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. In the long run, the aggregate supply curve is vertical because
 - (A) firms cannot change production
 - (B) input prices adjust fully, so output is determined by resources and technology
 - (C) the government fixes the price level
 - (D) consumers do not respond to price changes
 - (E) the central bank sets output
10. An economy is in a recessionary gap. Which of the following describes the economy?

(A) Unemployment is below the natural rate	(B) Real GDP exceeds potential output
(C) Cyclical unemployment is positive	(D) SRAS will shift left
(E) The price level is rising	
11. Which of the following would shift LRAS to the right?
 - (A) A decrease in the money supply
 - (B) An increase in government spending
 - (C) A temporary rise in oil prices
 - (D) A fall in the price level
 - (E) A permanent increase in labor productivity from new technology

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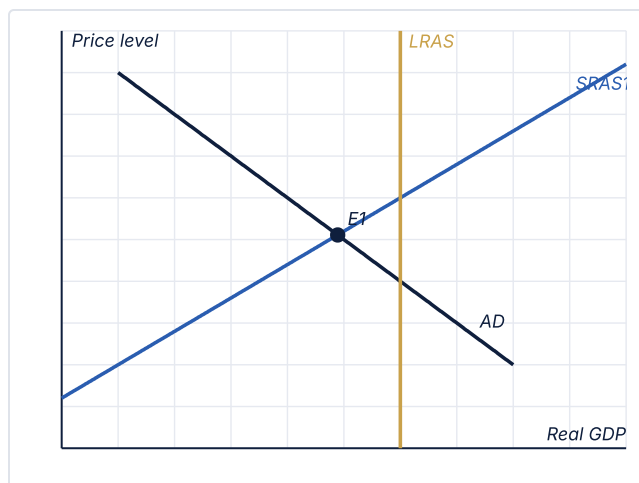
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12. Starting from a short-run equilibrium with an inflationary gap, with no policy action, in the long run
- (A) AD shifts left
 - (B) SRAS shifts right and the price level falls
 - (C) LRAS shifts left
 - (D) SRAS shifts left, raising the price level and lowering real GDP
 - (E) real GDP and the price level both rise
13. Potential output is \$800 billion and equilibrium real GDP is \$856 billion. The economy is in
- (A) an inflationary gap of \$ 56 billion
 - (B) a recessionary gap of \$ 56 billion
 - (C) an inflationary gap of \$ 856 billion
 - (D) a recessionary gap of 7 percent of potential output
 - (E) long-run equilibrium
14. Which of the following is true at long-run macroeconomic equilibrium?
- (A) The unemployment rate equals zero
 - (B) Real GDP is equal to the previous year's real GDP
 - (C) Cyclical unemployment equals zero and output equals potential output
 - (D) SRAS lies to the right of LRAS
 - (E) The price level is falling

SET C Apply and Extend

Write a complete response. Graphs should be labeled.

15. The graph shows an economy in short-run equilibrium. (a) Identify the type of gap and state how real GDP compares to potential output. (b) Describe how unemployment compares to the natural rate. (c) Explain, using wages and the SRAS curve, how the economy returns to long-run equilibrium without policy. (d) State what happens to the price level and real GDP during the adjustment.



Short-run equilibrium E1 relative to LRAS.

16. An economy is initially in long-run equilibrium. A sudden loss of consumer confidence shifts AD to the left. (a) Draw a correctly labeled AD-AS graph showing the initial equilibrium and the new short-run equilibrium. (b) Identify the output gap that results. (c) Show what happens in the long run and explain whether the final price level is higher, lower, or equal to the original. (d) Describe one reason the adjustment may be slow.
17. Country A and Country B each have potential output of \$2,000 billion. Country A is producing \$2,080 billion, and Country B is producing \$1,880 billion. (a) Identify and calculate the gap in each country as a percent of potential output. (b) Compare unemployment relative to the natural rate in each. (c) Predict what will happen to nominal wages in each country, and the effect on SRAS.

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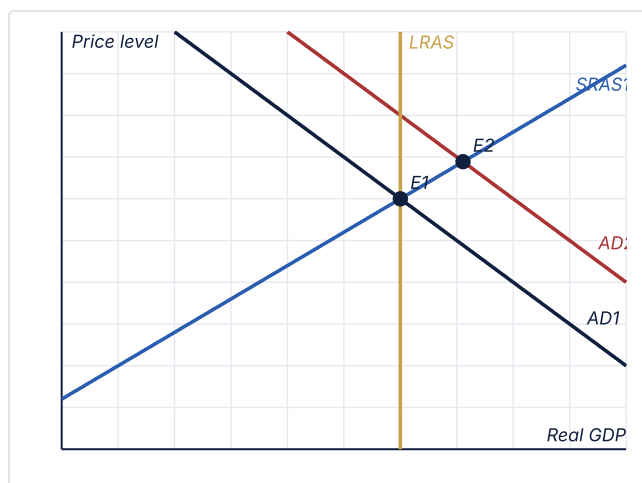
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3.4 Shocks and Changes in the AD-AS Model

Learn to predict the effects of demand and supply shocks on the price level, real GDP, and unemployment, and to draw the graph sequences for inflation, recession, and stagflation.

The AD-AS model becomes powerful when you use it to predict what happens after a **shock**, a disturbance that moves one of the curves. The rule that makes everything fast: a shift of **AD** moves the price level and real GDP in the **same** direction; a shift of **SRAS** moves them in **opposite** directions. Unemployment moves opposite to real GDP in the short run (a bigger output gap means more cyclical unemployment).

Demand shocks. A demand shock is a shift of AD caused by a change in consumption, investment, government spending, or net exports. A rightward shift of AD, starting from long-run equilibrium, raises the price level and real GDP. The increase in the price level that results from an AD increase is called **demand-pull inflation** because too much spending chases the available output. Unemployment falls below the natural rate as firms hire more workers to produce the extra output.



Demand-pull inflation: AD shifts right, raising both the price level and real GDP. E2 lies to the right of potential output, an inflationary gap.

The new equilibrium E2 is an inflationary gap. In the long run, higher nominal wages shift SRAS left until the economy returns to potential output at a still higher price level. The permanent effect of the AD increase is a higher price level with no lasting change in real output. A **leftward** shift of AD (for example, because households lose wealth in a stock market crash or exports collapse) produces the reverse: a lower price level, lower real GDP, and higher unemployment, a recessionary gap. A fall in the price level that is large and sustained is called **deflation**, which is more common in the model than in practice because wages are sticky downward, which keeps prices from falling much.

Demand shock results (short run)

AD increases: price level up, real GDP up, unemployment down (demand-pull inflation, inflationary gap).

AD decreases: price level down, real GDP down, unemployment up (recessionary gap).

Supply shocks. A supply shock is a shift of SRAS caused by a sudden change in input prices, productivity, or conditions of production. A **negative supply shock** (for example, an embargo that sharply raises oil prices) shifts SRAS left. The price level rises and real GDP falls. This pairing of rising prices with a falling real GDP and rising unemployment is called **stagflation**. The price rise from higher costs is called **cost-push inflation**, to distinguish it from demand-pull inflation.

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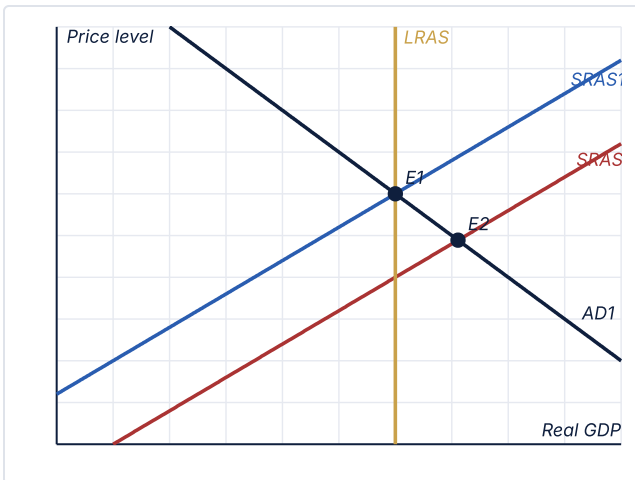
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Stagflation: a negative supply shock shifts SRAS left, raising the price level while real GDP falls below potential output.

A **positive supply shock** (a sharp fall in energy costs, a bumper harvest, or an important technology) shifts SRAS right. The price level falls and real GDP rises, so unemployment falls. This is the ideal combination of lower inflation with greater output. If the positive shock is also a permanent gain in productivity, LRAS shifts right too, and potential output increases.



A positive supply shock shifts SRAS right: the price level falls and real GDP rises above its earlier level.

Shock	Curve shift	Price level	Real GDP	Unemployment	Label
Demand increase	AD right	Up	Up	Down	Demand-pull inflation
Demand decrease	AD left	Down	Down	Up	Recession (recessionary gap)
Negative supply shock	SRAS left	Up	Down	Up	Stagflation, cost-push inflation
Positive supply shock	SRAS right	Down	Up	Down	Favorable (disinflation)

Why supply shocks are harder to treat. After a demand shock, price and output move in the same direction, so policy can offset the shock by shifting AD back, though with the risks of lags. After a negative supply shock, a policy dilemma appears. Stimulating AD to fight the recession raises the price level further, while restraining AD to fight inflation deepens the recession. If policymakers do nothing, the recessionary gap eventually closes as high unemployment pushes nominal wages down, shifting SRAS back to the right at the original price level, but this can be slow and painful. The 1970s oil price shocks, which produced both high inflation and high unemployment in many countries, are the classic example of stagflation.

Combined shocks and long-run growth. In real life, shocks often arrive together. Sustained economic growth is shown by LRAS shifting right over time, with SRAS and AD shifting right too. If AD grows at about the same pace as productive capacity, real GDP rises and the price level stays stable. If AD grows faster than LRAS, the price level rises (inflation). To answer combination questions, shift each curve separately. When two shifts move one variable in the same direction, you can state the direction. When they conflict, the effect is **ambiguous** unless the problem gives more information.

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Four-step method for any shock question

1. Start from long-run equilibrium (AD, SRAS, and LRAS meeting at one point) unless told otherwise.
2. Identify which curve the event affects and the direction of the shift.
3. Read the new short-run equilibrium: price level, real GDP, then unemployment.
4. For the long run, say which direction wages and SRAS move to close the gap, and where the economy ends up.

EXAMPLE 1: WEALTH SHOCK

A prolonged stock market crash reduces household wealth. Starting from long-run equilibrium, explain the short-run and long-run effects on the price level, real GDP, and unemployment. Assume no policy response.

SOLUTION

Lower wealth reduces consumption at every price level, so AD shifts left.

Short run: the price level falls, real GDP falls below potential, and unemployment rises above the natural rate. This is a recessionary gap.

Long run: high unemployment pressures nominal wages down, unit costs fall, and SRAS shifts right.

The economy ends at potential output with a price level lower than the original; real GDP is back at Y_f and unemployment returns to the natural rate.

EXAMPLE 2: OIL PRICE SPIKE

A conflict cuts the world supply of oil and the price doubles. Use the AD-AS model to describe the short-run changes, and explain the dilemma for policymakers.

SOLUTION

Oil is an input for most firms, so unit costs rise at every price level and SRAS shifts left.

Price level rises (cost-push inflation) while real GDP falls below potential and unemployment rises: stagflation.

Policy dilemma: raising AD to restore output would push the price level up even more; cutting AD to restrain inflation would lower real GDP further.

If no policy is used, the recessionary gap eventually closes as wages fall and SRAS shifts back right.

EXAMPLE 3: IDENTIFY THE SHOCK FROM DATA

In one year, an economy's price level index falls from 112 to 108, real GDP rises from \$3,900 billion to \$4,000 billion, and the unemployment rate falls from 6.2 percent to 5.6 percent. Which curve most likely shifted, and in which direction? Name the shock.

SOLUTION

Price level and real GDP moved in opposite directions (price down, output up).

A shift of SRAS produces opposite movements. A fall in price with a rise in output means SRAS shifted right.

This is a positive supply shock, such as a drop in energy costs or a productivity improvement. Falling unemployment is consistent with output increasing.

Common mistakes

(1) Calling any inflation 'demand-pull'. Inflation with falling real GDP is cost-push. (2) Using stagflation for any recession; stagflation requires a rising price level together with falling output. (3) Moving two curves at once to get to the answer when one shift is enough. (4) Forgetting that long-run equilibrium lies on the vertical LRAS, so real output is back at Y_f . (5) Writing 'AD increases because prices increased'. The price level change is a result, never the cause, of an AD shift.

Exam tip

On graph FRQs, label the original equilibrium E_1 , the new equilibrium E_2 , and mark PL_1 , PL_2 , Y_1 , Y_2 on the axes. Then answer in words: 'The price level rises from PL_1 to PL_2 and real GDP falls from Y_1 to Y_2 .' Graph and sentence are separate scoring points.

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Practice

SET A Check Your Understanding

Answer each question in two to four sentences.

1. Define demand-pull inflation and show it by naming the curve that shifts and the direction.
2. Define stagflation and cost-push inflation. Which curve shifts, and in which direction?
3. Starting from long-run equilibrium, a positive supply shock occurs. State the short-run effect on the price level, real GDP, and unemployment.
4. The Federal Reserve raises interest rates, which reduces investment. Describe the effect on AD, the price level, real GDP, and unemployment in the short run.
5. Explain how an inflationary gap caused by an AD increase is eliminated in the long run without policy. What is the long-run effect on real GDP?
6. Explain why a negative supply shock creates a dilemma for policymakers but a negative demand shock does not.
7. Give two examples of events that would cause a positive supply shock and one that would cause a negative supply shock.
8. If AD and SRAS both shift right by a large amount, what can you say definitely about real GDP, and what is ambiguous about the price level?

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. Starting from long-run equilibrium, a large increase in government spending will cause which of the following in the short run?
(A) Lower price level and lower real GDP
(B) Higher price level and lower real GDP
(C) Lower price level and higher real GDP
(D) No change in the price level
(E) Higher price level and higher real GDP
10. Which of the following events is most likely to cause stagflation?
(A) A decrease in income taxes
(B) A sharp rise in the price of imported oil
(C) An increase in consumer confidence
(D) A technological advance
(E) A rise in foreign incomes
11. A positive supply shock will most likely lead to
(A) higher price level and higher real GDP
(B) lower price level and lower real GDP
(C) higher price level and lower unemployment
(D) lower price level and higher real GDP
(E) lower price level and higher unemployment
12. An economy at long-run equilibrium experiences a decrease in AD. Without any government policy, what happens in the long run?
(A) SRAS shifts right as nominal wages fall, restoring potential output at a lower price level
(B) SRAS shifts left
(C) LRAS shifts left
(D) AD shifts right on its own and the price level returns to normal
(E) Real GDP stays below potential output permanently
13. The following data are observed over one year: price level up 5 percent, real GDP down 2 percent, unemployment up 1.5 percentage points. The most likely cause is
(A) an increase in AD
(B) a decrease in AD
(C) a decrease in SRAS
(D) an increase in SRAS
(E) an increase in LRAS
14. Which of the following best explains why cost-push inflation is difficult for policymakers to address?
(A) Price controls are always effective
(B) Supply shocks only affect the long run
(C) The AD curve is vertical
(D) Cost-push inflation does not affect real GDP
(E) Reducing inflation through lower AD increases unemployment further

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SET C Apply and Extend

Write a complete response. Graphs should be labeled.

15. An economy is in long-run equilibrium. A war disrupts oil supplies and the price of oil rises sharply. (a) Draw a correctly labeled AD-AS-LRAS graph showing the initial equilibrium and the short-run effect. (b) State what happens to the price level, real GDP, and unemployment. (c) Name this phenomenon. (d) Explain how the economy returns to potential output if the government does not intervene.
16. An economy is in long-run equilibrium. Business firms become extremely optimistic and raise investment. (a) Show the effect on a graph. (b) Identify the output gap that results and describe unemployment relative to its natural rate. (c) Explain the long-run adjustment and the final change in the price level and real GDP compared to the original equilibrium.
17. Evaluate: 'If the price level is rising, the cause must be too much aggregate demand.' Use two different shock scenarios and state, for each, the effect on real GDP and unemployment.

3.5 Consumption, Saving, and the Multiplier

Learn how disposable income splits into consumption and saving, how the MPC and MPS drive the spending, tax, and balanced-budget multipliers, and how to calculate changes in GDP.

Households receive income and decide how much to spend and how much to save. This split drives the largest component of aggregate demand, and it explains why a change in spending can have a bigger effect on GDP than the original change. Start with **disposable income** (Y_d): income after taxes and plus transfer payments, the money households can use for spending or saving. Every dollar of disposable income is either consumed or saved, so $Y_d = C + S$.

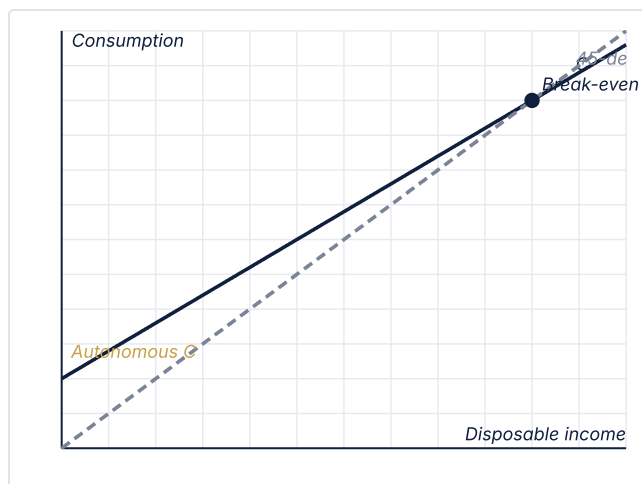
Marginal and average propensities

$MPC = \frac{\Delta C}{\Delta Y_d}$ and $MPS = \frac{\Delta S}{\Delta Y_d}$, so $MPC + MPS = 1$.

$APC = \frac{C}{Y_d}$ and $APS = \frac{S}{Y_d}$, so $APC + APS = 1$.

'Marginal' refers to the extra dollar of income; 'average' refers to all income.

Consumption function. The consumption function relates consumption spending to disposable income. In its linear form, $C = a + MPC \times Y_d$. The constant a is **autonomous consumption**: spending that occurs even if disposable income is zero (financed by savings or borrowing). The term $MPC \times Y_d$ is **induced consumption**, the part that changes because income changes. The slope of the consumption line equals the MPC. A typical value for a U.S. household is between 0.7 and 0.95, since households spend most of any added income.



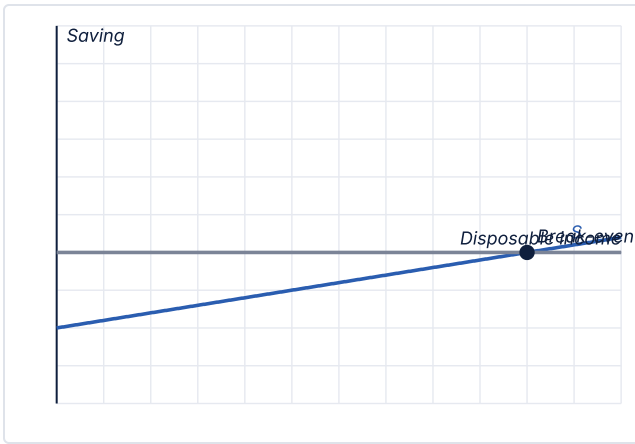
The consumption function has intercept equal to autonomous consumption and slope equal to the MPC. Where it crosses the 45-degree line, consumption equals disposable income and saving is zero.

Saving function. Since saving is what remains after consumption, $S = Y_d - C = -a + MPS \times Y_d$. The saving function has a negative intercept (households dissave at very low income), a slope equal to the MPS, and crosses the horizontal axis at the break-even income, where $C = Y_d$ and saving is zero. If the consumption function shifts up, the saving function shifts down by the same amount.

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The saving function has a negative intercept (dissaving), a slope equal to the MPS, and crosses zero at the break-even income.

What shifts the consumption (and saving) function? A change in disposable income moves you along the function. A change in anything else shifts it: household wealth (a rise shifts C up and S down), expectations about future income or prices, household debt (high debt lowers C), and expectations about future taxes (a change in current income taxes changes Y_d itself, which moves you along the function). A change in the interest rate also affects the saving decision.

The spending multiplier. Autonomous spending (the part of C, I, G, or X-M that does not depend on current income) sets off a chain of induced spending. Suppose the government spends \$100 on a project. Contractors receive \$100 as income. With an MPC of 0.8, they spend \$80 and save \$20. The sellers of those goods receive \$80, spend \$64, and so on. The total is a geometric series:

$$100 + 80 + 64 + 51.2 + \dots = 100 \times \frac{1}{1 - 0.8} = 500$$

Multiplier formulas (AP Macroeconomics)

Spending multiplier = $\frac{1}{1 - MPC} = \frac{1}{MPS}$. Change in GDP = multiplier $\times$ Δ autonomous spending (C, I, G, or net exports).

Tax multiplier = $-\frac{MPC}{MPS} = -\frac{MPC}{1 - MPC}$. A tax increase lowers GDP; a tax cut raises GDP. The same magnitude applies to a change in transfer payments, but with the opposite sign to a change in taxes (a transfer increase raises GDP).

Balanced-budget multiplier = 1: equal increases in G and taxes raise GDP by the amount of the change.

Why the tax multiplier is smaller in magnitude. A \$100 increase in government spending is a direct \$100 of initial spending. A \$100 tax cut raises disposable income by \$100, but households save part of it: with an MPC of 0.8 only \$80 is spent in the first round. The chain starts at \$80, not \$100, so the total is $80 \times 5 = 400$, which equals $\frac{MPC}{MPS} \times 100$. This is why a dollar of government spending has a bigger effect on GDP than a dollar of tax cut. The balanced-budget multiplier follows: with MPC = 0.8, a \$100 rise in G adds \$500, a \$100 rise in taxes subtracts \$400, net \$100.

Policy change of \$100 (MPC = 0.8)	Multiplier	Change in GDP
Increase government spending	5	+\$500
Decrease government spending	5	-\$500
Cut taxes	-4 (tax multiplier)	+\$400
Raise taxes	-4	-\$400
Increase transfer payments	4	+\$400
Equal rise in G and taxes (balanced budget)	1	+\$100

Limits of the simple multiplier. The formulas assume that all added income is either consumed or saved. In reality, income is also lost to taxes and spent on imports, so the real-world multiplier is smaller. Prices also matter: in the AD-AS model, the multiplier gives the horizontal shift of AD, but if the price level rises, the equilibrium increase in real GDP is smaller. The multiplier works in both directions, so a decrease in autonomous investment can cause a larger decrease in GDP.

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EXAMPLE 1: CONSUMPTION SCHEDULE

A household's consumption schedule is shown. Calculate the MPC, MPS, APC at \$400 of disposable income, and the break-even income.

Disposable income	Consumption	Saving
\$0	\$60	-\$60
\$100	\$135	-\$35
\$200	\$210	-\$10
\$300	\$285	\$15
\$400	\$360	\$40

SOLUTION

$$\text{MPC} = \frac{\Delta C}{\Delta Y_d} = \frac{75}{100} = 0.75.$$

$$\text{MPS} = 1 - 0.75 = 0.25 \text{ (check: saving rises by \$25 for each \$100).}$$

$$\text{APC at \$400} = \frac{360}{400} = 0.90.$$

Break-even income is where $C = Y_d$. Between \$200 and \$300, consumption goes from above income to below income. Using $C = 60 + 0.75 Y_d$, set $60 + 0.75 Y_d = Y_d$, so $Y_d = 60 / 0.25 = \$240$.

EXAMPLE 2: GOVERNMENT SPENDING MULTIPLIER

The economy has an MPC of 0.75 and a recessionary gap. The government increases spending by \$40 billion. Calculate the multiplier and the change in aggregate demand (at the initial price level), then show the first three rounds of spending.

SOLUTION

$$\text{Multiplier} = \frac{1}{1 - 0.75} = 4.$$

Change in AD (horizontal shift) = $4 \times \$40 = \$160$ billion.

Round 1: \$40 billion of government spending. Round 2: $0.75 \times 40 = \$30$ billion. Round 3: $0.75 \times 30 = \$22.5$ billion. The rounds keep shrinking and sum to \$160 billion.

EXAMPLE 3: TAX CUT AND BALANCED BUDGET

With $\text{MPC} = 0.75$, (a) calculate the effect on GDP of a \$40 billion tax cut; (b) calculate the effect of raising both G and taxes by \$40 billion.

SOLUTION

(a) Tax multiplier = $-\frac{0.75}{0.25} = -3$. A tax cut of \$40 billion changes GDP by $(-3) \times (-40) = +\$120$ billion.

(b) The spending increase adds $4 \times 40 = +\$160$ billion. The tax increase subtracts $3 \times 40 = \$120$ billion. Net = $+\$40$ billion, which equals the size of the change, confirming the balanced-budget multiplier of 1.

Common mistakes

(1) Using MPC instead of $1/(1 - \text{MPC})$ as the multiplier. (2) Forgetting the negative sign on the tax multiplier, or using the same multiplier for taxes and spending. (3) Computing MPC from consumption levels instead of changes. (4) Mixing APC with MPC; APC uses totals. (5) Applying a multiplier to a change in the price level or to a change in disposable income caused by a movement along the function (the multiplier applies to autonomous spending).

Exam tip

Always compute the multiplier first, write it down, then multiply by the correct initial change: spending multiplier for G , I , C , and net exports; tax multiplier for taxes and transfers. Label the unit, and state whether GDP rises or falls. When asked about a shift in AD, remember that the multiplier gives the horizontal shift at a fixed price level.

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Practice

SET A Check Your Understanding

Show your work for calculations.

1. Define MPC and MPS. If the MPC is 0.85, what is the MPS and what does it mean?
2. A household's disposable income rises from \$30,000 to \$34,000 and consumption rises from \$27,000 to \$30,200. Calculate the MPC and MPS.
3. Distinguish autonomous consumption from induced consumption using the equation $C = 200 + 0.6 Y_d$.
4. For $C = 200 + 0.6 Y_d$, find the break-even level of disposable income and APC at $Y_d = \$1,000$.
5. Calculate the spending multiplier when the MPC is 0.9, and the change in GDP from a \$25 billion rise in investment.
6. Calculate the tax multiplier when $MPC = 0.8$ and the effect of a \$10 billion tax increase on GDP.
7. Explain why the tax multiplier is smaller in magnitude than the government spending multiplier.
8. Explain the effect on the consumption and saving functions of a rise in household wealth.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. If the marginal propensity to consume is 0.8, the spending multiplier is
(A) 0.8 (B) 1.25 (C) 4 (D) 5 (E) 8
10. Disposable income rises by \$500 and saving rises by \$100. The marginal propensity to consume is
(A) 0.2 (B) 0.4 (C) 0.8 (D) 0.6 (E) 1.25
11. With $MPC = 0.75$, an increase in government spending of \$20 billion and a simultaneous increase in lump-sum taxes of \$20 billion will change GDP by
(A) \$0 (B) \$20 billion (C) \$60 billion
(D) \$80 billion (E) \$140 billion
12. The consumption function $C = 100 + 0.9Y_d$ implies that when $Y_d = 0$, consumption is
(A) 100 (B) 0 (C) 10 (D) 90 (E) 900
13. A decrease in household wealth will most likely
(A) shift the consumption function up and the saving function down
(B) shift the consumption function down and the saving function up
(C) move along the consumption function to a lower point
(D) increase the MPC
(E) decrease the multiplier to zero
14. Which of the following is true about the tax multiplier compared to the spending multiplier?
(A) It is larger in absolute value
(B) It is equal in absolute value
(C) It is the reciprocal of the MPC
(D) It is always zero
(E) It is smaller in absolute value and negative for a tax increase

SET C Apply and Extend

Show your calculations and explain your reasoning.

15. An economy's MPC is 0.6, and it has a recessionary gap of \$150 billion in real GDP. (a) Calculate the spending multiplier. (b) By how much must government spending increase to close the gap, assuming the price level stays constant? (c) Calculate the tax cut required to close the same gap. (d) Which policy requires a larger change, and why?
16. The table shows a household's consumption at different disposable incomes. Disposable income: \$0, \$200, \$400, \$600; consumption: \$100, \$250, \$400, \$550. (a) Calculate the MPC and MPS. (b) Write the consumption function. (c) Find break-even disposable income. (d) Describe how the table would change if household wealth rose by \$50 at every income level.
17. Evaluate the statement: 'If the government raises taxes and spending by the same amount, GDP will not change.' Use the $MPC = 0.5$ case and calculate the effect of a \$100 billion rise in both.

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3.6

Fiscal Policy

Learn how government spending, taxes, and transfers shift aggregate demand, how automatic stabilizers work, what deficits and debt mean, and why fiscal policy has lags and limits.

Fiscal policy is the use of government spending and taxation to influence the economy. In the United States, fiscal policy is set by Congress and the President. The tools are government purchases of goods and services (G), taxes (T), and transfer payments (such as unemployment insurance, Social Security, and food assistance). Because G is a component of AD, and taxes and transfers change disposable income and therefore consumption, fiscal policy shifts the AD curve. Its goals are to close output gaps, keep unemployment near the natural rate, and keep inflation low and stable.

Expansionary and contractionary fiscal policy

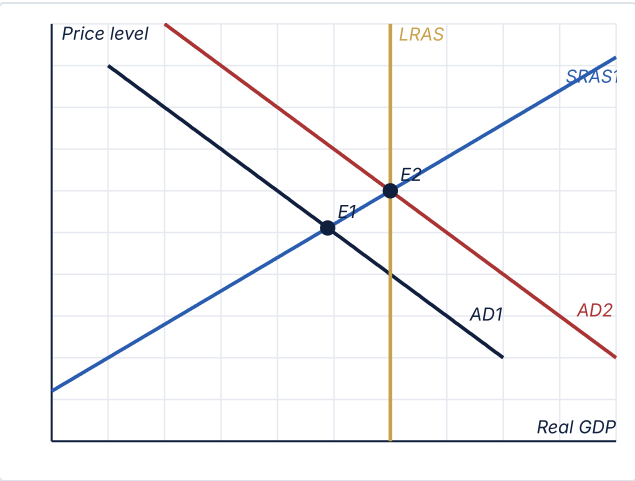
Expansionary fiscal policy: increase G, cut taxes, or raise transfers. AD shifts right. Used to fight a recessionary gap.

Contractionary fiscal policy: cut G, raise taxes, or cut transfers. AD shifts left. Used to fight an inflationary gap (demand-pull inflation).

Discretionary versus automatic. **Discretionary fiscal policy** consists of deliberate changes in G or T enacted by new legislation, such as an infrastructure bill or a temporary tax rebate. **Automatic stabilizers** are features of the tax and transfer system that change spending and tax revenue automatically as the economy fluctuates, with no new law. When real GDP falls, income tax revenue falls (especially with a progressive income tax, where people fall into lower tax brackets), and transfer payments such as unemployment insurance and food assistance rise. Both changes cushion the fall in disposable income and consumption. When the economy booms, the opposite happens: tax revenue rises and transfers fall, restraining spending. Automatic stabilizers reduce the size of swings in real GDP but do not eliminate them.

Feature	Discretionary fiscal policy	Automatic stabilizers
Who acts	Congress and the President pass new laws	Built into existing law; no new action
Timing	Subject to long lags	Immediate
Examples	Stimulus spending, tax rebates, tax cuts, defense cuts	Progressive income tax, unemployment insurance, SNAP
Size of effect	Can be large and targeted	Moderate; smooths but does not stop fluctuations
Budget effect	Chosen	Deficit grows in recessions, shrinks in booms

Fiscal policy in the AD-AS model. In a recessionary gap, the economy produces below potential and unemployment is above the natural rate. Expansionary fiscal policy increases G, cuts taxes, or raises transfers, shifting AD right and moving real GDP toward potential output. In an inflationary gap, contractionary fiscal policy shifts AD left, lowering the price level pressure and bringing real GDP back toward potential. The aim is to reach the new equilibrium at the LRAS line.



Expansionary fiscal policy: increased G or lower taxes shifts AD right from AD1 to AD2, closing the recessionary gap at E2.

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Contractionary fiscal policy: lower G or higher taxes shifts AD left, closing an inflationary gap.

Government budget. The **budget balance** is tax revenue minus total government spending (purchases plus transfers plus interest). If revenue exceeds spending, there is a **budget surplus**. If spending exceeds revenue, there is a **budget deficit**, which the government finances by borrowing, mainly by selling Treasury bonds. If they are equal, the budget is balanced. The **national debt** is the total accumulated amount of past deficits net of surpluses. Distinguish deficit (a flow in one year) from debt (a stock). Expansionary policy tends to produce larger deficits (or smaller surpluses); contractionary policy tends to reduce deficits. A recession increases the deficit even with no new policy because of the automatic stabilizers, so it is useful to separate the **cyclical deficit** (caused by the state of the business cycle) from the **structural deficit** (what the deficit would be at potential output).

Budget terms

Budget deficit = government spending - tax revenue (when positive). Budget surplus = tax revenue - spending (when positive).
The national debt is the sum of all past deficits minus surpluses. A deficit adds to the debt; a surplus reduces it.

Lags and limits. Fiscal policy is powerful in theory but hard to time in practice. There are four lags. The **recognition lag** is the time needed to see that the economy has changed. The **decision (legislative) lag** is the time Congress takes to agree on a bill. The **implementation lag** is the time needed to put the policy into effect (for example, to start construction projects). The **impact lag** is the time it takes for the policy to affect spending and output. By the time a stimulus is felt, the recession may have ended and the added demand could cause inflation instead, so policy could be destabilizing.

Limit	How it weakens fiscal policy
Time lags	Policy may take effect when conditions have already changed
Political constraints	Spending is easy to start and hard to cut; tax increases are unpopular, so contractionary policy is under-used
Crowding out	Government borrowing raises interest rates and reduces private investment, offsetting part of the stimulus
Multiplier uncertainty	The size of the multiplier is not precisely known, and it varies with the state of the economy
Expectations	If households expect future taxes to rise to repay debt, they may save more of any tax cut
Debt burden	Persistent deficits raise the debt and interest payments, limiting future flexibility

Crowding out deserves a first look now. When the government runs a deficit and borrows, it adds to the demand for loanable funds, which pushes up the real interest rate. A higher interest rate discourages private investment spending, so part of the increase in G is offset by a fall in I . The net effect on AD is smaller than the multiplier alone suggests. The effect is stronger when the economy is near full employment; during a deep recession with weak private borrowing demand, crowding out is likely to be small.

Which tool is best? Government purchases have the most direct effect because each dollar enters spending in the first round. Tax cuts and transfers work through households' decisions, and some of the money is saved. Transfers aimed at lower-income households have a higher effect because their MPC is higher. Temporary tax cuts raise spending less than permanent ones, since households smooth consumption over time.

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EXAMPLE 1: CLASSIFY THE POLICY

A recession pushes unemployment to 9 percent. Classify each action as expansionary or contractionary, and as discretionary or automatic.

- (i) Congress passes a law funding repair of highways and bridges.
- (ii) Tax collections fall as incomes fall.
- (iii) Unemployment insurance payments increase as layoffs rise.
- (iv) Congress passes a one-time tax rebate for all households.

SOLUTION

- (i) Expansionary, discretionary: new law raises G.
- (ii) Expansionary (it cushions the downturn), automatic: no law is needed.
- (iii) Expansionary, automatic: transfers rise as unemployment rises.
- (iv) Expansionary, discretionary: new legislation cuts taxes, raising disposable income and consumption.

EXAMPLE 2: DEFICIT AND THE CYCLE

In a normal year, government spending is \$4,000 billion and tax revenue is \$3,800 billion. In a recession, revenue falls to \$3,500 billion and spending rises to \$4,150 billion, with no change in policy rules. Calculate the budget balance in each year and explain the change.

SOLUTION

Normal year: $3,800 - 4,000 = -\$200$ billion, a deficit of \$200 billion.

Recession year: $3,500 - 4,150 = -\$650$ billion, a deficit of \$650 billion.

The deficit grew by \$450 billion: revenue fell by \$300 billion and spending rose by \$150 billion, both from automatic stabilizers. This is the cyclical deficit; it supports spending during the downturn.

EXAMPLE 3: CHOOSING THE POLICY

The economy has an inflationary gap with unemployment of 3.5 percent (the natural rate is 5 percent) and the price level is rising 6 percent a year. Recommend a fiscal policy, show the effect on a graph, and state the effect on the budget.

SOLUTION

Real GDP exceeds potential output, so contractionary policy is needed: reduce G, raise taxes, or cut transfers.

AD shifts left from AD1 to AD2; the equilibrium moves down along SRAS toward the LRAS line, lowering inflation pressure and real GDP toward potential.

The budget balance moves toward a surplus (or a smaller deficit), because spending falls and tax revenue rises. Unemployment rises toward the natural rate.

Common mistakes

(1) Mixing up the direction: a recessionary gap needs expansionary policy (AD right). (2) Calling a budget deficit 'the debt'. (3) Treating automatic stabilizers as new policy. (4) Assuming a bigger deficit always means expansionary policy; a recession raises the deficit automatically. (5) Forgetting lags: saying policy 'immediately' works. (6) Shifting SRAS instead of AD to describe fiscal policy.

Exam tip

When asked to 'explain' a fiscal policy effect, give a chain: policy action → change in G or disposable income → change in C or AD → direction of the AD shift → effect on real GDP, price level, and unemployment. Also name the effect on the budget (deficit rises for expansionary policy).

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Practice

SET A Check Your Understanding

Answer each question in two to four sentences.

1. Define fiscal policy and name its three main tools.
2. Distinguish discretionary fiscal policy from automatic stabilizers, and give one example of each.
3. Explain why a progressive income tax acts as an automatic stabilizer.
4. The economy is in a recessionary gap. Describe a fiscal policy response and its effect on AD, the price level, real GDP, and unemployment.
5. Distinguish a budget deficit from the national debt.
6. Explain how a recession affects the budget balance even if Congress passes no new laws.
7. Name and describe two lags that limit the effectiveness of discretionary fiscal policy.
8. Briefly explain crowding out and state what it does to the effectiveness of expansionary fiscal policy.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. Which of the following is an automatic stabilizer?
(A) A tax rebate passed by Congress
(B) A new highway construction bill
(C) Unemployment insurance benefits
(D) A reduction in the corporate tax rate
(E) The Federal Reserve lowering interest rates
10. The economy is experiencing high inflation and real GDP above potential. Which fiscal policy is most appropriate?
(A) Increase government purchases
(B) Cut income taxes
(C) Increase transfer payments
(D) Reduce government purchases and raise taxes
(E) Run larger deficits
11. Which of the following would cause the largest budget deficit with no change in policy?
(A) A strong economic expansion
(B) An increase in the stock market
(C) Falling unemployment
(D) A rise in tax rates
(E) A deep recession
12. Which describes the national debt?
(A) The sum of all past deficits net of surpluses
(B) The amount by which spending exceeds revenue in a year
(C) The trade deficit
(D) Total government spending
(E) The amount the government owes to foreigners only
13. Expansionary fiscal policy is most likely to be offset by crowding out if
(A) the economy has large unused capacity and low interest rates
(B) government borrowing raises real interest rates and reduces private investment
(C) taxes are cut and households save the entire cut
(D) imports fall
(E) the central bank is passive and unemployment is high
14. A major limitation of discretionary fiscal policy in fighting recessions is
(A) it has no effect on aggregate demand
(B) it cannot raise real GDP
(C) it always raises unemployment
(D) taxes cannot be changed
(E) the lags between the start of a recession and the effect of the policy

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SET C Apply and Extend

Write a complete response. Graphs should be labeled.

15. An economy is in a recessionary gap. (a) Draw a correctly labeled AD-AS-LRAS graph showing the gap. (b) Describe one discretionary expansionary fiscal action and show its effect on your graph. (c) State the effect on the budget deficit. (d) Explain one reason the policy might not fully close the gap.
16. Compare an increase in government purchases with a tax cut of the same size. Explain (a) which has a larger first-round effect and why, (b) which has a larger multiplier, and (c) how the economy's automatic stabilizers would change the budget deficit when real GDP rises after the policy.
17. Evaluate the claim: 'The government should always run a balanced budget every year.' In your answer, use automatic stabilizers and the business cycle to explain at least two problems with this rule.

3.7 Fiscal Policy Calculations and Policy Evaluation

Learn to calculate the spending and tax changes needed to close output gaps, adjust for crowding out, and evaluate fiscal policy trade-offs in exam-style problems.

This lesson turns the theory of fiscal policy into numbers. On the AP exam you may be asked to calculate how large a change in government spending or taxes is needed to close an output gap, to compare two policies, or to explain why a policy may work less well than a calculation suggests. The same three steps solve almost every problem.

- 1 **Find the gap** Recessionary gap = $Y_f - Y$ (potential output minus actual output). Inflationary gap = $Y - Y_f$. Use the units of the problem (billions of dollars).
- 2 **Compute the right multiplier** For a change in G , investment, or net exports, use $\frac{1}{1-MPC}$. For a change in taxes or transfers, use the tax multiplier $-\frac{MPC}{1-MPC}$ for taxes (the sign is negative) and $+\frac{MPC}{1-MPC}$ for transfers.
- 3 **Divide the gap by the multiplier** Required change in policy = $\frac{\text{gap}}{\text{multiplier}}$. Choose the direction: spending up or taxes down for a recessionary gap; spending down or taxes up for an inflationary gap.

Required policy change to close a gap (price level held constant)

Change in G needed = $\frac{\text{gap}}{1/(1-MPC)} = \text{gap} \times (1 - MPC)$.

Change in taxes needed = $\frac{\text{gap}}{MPC/(1-MPC)} = \text{gap} \times \frac{1-MPC}{MPC}$ (a cut for a recessionary gap).

A tax change must be larger than a spending change because each dollar of tax change is partly saved: the ratio of the required tax change to the required spending change is $1/MPC$.

Policy tool (change of \$1)	Multiplier (MPC = 0.8)	Effect on equilibrium GDP (price level fixed)
Government purchases up	5	+\$5
Transfer payments up	4	+\$4
Taxes down	4	+\$4
Taxes up	-4	-\$4
Government purchases down	5	-\$5
G and taxes up together	1	+\$1

Reading the gap on a graph. A recessionary gap is the horizontal distance between the short-run equilibrium output and potential output. The fiscal policy has to shift AD to the right by enough, at the original price level, to bring the AD-SRAS intersection onto the LRAS curve. In the simplest AP setting we assume the multiplier tells us that horizontal shift and the gap is the amount to close. If the price level rises as AD shifts right (as it does along an upward-sloping SRAS), the required shift in AD is somewhat larger than the gap, because some of the demand increase is absorbed by higher prices. Examination problems that give numbers usually say 'assuming the price level is constant', which tells you to use the simple method.

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Closing a recessionary gap: fiscal policy must move AD far enough to the right to bring equilibrium to the potential output line.

Crowding out in calculations. The simple multiplier overstates the effect of deficit-financed spending if borrowing raises the interest rate. To adjust, treat the fall in investment as a negative change in autonomous spending and multiply it by the same multiplier. For example, if government purchases rise \$50 billion and the resulting higher interest rate reduces investment by \$10 billion, the net change in autonomous spending is \$40 billion. With a multiplier of 4, AD shifts right by \$160 billion instead of \$200 billion.

Adjusting for crowding out

Net change in autonomous spending = change in G (or other initial change) + change in private investment caused by higher interest rates.

Change in AD = spending multiplier $\times$ net change in autonomous spending.

Evaluating policy trade-offs. Free-response questions often ask whether a policy is a good idea. Use the following criteria and give a reason from the model.

Criterion	Spending increase	Tax cut / transfer increase
Size of effect per dollar	Largest (multiplier $1/\text{MPS}$)	Smaller (multiplier MPC/MPS)
Speed	Slow if projects must be planned	Faster if rebates can be sent quickly
Targeting	Can be aimed at specific sectors or regions	Broad; depends on who receives it
Effect on deficit	Raises it	Raises it
Risk	Waste, inefficient projects, hard to reverse	Savings leakage; temporary cuts may be saved
Long-run supply effect	Infrastructure and education can raise LRAS	Lower marginal tax rates may raise labor supply and investment

Beyond the numbers, remember three trade-offs. First, **stabilization versus debt**: expansionary policy raises the deficit, and a large debt means higher future interest payments and possible crowding out. Second, **short run versus long run**: stimulus helps now, while contractionary policy to cut a deficit can slow a weak economy. Third, **inflation versus unemployment**: policy that closes a recessionary gap reduces unemployment but raises the price level, and pushing AD beyond potential output creates an inflationary gap. A sound evaluation names the goal (for example, closing a recessionary gap), the tool, the mechanism, and at least one cost or limit.

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EXAMPLE 1: CLOSING A RECESSIONARY GAP

Potential output is \$5,000 billion and real GDP is \$4,800 billion. The MPC is 0.8, and the price level is assumed constant. (a) What change in government purchases would close the gap? (b) What tax change would close it? (c) Suppose the government uses a \$20 billion increase in purchases; what tax cut closes the rest?

SOLUTION

Gap = $5,000 - 4,800 = \$200$ billion.

(a) Spending multiplier = $1/(1 - 0.8) = 5$. Required increase in $G = 200/5 = \$40$ billion.

(b) Tax multiplier = $-0.8/0.2 = -4$. Required tax cut = $200/4 = \$50$ billion.

(c) A \$20 billion rise in G adds $5 \times 20 = \$100$ billion. The remaining gap is \$100 billion. Tax cut needed = $100/4 = \$25$ billion.

EXAMPLE 2: INFLATIONARY GAP

An economy has real GDP of \$3,090 billion and potential output of \$3,000 billion. The MPC is 0.9. What fiscal policy would close the gap? Give one spending option and one tax option.

SOLUTION

Gap = $3,090 - 3,000 = \$90$ billion (inflationary).

Spending multiplier = $1/(1 - 0.9) = 10$. Cut G by $90/10 = \$9$ billion.

Tax multiplier = $-0.9/0.1 = -9$. Raise taxes by $90/9 = \$10$ billion.

Both are contractionary, shifting AD left. The tax increase is slightly larger because some of the lost income comes out of savings.

EXAMPLE 3: ADJUSTING FOR CROWDING OUT

The MPC is 0.75. The government raises purchases by \$60 billion, financed by borrowing. The higher interest rate reduces investment by \$12 billion. Calculate the net change in AD at the initial price level, and compare it with the change that would occur without crowding out.

SOLUTION

Multiplier = $1/(1 - 0.75) = 4$.

Without crowding out: $4 \times 60 = \$240$ billion.

Net change in autonomous spending = $60 - 12 = \$48$ billion; net change in AD = $4 \times 48 = \$192$ billion.

Crowding out reduces the increase in AD by \$48 billion (20 percent).

EXAMPLE 4: FRQ-STYLE EVALUATION

An economy with an MPC of 0.5 faces a recessionary gap of \$100 billion. Policymaker A proposes a \$50 billion rise in G . Policymaker B proposes a \$50 billion tax cut. Which closes the gap? Which would you choose, and why?

SOLUTION

Spending multiplier = $1/(1 - 0.5) = 2$, so A's effect = $2 \times 50 = \$100$ billion. This closes the gap exactly.

Tax multiplier = $-0.5/0.5 = -1$, so B's effect = $1 \times 50 = \$50$ billion. This closes only half of the gap.

Choose A to close the gap with the smallest deficit increase of \$50 billion. B would need a \$100 billion cut.

Caveats: spending takes longer to implement, and if government borrowing crowds out investment, A's effect could be below \$100 billion, so a slightly larger package might be needed.

Common mistakes

(1) Dividing the gap by the wrong multiplier, or using the spending multiplier for a tax change. (2) Using the MPC as the multiplier. (3) Giving the answer as an increase when the problem has an inflationary gap. (4) Forgetting to say that these calculations assume the price level is constant. (5) Ignoring that equal tax and spending changes of the same size do not cancel; the balanced-budget multiplier is 1. (6) Treating crowding out as a negative multiplier rather than as a fall in investment multiplied by the spending multiplier.

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Exam tip

Show formulas and substitution on every calculation: 'multiplier = $1/(1 - 0.8) = 5$; change in $G = 200/5 =$

40 billion.' Points are awarded for the setup as well as the answer, and a wrong answer with correct setup can still earn credit. For 'explain' parts, line

AD shifts right by 200 billion at each price level.'

Practice**SET A Check Your Understanding**

Show your work for calculations.

1. The MPC is 0.75 and the economy has a recessionary gap of \$120 billion. Calculate the increase in government purchases needed to close the gap.
2. Using the same data (MPC 0.75, gap \$120 billion), calculate the tax cut needed to close the gap.
3. The MPC is 0.6 and there is an inflationary gap of \$60 billion. Calculate the cut in government purchases needed.
4. Explain why the tax change needed to close a gap is larger than the spending change needed.
5. Government purchases rise \$30 billion with MPC = 0.8. Crowding out cuts investment by \$6 billion. Calculate the net change in AD.
6. The government raises both G and taxes by \$25 billion, MPC = 0.9. Calculate the change in GDP.
7. Name two criteria for evaluating a fiscal policy proposal and explain how they apply to a tax rebate.
8. Explain why a calculation that closes the gap 'exactly' assumes the price level stays constant, and how the answer changes if SRAS slopes upward.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

9. The MPC is 0.8, potential output is \$2,500 billion, and real GDP is \$2,400 billion. To close the gap with a change in government purchases (price level constant), government purchases should
 (A) increase by \$ 20 billion (B) decrease by \$ 20 billion (C) increase by \$ 25 billion
 (D) increase by \$ 100 billion (E) increase by \$ 500 billion
10. With MPC = 0.75, the tax cut needed to close a \$90 billion recessionary gap is
 (A) \$ 22.5 billion (B) \$ 67.5 billion (C) \$ 90 billion
 (D) \$ 30 billion (E) \$ 120 billion
11. An economy with MPC = 0.5 has an inflationary gap of \$40 billion. Which policy would close the gap?
 (A) Cut government purchases by \$ 40 billion (B) Cut taxes by \$ 40 billion
 (C) Raise taxes by \$ 20 billion (D) Raise government purchases by \$ 20 billion
 (E) Cut government purchases by \$ 20 billion
12. Which of the following explains why the actual increase in real GDP from an increase in government purchases may be less than the spending multiplier predicts?
 (A) The marginal propensity to consume is higher than expected
 (B) Higher interest rates may reduce private investment, and prices may rise
 (C) The government spends the money too slowly
 (D) Taxes are lowered at the same time
 (E) Imports fall
13. Starting with the same budget deficit, a government wants to raise GDP by \$60 billion with MPC = 0.8. Compared with a tax cut, a rise in government purchases would require
 (A) a larger change and a bigger deficit increase
 (B) the same change and the same deficit increase
 (C) a smaller change and a smaller deficit increase
 (D) a larger change but a smaller deficit increase
 (E) no change in the deficit

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14. Which of the following would be the best argument against using a large expansionary fiscal policy when the economy is near full employment?
- (A) It could crowd out private investment and create an inflationary gap
 - (B) It would reduce the national debt
 - (C) It would lower the price level
 - (D) It would decrease aggregate demand
 - (E) It would raise the natural rate of unemployment by definition

SET C Apply and Extend

Show calculations and explain your reasoning.

15. An economy has potential output of \$6,000 billion, real GDP of \$5,700 billion, and an MPC of 0.8. Assume the price level is constant. (a) State the type and size of the gap. (b) Calculate the increase in government purchases that would close the gap. (c) Calculate the tax cut that would close it. (d) If crowding out reduces investment by \$15 billion after the spending increase in (b), calculate the remaining gap.
16. A government wants to close a recessionary gap of \$400 billion with $MPC = 0.75$. It uses a \$60 billion increase in purchases and a tax cut. (a) Calculate the effect of the spending increase on AD. (b) Calculate the tax cut needed for the remainder. (c) State what happens to the budget deficit and explain.
17. Evaluate the following proposal: 'To end a recession, the government should cut taxes now and raise them later to repay the debt.' Discuss two benefits and two costs or limits using AD-AS reasoning.

3.8 Multiple-Choice Practice: National Income and Price Determination

Twenty AP-style multiple-choice questions covering aggregate demand, aggregate supply, equilibrium, shocks, multipliers, and fiscal policy.

Choose the best answer for each question. Set A checks core concepts, Set B uses data, tables, and graphs, and Set C asks exam-level questions that combine ideas. Each explanation tells you why the right answer is right and why the most tempting wrong answer fails. Graph axes are price level (vertical) and real GDP (horizontal); the vertical gold line is LRAS.

SET A Core Concepts

Choose the best answer for each question.

1. The wealth effect helps explain the downward slope of the aggregate demand curve because a decrease in the price level
- (A) lowers the real value of household financial assets, which decreases saving
 - (B) makes domestic goods more expensive relative to foreign goods
 - (C) raises the real value of household financial assets, which increases consumption
 - (D) raises nominal interest rates, which increases investment
 - (E) causes consumers to substitute away from relatively expensive goods
2. Which of the following would shift the short-run aggregate supply curve to the right?
- (A) A decrease in the price of imported raw materials
 - (B) An increase in the price level
 - (C) An increase in nominal wages with no change in productivity
 - (D) An increase in government purchases
 - (E) An increase in consumer confidence
3. The long-run aggregate supply curve is vertical at the economy's potential output because, in the long run,
- (A) firms are unable to change their level of production
 - (B) the central bank sets output equal to full employment
 - (C) aggregate demand always equals aggregate supply
 - (D) consumers do not respond to changes in the price level
 - (E) all input prices adjust to changes in the price level, so real output is determined by resources, technology, and institutions

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4. An economy is operating in a recessionary gap. Which of the following is true?
- (A) Real GDP is greater than potential output
 - (B) Actual unemployment is greater than the natural rate of unemployment
 - (C) Cyclical unemployment is negative
 - (D) Nominal wages are likely to rise rapidly
 - (E) SRAS will shift to the left
5. Stagflation is most likely to result from
- (A) an increase in government purchases
 - (B) a decrease in income taxes
 - (C) an increase in consumer wealth
 - (D) a sharp increase in the price of oil
 - (E) a decrease in the price level
6. The marginal propensity to consume is 0.75. If government purchases increase by \$20 billion, aggregate demand will increase by
- (A) \$ 15 billion
 - (B) \$ 80 billion
 - (C) \$ 20 billion
 - (D) \$ 60 billion
 - (E) \$ 100 billion
7. Which of the following is an automatic stabilizer?
- (A) Unemployment insurance payments that increase when unemployment rises
 - (B) A law that funds new bridge construction
 - (C) A reduction in the corporate tax rate passed by Congress
 - (D) A decision by the Federal Reserve to raise interest rates
 - (E) A one-time tax rebate mailed to households

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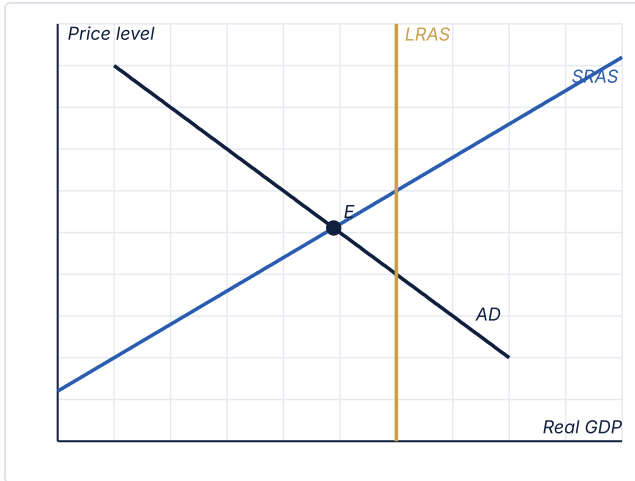
SET B Applications and Data

Choose the best answer for each question.

8. Use the consumption schedule to answer the question. What is the marginal propensity to save?

Disposable income	Consumption
\$200	\$190
\$300	\$270
\$400	\$350

- (A) 0.1 (B) 0.2 (C) 0.5 (D) 0.8 (E) 1.25
9. The graph shows an economy in short-run equilibrium. Which of the following is true at the current equilibrium?



- (A) Real GDP exceeds potential output
 (B) Cyclical unemployment is negative
 (C) The economy is in long-run equilibrium
 (D) Unemployment exceeds the natural rate, and nominal wages will tend to fall
 (E) SRAS will shift to the left over time
10. In one year the price level index rises from 100 to 106, real GDP falls from \$3,000 billion to \$2,940 billion, and unemployment rises from 5.0 percent to 6.2 percent. The most likely cause is
- (A) a decrease in short-run aggregate supply (B) an increase in aggregate demand
 (C) a decrease in aggregate demand (D) an increase in short-run aggregate supply
 (E) an increase in long-run aggregate supply
11. Potential output is \$2,000 billion and equilibrium real GDP is \$1,920 billion. The MPC is 0.75. To close the gap with government spending (price level constant), government purchases should rise by
- (A) \$ 80 billion (B) \$ 60 billion (C) \$ 320 billion
 (D) \$ 26.7 billion (E) \$ 20 billion
12. The table shows government finances. Which statement best explains the change from Year 1 to Year 2?

	Spending	Tax revenue
Year 1	\$3,000 billion	\$2,900 billion
Year 2	\$3,100 billion	\$2,700 billion

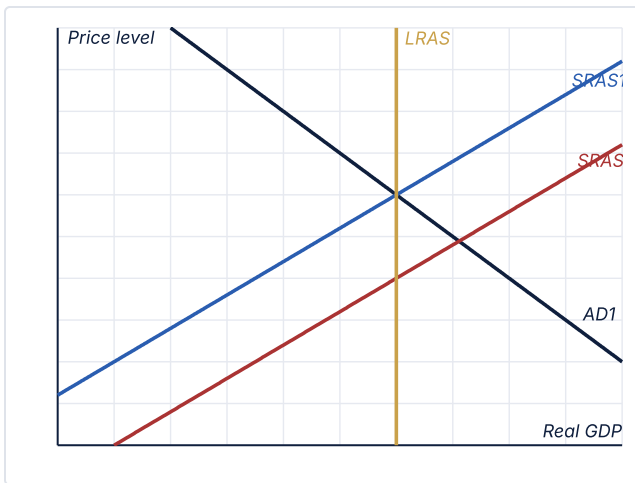
- (A) A recession reduced tax revenue and increased transfer spending through automatic stabilizers, raising the deficit
 (B) Congress passed a large tax increase
 (C) The national debt fell
 (D) A strong expansion raised tax revenue
 (E) The government ran a surplus in Year 2

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13. The graph shows a shift of the short-run aggregate supply curve from SRAS1 to SRAS2. Which of the following could cause the shift?



- (A) A rise in the price of oil
 (B) An increase in nominal wages with no productivity growth
 (C) An increase in government spending
 (D) A technological improvement that raises productivity
 (E) A depreciation of the currency that raises the cost of imported inputs
14. The MPC is 0.75. Government purchases rise by \$40 billion, and the resulting rise in interest rates reduces investment by \$8 billion. The net increase in aggregate demand is
- (A) \$160 billion
 (B) \$128 billion
 (C) \$32 billion
 (D) \$120 billion
 (E) \$152 billion

SET C Exam-Level Stretch

Choose the best answer for each question.

15. An economy experiences a simultaneous increase in aggregate demand and a decrease in short-run aggregate supply. Which of the following must be true?
- (A) Real GDP rises and the price level falls
 (B) Both real GDP and the price level rise
 (C) Both real GDP and the price level fall
 (D) Real GDP falls and the price level is ambiguous
 (E) The price level rises, and the change in real GDP is ambiguous
16. The MPC is 0.9. Government purchases increase by \$10 billion, and higher interest rates reduce investment by \$4 billion. The net increase in AD at the initial price level is
- (A) \$100 billion
 (B) \$60 billion
 (C) \$140 billion
 (D) \$10 billion
 (E) \$54 billion
17. A recessionary gap of \$120 billion exists and the MPC is 0.8. To close it, policymakers choose either an increase in government purchases or a tax cut. Which choice correctly compares the two?
- (A) Government purchases must rise by \$24 billion, and a tax cut must be \$30 billion, so purchases add less to the deficit
 (B) Both require \$24 billion, so they add equally to the deficit
 (C) Taxes must be cut by \$24 billion, and purchases must rise by \$30 billion
 (D) Purchases must rise by \$96 billion and taxes cut by \$120 billion
 (E) Purchases must rise by \$150 billion because the multiplier is 0.8
18. A negative supply shock raises unemployment and the price level. Which policy response would reduce unemployment but worsen inflation?
- (A) An increase in taxes
 (B) A decrease in transfer payments
 (C) A decrease in government purchases
 (D) An increase in government purchases
 (E) No policy response, allowing wages to adjust

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19. A firm's nominal wage rises 8 percent while labor productivity rises 5 percent. If this pattern occurs throughout the economy, unit labor cost
- (A) falls about 3 percent, shifting SRAS right
 - (B) rises 13 percent, shifting SRAS left
 - (C) rises about 3 percent, shifting SRAS left
 - (D) is unchanged, so SRAS does not shift
 - (E) rises about 5 percent, shifting AD left
20. Congress passes a large stimulus package 18 months after a recession began. By the time the spending takes effect, the economy has recovered and is near potential output. This best illustrates
- (A) the effectiveness of automatic stabilizers
 - (B) crowding out in the loanable funds market
 - (C) the balanced-budget multiplier
 - (D) a positive supply shock
 - (E) the problem of time lags, which can make discretionary fiscal policy destabilizing

3.9 Free-Response Practice: National Income and Price Determination

Four free-response questions on AD-AS graphs, multipliers, fiscal policy, and supply shocks.

Each question is scored by points listed in the model answers. Graphs must have labeled axes (price level and real GDP), labeled curves, and marked equilibrium values. Calculations earn credit for the setup and the final result; always show your work and include units.

Question 1 resembles the long free-response question on the AP exam, and Questions 2 through 4 resemble the short questions.

QUESTION 1 AD-AS Graph: Falling Consumer Confidence

The economy of Alpha is initially in long-run macroeconomic equilibrium. A sudden wave of pessimism causes households to cut their spending sharply. The marginal propensity to consume in Alpha is 0.75.

1. (a) Draw a correctly labeled graph of aggregate demand, short-run aggregate supply, and long-run aggregate supply for Alpha. Show the initial equilibrium price level and real GDP, labeled PL1 and Y1.
2. (b) On your graph, show the effect of the fall in consumer spending. Label the new short-run equilibrium price level PL2 and real GDP Y2.
3. (c) State what happens to the price level, real GDP, and the unemployment rate in the short run.
4. (d) The government wants to close the output gap with a fiscal policy action. Identify one expansionary fiscal action and explain how it would change aggregate demand.
5. (e) The output gap is \$60 billion. Calculate the change in government purchases required to close the gap, assuming the price level stays constant. Show your work.
6. (f) If no policy is used, explain what will happen to nominal wages and to the SRAS curve in the long run.

QUESTION 2 Multipliers and Closing a Gap

The country of Betaland has potential real GDP of \$8,000 billion and current real GDP of \$7,700 billion. The marginal propensity to consume is 0.8. Assume the price level is constant.

7. (a) Identify the type of output gap and calculate its size.
8. (b) Calculate the value of the spending multiplier.
9. (c) Calculate the increase in government purchases needed to close the gap.
10. (d) Calculate the tax cut needed to close the gap instead.
11. (e) Which of the two policies in (c) and (d) requires the smaller change in the budget balance? Explain.
12. (f) Suppose the government carries out the spending increase in (c), financed by borrowing, and the higher interest rate reduces investment by \$10 billion. Calculate the remaining gap.

QUESTION 3 Supply Shock and Policy Dilemma

A war in an oil-producing region sharply raises the world price of crude oil. Assume the economy of Gammaland, a net oil importer, begins in long-run macroeconomic equilibrium.

13. (a) Draw a correctly labeled graph of aggregate demand, short-run aggregate supply, and long-run aggregate supply showing the initial equilibrium.
14. (b) On your graph, show the effect of the oil price rise on short-run aggregate supply and label the new equilibrium price level and real GDP.
15. (c) Explain why the curve you shifted in (b) shifted in that direction.

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16. (d) Identify the term that describes the combination of changes in the price level and real GDP in the short run.
17. (e) Explain the dilemma facing policymakers in the short run.
18. (f) Describe what would happen in the long run if policymakers take no action.

QUESTION 4 Inflationary Gap and Fiscal Policy

The economy of Deltaland has potential output of \$5,000 billion and an actual real GDP of \$5,090 billion. The MPC is 0.9, the unemployment rate is 3.5 percent, and the natural rate of unemployment is 5 percent. Assume the price level is constant for calculations.

19. (a) Identify the type of gap and explain how the unemployment rate is consistent with it.
20. (b) Calculate the change in government purchases that would close the gap.
21. (c) Calculate the change in taxes that would close the gap.
22. (d) Show on a labeled AD-AS-LRAS graph how the policy in (b) affects the economy, and describe the effect on the price level and real GDP.
23. (e) State the effect of the policy in (b) on the government budget balance.
24. (f) Explain how automatic stabilizers affect the budget balance when the economy moves from an expansion to a recession, and name one lag that limits discretionary policy.

Answers Chapter 3: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

3.1 Aggregate Demand

SET A · CHECK YOUR UNDERSTANDING

1. The wealth effect says that a rise in the price level lowers the real purchasing power of people's financial assets, such as savings accounts and bonds. Feeling poorer in real terms, households cut consumption. A lower price level raises real wealth and raises consumption. Therefore the quantity of real GDP demanded moves inversely with the price level.
2. A fall in the price level means people need less money to carry out transactions, so money demand decreases. With a given money supply, the nominal interest rate falls. Lower interest rates reduce the cost of borrowing, so firms invest more in capital and households buy more homes and durable goods. The quantity of real GDP demanded rises.
3. If the domestic price level rises while foreign prices stay the same, domestic goods become more expensive relative to foreign goods. Foreign buyers purchase fewer of our exports and domestic buyers purchase more imports. Net exports ($X - M$) fall, so the quantity of real GDP demanded falls. This is a movement up along AD.
4. AD measures the price level of everything, so there are no substitute goods outside the economy to switch to. The substitution story belongs to a single market. The correct explanation for the slope is the combination of the wealth effect, the interest-rate effect, and the exchange-rate effect.
5. (a) Investment rises, so AD shifts right. (b) Government purchases fall, so AD shifts left. (c) Consumption falls, so AD shifts left. Each is a change in a spending component at a given price level, so it shifts the curve rather than moving along it.
6. No. A Social Security payment is a transfer payment: the government hands over money but receives no newly produced good or service in return, so it is not in G . Higher transfers raise households' disposable income, which can raise consumption, so AD would shift right through C , though by less than an equal rise in G because some of the transfer is saved.
7. Multiplier = $\frac{1}{1-0.75} = 4$. Shift = $4 \times \$20 \text{ billion} = \$80 \text{ billion}$. AD shifts right by \$80 billion at the initial price level.
8. An appreciation makes the domestic currency more valuable, so domestic goods cost more to foreigners and foreign goods cost less to domestic buyers. Exports fall and imports rise, so net exports fall. Because net exports are part of AD, AD shifts left.

SET B · EXAM-STYLE MULTIPLE CHOICE

9. C. Lower prices reduce money demand, which lowers interest rates and raises investment (the interest-rate effect). A is the single-market substitution story and does not apply to the average price of everything. B has the wealth effect backwards, since higher prices lower the real value of savings.
10. A. Greater wealth raises consumption at every price level, a rightward shift. B is only a movement along AD. C would lower net exports, D would lower investment, and E would lower investment, so all three shift AD left.
11. E. A higher domestic price level raises the relative price of domestic goods, so exports fall and imports rise. D is tempting but a depreciation would raise net exports, not lower them. B has the wealth effect reversed, and C is a shifter unrelated to the domestic price level.
12. B. The multiplier is $1/(1-0.9) = 10$, so the shift is $10 \times \$10 \text{ billion} = \$100 \text{ billion}$. C is the common error of multiplying by the MPC (9) instead of using $1/(1-MPC)$, and D ignores the multiplier.
13. D. Teachers' salaries pay for a service (education) that is produced, so they count in G . A, C, and E are transfer payments, and B is a transfer of income to bondholders; none buys newly produced output directly.
14. C. Pessimistic profit expectations reduce investment at every price level. A and E raise investment and consumption, B raises exports, and D raises net exports, so all of those shift AD right.

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SET C · APPLY AND EXTEND

15. Model response. (a) Consumption rises at every price level, so AD shifts right to AD2 (1 point for direction, 1 point for naming the component C). (b) Net exports fall because foreign income falls and foreigners buy fewer exports, so AD shifts left (1 point). (c) The price level rising is not a shift: the economy moves up along the unchanged AD1 to a smaller quantity of real GDP demanded because of the wealth, interest-rate, and exchange-rate effects (1 point for 'movement along', 1 point for naming at least one effect). Scoring: 5 points in total.
16. Model response. (a) Multiplier = $1/(1 - 0.6) = 2.5$ (1 point). (b) Net change in autonomous spending = $30 - 10 = \$20$ billion; shift = $2.5 \times 20 = \$50$ billion (2 points; award 1 for the correct net change). (c) Rightward shift, AD increases (1 point). (d) With an upward-sloping SRAS, the price level rises when AD shifts right, which pulls the economy back along the new AD curve through the wealth, interest-rate, and exchange-rate effects, so the rise in equilibrium real GDP is less than \$50 billion (1 point). Total 5 points.
17. Model response. The claim is wrong (1 point). A rise in the price level causes a movement along AD to a smaller quantity of real GDP demanded, not a shift (1 point). Two explanations: the wealth effect (higher prices reduce the real value of savings, so consumption falls) and the interest-rate effect (higher prices raise money demand and interest rates, reducing investment) or the exchange-rate effect (2 points for two correctly explained). An example of a real leftward shift: a fall in consumer confidence, higher taxes, or a drop in foreign income (1 point). Total 5 points.

3.2 Short-Run Aggregate Supply**SET A · CHECK YOUR UNDERSTANDING**

1. SRAS shows the real GDP firms are willing to supply at each price level in the short run. Along the curve, nominal wages and other input prices are held fixed (they are sticky), as are technology and resource availability, so the only thing that changes is the price level of output.
2. If the price level rises but the nominal wage is fixed by contract, the real wage falls, so labor becomes cheaper in real terms. Firms see higher output prices against unchanged labor cost, so profit per unit rises. They hire more workers and expand production, which gives a positive relationship between the price level and real GDP supplied.
3. Menu costs are the costs of changing prices. Because of them, some firms leave prices unchanged when the economy changes, so the average price level adjusts slowly. When firms that do raise prices face unchanged input costs, they make more profit per unit and produce more, producing the upward-sloping curve.
4. (a) Lower energy costs reduce unit costs, so SRAS shifts right. (b) Higher wage costs raise unit costs, so SRAS shifts left. (c) Productivity doubling cuts unit costs sharply, so SRAS shifts right.
5. Unit labor cost at start = $20/5 = \$4$ per unit. After the wage rise = $22/5 = \$4.40$ per unit, a 10 percent increase. Because per-unit cost rises with no productivity gain, SRAS shifts left.
6. Workers set wages partly based on the inflation they expect. If they expect more inflation, they bargain for higher nominal wage increases to protect their purchasing power. Higher wages raise unit labor costs at every price level, so SRAS shifts left.
7. A movement along SRAS is caused only by a change in the price level, with input prices fixed. A shift is caused by a change in per-unit costs, such as a rise in oil prices (shift left) or a gain in technology (shift right). Mixing the two is the most common error on the exam.
8. A depreciation raises the domestic-currency price of imported inputs such as oil and metals. Firms that use these inputs face higher costs per unit at every price level, so SRAS shifts left.

SET B · EXAM-STYLE MULTIPLE CHOICE

9. A. With sticky nominal wages, a higher price level raises profit per unit and encourages more output. B is a demand-side net export effect, C describes the long run, and D concerns the interest-rate effect on AD.
10. B. Oil is an input for many industries, so unit costs rise at every price level and SRAS decreases. A is the effect of a fall in oil prices. C and D confuse supply and demand and shifts and movements. E ignores the economy-wide importance of energy.
11. D. Higher productivity lowers unit costs, shifting SRAS right. A moves along SRAS, B and E shift AD, and C raises unit costs, shifting SRAS left.
12. B. A fixed nominal wage divided by a higher price level gives a lower real wage, so firms hire more and produce more. A reverses the real wage change, D reverses the profit change, and E mistakes a movement for a shift.
13. D. Unit labor cost is wage divided by productivity, so equal percentage increases leave it about unchanged. A ignores productivity. C adds the percentages instead of dividing. E is wrong because unit cost does not depend on the output price level.
14. B. The short run is defined by sticky input prices, not by a calendar length (A). C mixes macro with the micro short run, D describes the long run, and E is incorrect because the price level does move in the short run.

SET C · APPLY AND EXTEND

15. Model response. Label axes 'Price level' and 'Real GDP' and draw SRAS1 sloping upward, then SRAS2 to the left of SRAS1 (2 points). The determinant is input prices (nominal wages) rising without a productivity gain (1 point). Unit labor cost rises at every price level, so the quantity supplied at each price level falls, shifting SRAS left (2 points). Total 5 points.
16. Model response. With an unexpected price rise and a fixed nominal wage, the real wage falls, labor is cheaper, and profits per unit rise, so the firm expands output (2 points). If the rise was anticipated and new contracts raise wages in proportion, the real wage and unit costs do not fall, so there is no extra incentive to produce more and SRAS shifts left or stays stable depending on wage growth (2 points). Conclusion: the output response depends on wages being sticky relative to prices (1 point). Total 5 points.
17. Model response. (a) Economy X: unit labor cost rises about $4 - 1 = 3$ percent. Economy Y: about $4 - 6 = -2$ percent, a fall of about 2 percent (2 points). (b) X: SRAS shifts left. Y: SRAS shifts right (2 points). (c) Economy Y, because costs per unit fall, so firms can supply output at lower prices and there is less cost pressure on the price level (1 point). Total 5 points.

3.3 Long-Run Aggregate Supply and Equilibrium

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SET A · CHECK YOUR UNDERSTANDING

1. LRAS is vertical at potential output. In the long run all input prices, including wages, adjust fully to the price level, so a change in the price level does not change profit per unit or the quantity firms want to supply. Output depends only on real resources, technology, and institutions.
2. Any three of: growth in the labor force, an increase in the capital stock through investment, improved technology, better education and job training, discovery of natural resources, or stronger institutions such as property rights. Each raises the economy's productive capacity at full employment.
3. A recessionary gap exists when short-run equilibrium real GDP is less than potential output. Unemployment is above the natural rate because there is cyclical unemployment. On the graph, the intersection of AD and SRAS lies to the left of the LRAS line.
4. An inflationary gap exists when short-run equilibrium real GDP exceeds potential output. Unemployment is below the natural rate (negative cyclical unemployment). The AD-SRAS intersection lies to the right of LRAS, and the economy is overheating.
5. The gap is $1,200 - 1,140 = \$60$ billion. As a percent of potential output, $\frac{1,140 - 1,200}{1,200} = -5\%$, so the output gap is -5 percent. Since actual output is below potential, it is a recessionary gap.
6. Tight labor markets push nominal wages and input prices up, raising unit costs. SRAS shifts left, raising the price level and lowering real GDP along AD until output returns to potential output at Y_f .
7. Nominal wages and prices are sticky downward: workers and firms resist cuts, contracts last for long periods, and morale concerns discourage pay cuts. When there is slack, wages decline only slowly, so SRAS shifts right slowly. In an inflationary gap, wages rise more readily, so the adjustment is quicker.
8. Short-run equilibrium is the intersection of AD and SRAS and can occur at any level of output, above or below potential. Long-run macroeconomic equilibrium requires AD, SRAS, and LRAS to intersect at the same point, so that output equals potential and cyclical unemployment is zero.

SET B · EXAM-STYLE MULTIPLE CHOICE

9. B. When wages and other input prices adjust fully, the price level does not influence real output, which then depends on real resources and technology. A is incorrect because firms can change production; the change just does not depend on the price level. C, D, and E do not describe the mechanism.
10. C. In a recessionary gap output is below potential and cyclical unemployment is positive, so total unemployment exceeds the natural rate. A and B describe an inflationary gap, D is the self-correction of an inflationary gap, and E is the usual pattern of an inflationary gap.
11. E. Technology raises productive capacity and potential output. A and B are demand-side changes, C shifts SRAS temporarily, and D is only a movement along the curves.
12. D. Tight markets raise nominal wages, so unit costs rise and SRAS shifts left until output returns to potential, with a higher price level. B is the self-correction of a recessionary gap. A is the usual mistake of making AD do the adjusting, but in the model it is SRAS that moves.
13. A. Actual output exceeds potential by $856 - 800 = \$56$ billion, so the gap is inflationary (7 percent of potential output). B and D have the wrong type. C confuses the size of the gap with the level of output.
14. C. At long-run equilibrium AD, SRAS, and LRAS intersect, so output equals potential and only frictional and structural unemployment remain. A is wrong because the natural rate is positive. B confuses equilibrium with no growth.

SET C · APPLY AND EXTEND

15. Model response. (a) Recessionary gap: equilibrium real GDP Y_1 is below potential Y_f (1 point for each). (b) Unemployment is above the natural rate because cyclical unemployment is positive (1 point). (c) Slack in the labor market pushes nominal wages down or restrains their growth, lowering unit costs and shifting SRAS right (1 point). (d) The price level falls and real GDP rises along AD until it reaches Y_f (1 point). Total 5 points.
16. Model response. (a) A graph with AD₁, SRAS₁, and LRAS meeting at E₁ at Y_f , and AD₂ to the left meeting SRAS₁ at E₂ with output below Y_f and a lower price level (2 points). (b) A recessionary gap equal to Y_f minus Y_2 (1 point). (c) Slack labor markets push nominal wages down, SRAS shifts right, and the economy settles where AD₂ meets LRAS, with real GDP back at Y_f and a price level lower than the original (1 point for the SRAS shift, 1 point for the lower final price level). (d) Wages and prices are sticky downward because of contracts, menu costs, and morale concerns, so the shift is slow (1 point, accept any one reason). Total 6 points.
17. Model response. (a) A: inflationary gap of 80, which is $80/2,000 = 4$ percent of potential. B: recessionary gap of 120, which is $120/2,000 = 6$ percent (2 points). (b) A: unemployment below the natural rate. B: unemployment above the natural rate (1 point). (c) A: tight labor markets push nominal wages up, raising costs and shifting SRAS left. B: slack labor markets push wages down or hold them back, shifting SRAS right (2 points). Total 5 points.

3.4 Shocks and Changes in the AD-AS Model**SET A · CHECK YOUR UNDERSTANDING**

1. Demand-pull inflation is an increase in the price level caused by an increase in aggregate demand. AD shifts to the right, so the economy moves up along SRAS to a higher price level and greater real GDP. The phrase refers to too much spending 'pulling' prices upward.
2. Stagflation is a combination of a rising price level and falling real GDP (with rising unemployment). Cost-push inflation is the price rise caused by increases in production costs. Both result from a negative supply shock that shifts SRAS to the left.
3. SRAS shifts right. The price level falls, real GDP rises, and unemployment falls. The economy gets lower inflation and higher output at the same time.
4. Higher interest rates reduce investment, so AD shifts left. The price level falls, real GDP falls below potential, and unemployment rises above the natural rate, a recessionary gap.

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- At the inflationary gap, labor and input markets are tight, so nominal wages and other input prices rise. SRAS shifts left, raising the price level further and reducing real GDP until it returns to potential output. In the long run real GDP is unchanged from its original level, and the only permanent effect is a higher price level.
- After a negative demand shock, price level and output both fall, and expansionary policy that shifts AD right would raise both back to the starting point. After a negative supply shock, the price level rises and output falls, so a policy that fixes one problem worsens the other: expanding AD raises prices more, and contracting AD deepens the recession.
- Positive: a fall in oil prices, a major technology gain, or a bumper harvest (any two). Negative: a hurricane that destroys refineries, a sharp increase in raw material prices, or a new costly regulation (any one). Each changes unit production costs across the economy.
- Real GDP definitely rises because both shifts increase output. The price level is ambiguous: the AD shift pushes the price level up, while the SRAS shift pushes it down. The result depends on which shift is larger.

SET B · EXAM-STYLE MULTIPLE CHOICE

- More government spending shifts AD right, which moves the economy up along SRAS: both price and output rise. B is stagflation, which comes from an SRAS shift. C comes from an SRAS increase.
- Higher oil prices raise costs and shift SRAS left, raising prices while lowering output. A, C, and E shift AD right and raise output, and D shifts SRAS right.
- SRAS shifts right, lowering the price level and raising real GDP, which lowers unemployment. C mixes a demand-side result with the supply shift; E has unemployment the wrong way.
- A. Cyclical unemployment pushes wages down, so SRAS shifts right until output returns to potential output at a lower price level. B describes the inflationary gap, C confuses a demand shock with a change in capacity, and E ignores wage flexibility.
- C. Rising prices with falling output and rising unemployment is stagflation, which is a leftward shift of SRAS. A would raise output, B would lower the price level, D would lower the price level, and E would raise output.
- E. Because a negative supply shock raises prices and lowers output at the same time, a contractionary policy to cut prices lowers output further. A is incorrect, B is incorrect since supply shocks shift SRAS in the short run, and D ignores the fall in output.

SET C · APPLY AND EXTEND

- Model response. (a) AD, SRAS₁, and LRAS intersect at E₁ at Y_f; SRAS shifts left to SRAS₂, with the new equilibrium E₂ at a higher price level and lower real GDP (2 points). (b) The price level rises, real GDP falls below Y_f, and unemployment rises (1 point). (c) Stagflation, with cost-push inflation (1 point). (d) With high unemployment, nominal wages fall, shifting SRAS back to the right until the price level returns to its original level and output to Y_f (1 point). Total 5 points.
- Model response. (a) AD shifts right from AD₁ to AD₂ with the economy moving along SRAS to a higher price level and higher real GDP (2 points). (b) Inflationary gap: real GDP above Y_f; unemployment below the natural rate (1 point). (c) Wages rise, SRAS shifts left, the price level rises further and real GDP returns to Y_f; the final price level is higher than at the start and real GDP equals the original potential output (2 points). Total 5 points.
- Model response. The claim is false (1 point). Scenario 1: AD increases, which raises the price level and real GDP and lowers unemployment (demand-pull) (1 point). Scenario 2: SRAS decreases, which raises the price level but lowers real GDP and raises unemployment (cost-push, stagflation) (1 point). Therefore rising prices alone do not identify the cause; one must look at the direction of real GDP and unemployment (1 point). Total 4 points; award a fifth point for correct graph labeling of either scenario.

3.5 Consumption, Saving, and the Multiplier

SET A · CHECK YOUR UNDERSTANDING

- MPC is the fraction of an additional dollar of disposable income that is spent on consumption, and MPS is the fraction that is saved. With $MPC = 0.85$, $MPS = 1 - 0.85 = 0.15$, which means households save 15 cents of every extra dollar of disposable income.
- The change in consumption is $30,200 - 27,000 = 3,200$ and the change in disposable income is 4,000. $MPC = 3,200/4,000 = 0.8$, so $MPS = 1 - 0.8 = 0.2$.
- Autonomous consumption is 200, which is spent even if Y_d is zero. Induced consumption is 0.6 Y_d, the part that varies with income. For every extra dollar of Y_d, induced consumption rises by 60 cents.
- At break-even, $C = Y_d$: $200 + 0.6Y_d = Y_d$, so $Y_d = 200/0.4 = \$500$. At $Y_d = \$1,000$, $C = 800$ and $APC = 0.8$.
- Multiplier $= 1/(1 - 0.9) = 10$. The change in GDP is $10 \times \$25 \text{ billion} = \$250 \text{ billion}$.
- Tax multiplier $= -0.8/0.2 = -4$. A \$10 billion tax increase changes GDP by $-4 \times 10 = -\$40 \text{ billion}$.
- A dollar of government spending enters the spending stream immediately. A dollar of tax change first changes disposable income, and households save part of it (the MPS), so only the MPC share is spent in the first round. The initial push is smaller, so the final change is smaller by the factor MPC.
- Higher wealth increases autonomous consumption, shifting the consumption function upward. Since saving is the residual of income and consumption, the saving function shifts downward by the same amount. The slopes (MPC and MPS) do not change in this case.

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SET B · EXAM-STYLE MULTIPLE CHOICE

9. D. Multiplier = $1/(1 - 0.8) = 5$. A uses the MPC itself, B is the reciprocal of the MPC, and C is the tax multiplier magnitude $0.8/0.2$.
10. C. $MPS = 100/500 = 0.2$, so $MPC = 1 - 0.2 = 0.8$. A is the MPS, not the MPC, and D is the complement of the wrong ratio.
11. B. The spending increase adds $4 \times 20 = 80$ and the tax increase subtracts $3 \times 20 = 60$, for a net of \$20 billion (balanced-budget multiplier of 1). C is the tax effect alone, D is the spending effect alone.
12. A. Autonomous consumption is the intercept, 100. B ignores autonomous consumption, and D confuses it with the induced part at $Y_d = 100$.
13. B. Less wealth lowers autonomous consumption, so the consumption function shifts down and the saving function shifts up. A has the directions reversed, and C describes a change in income, not wealth.
14. E. Tax multiplier = $-MPC/MPS$, smaller in absolute value by one than the spending multiplier $1/MPS$. A tax increase reduces GDP so the sign is negative. B would imply the balanced-budget multiplier is zero, which it is not.

SET C · APPLY AND EXTEND

15. Model response. (a) Multiplier = $1/(1 - 0.6) = 2.5$ (1 point). (b) Required change in $G = 150/2.5 = \$60$ billion (1 point). (c) Tax multiplier = $-0.6/0.4 = -1.5$, so a tax cut of $150/1.5 = \$100$ billion is required (2 points). (d) The tax cut must be larger (\$100 billion versus \$60 billion) because part of a tax cut is saved, so its multiplier is smaller (1 point). Total 5 points.
16. Model response. (a) $MPC = (250 - 100)/200 = 0.75$; $MPS = 0.25$ (2 points). (b) $C = 100 + 0.75Y_d$ (1 point). (c) $100 + 0.75Y_d = Y_d$, so $Y_d = \$400$ (1 point). (d) Consumption would be \$50 higher at each income level, an upward shift of the function with the same slope (1 point). Total 5 points.
17. Model response. The statement is false (1 point). With $MPC = 0.5$, spending multiplier = $1/0.5 = 2$, so G adds $2 \times 100 = \$200$ billion (1 point). Tax multiplier = $-0.5/0.5 = -1$, so the tax increase subtracts \$100 billion (1 point). Net change = $+\$100$ billion, equal to the amount of the change, the balanced-budget multiplier of 1 (1 point). GDP rises, so the statement is incorrect (1 point). Total 5 points.

3.6 Fiscal Policy**SET A · CHECK YOUR UNDERSTANDING**

1. Fiscal policy is the use of government spending and taxation to influence aggregate demand, output, employment, and inflation. The tools are government purchases of goods and services, taxes, and transfer payments.
2. Discretionary policy involves deliberate new laws, such as an infrastructure bill. Automatic stabilizers work without new action, such as unemployment insurance payments that rise when layoffs increase. The key difference is whether Congress must act.
3. In a progressive tax, the average tax rate rises with income. When income falls in a recession, households pay a smaller share in taxes, so tax revenue falls faster than income and disposable income falls less. In a boom, the share paid rises, which restrains spending. This dampens swings in AD without new legislation.
4. The government should increase G , cut taxes, or raise transfers. These shift AD right, moving the economy up along SRAS: real GDP rises toward potential output, the price level rises modestly, and unemployment falls toward the natural rate.
5. A deficit is a flow: the amount by which spending exceeds revenue in one year. The national debt is a stock: the total accumulated borrowing from all past deficits net of surpluses. Running a deficit increases the debt by that amount.
6. In a recession, income and tax revenue fall, and transfer payments such as unemployment benefits rise. With revenue lower and spending higher, the deficit increases automatically. This is the cyclical part of the deficit and it supports total spending.
7. Any two of: recognition lag (time to see the economy has changed), decision lag (Congress takes time to pass a bill), implementation lag (time to set up spending), impact lag (time for the policy to change spending and output). Lags can make policy take effect after the problem is gone, causing instability.
8. When the government borrows to finance a deficit, it increases the demand for loanable funds and raises the interest rate. The higher rate discourages private investment, which offsets part of the increase in G . Crowding out reduces the net effect of expansionary fiscal policy on AD.

SET B · EXAM-STYLE MULTIPLE CHOICE

9. C. Unemployment insurance payments rise automatically as unemployment rises, with no new law. A, B, and D are discretionary fiscal policies and E is monetary policy.
10. D. Contractionary policy shifts AD left to close an inflationary gap. A, B, C, and E all raise AD or the deficit, worsening the overheating.
11. E. In a recession, tax revenue falls and transfers rise automatically. A and C raise revenue and cut transfers, B tends to raise income and revenue, and D raises revenue.
12. A. The debt is the accumulated stock of borrowing. B describes the deficit (a flow), C is net exports, and E is only a part of the debt.
13. B. Crowding out occurs when deficit borrowing raises interest rates, lowering investment. A and E describe conditions in which crowding out is small, and C describes a failure of the tax multiplier, not crowding out.
14. E. Recognition, decision, implementation, and impact lags mean the policy may arrive late. A, B, and C are false, and D is incorrect because taxes can be changed by law.

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SET C · APPLY AND EXTEND

15. Model response. (a) AD1 intersects SRAS to the left of LRAS (1 point). (b) Increase government purchases or cut taxes, and shift AD right to AD2, intersecting at LRAS (2 points). (c) The deficit increases because G rises or taxes fall (1 point). (d) Possible reasons: crowding out, time lags, uncertainty about the multiplier, or households saving a tax cut (1 point). Total 5 points.
16. Model response. (a) Government purchases have the larger first-round effect because every dollar is spent, whereas households save part of a tax cut, so only MPC times the cut is spent in round one (2 points). (b) The government spending multiplier $1/(1 - MPC)$ is larger than the tax multiplier in absolute value $MPC/(1 - MPC)$ (1 point). (c) As real GDP rises, tax revenue rises and transfers fall automatically, so the deficit shrinks (2 points). Total 5 points.
17. Model response. The claim is flawed (1 point). In a recession, revenue falls and transfers rise, so the deficit rises automatically; forcing a balanced budget would require raising taxes or cutting spending, which would shift AD left and deepen the recession (2 points). In a boom, revenue rises and surpluses emerge; forcing balance would require tax cuts or spending, which would add to inflation (1 point). The rule therefore makes policy procyclical and removes automatic stabilizers (1 point). Total 5 points.

3.7 Fiscal Policy Calculations and Policy Evaluation**SET A · CHECK YOUR UNDERSTANDING**

1. Multiplier = $1/(1 - 0.75) = 4$. Required increase in $G = 120/4 = \$30$ billion.
2. Tax multiplier = $-0.75/0.25 = -3$. Required tax cut = $120/3 = \$40$ billion.
3. Multiplier = $1/(1 - 0.6) = 2.5$. Required cut in $G = 60/2.5 = \$24$ billion, which shifts AD left by \$60 billion.
4. Part of a tax cut is saved (the MPS) rather than spent, so the initial effect on spending is only MPC times the tax cut. The tax multiplier is therefore one less than the spending multiplier in absolute value. A larger tax change is needed to generate the same shift in AD.
5. Net change in autonomous spending = $30 - 6 = 24$. Multiplier = $1/(1 - 0.8) = 5$. Net change in AD = $5 \times 24 = \$120$ billion, compared with \$150 billion without crowding out.
6. Spending effect = $10 \times 25 = +250$. Tax effect = $-9 \times 25 = -225$. Net = $+\$25$ billion, the size of the balanced change (balanced-budget multiplier of 1).
7. Possible criteria: speed (a rebate can be sent quickly, so short lags), size (households save part of a rebate, so the effect is smaller than the same amount of G), targeting (broad, not aimed at the unemployed), and effect on the deficit (it raises it). Any two with correct application.
8. The multiplier gives the horizontal shift of AD at a fixed price level. With an upward-sloping SRAS, a rightward AD shift raises the price level, which reduces the quantity of real GDP demanded along the new AD, so the actual rise in real GDP is smaller than the shift. To close the gap, AD must therefore be shifted more than the gap itself.

SET B · EXAM-STYLE MULTIPLE CHOICE

9. A. Gap = 100; multiplier = 5; change in $G = 100/5 = \$20$ billion, an increase because the gap is recessionary. B has the wrong sign, D ignores the multiplier, and E multiplies instead of divides.
10. D. The tax multiplier magnitude is $0.75/0.25 = 3$, so the cut is $90/3 = \$30$ billion. A uses the spending multiplier ($90/4 = 22.5$), and B multiplies by the MPC.
11. E. Spending multiplier = 2, so G must fall by $40/2 = \$20$ billion. C would reduce AD by only $1 \times 20 = \$20$ billion. A overshoots, and B and D are expansionary.
12. B. Crowding out and a rising price level both reduce the gain in output. A would increase the multiplier, D is expansionary, and E would raise net exports and increase GDP.
13. C. G needs to change by $60/5 = 12$, whereas the tax cut needed is $60/4 = 15$, so the G change is smaller and the deficit rises by less. A and D have the wrong size, and E ignores the budget.
14. A. Near full employment, extra AD mostly raises prices, and deficit borrowing raises interest rates and crowds out investment. B, C, and D contradict the effects of expansionary policy.

SET C · APPLY AND EXTEND

15. Model response. (a) Recessionary gap of $6,000 - 5,700 = \$300$ billion (1 point). (b) Multiplier = 5; $300/5 = \$60$ billion increase in G (2 points: 1 for multiplier, 1 for result). (c) Tax multiplier magnitude = 4; $300/4 = \$75$ billion tax cut (1 point). (d) A fall in investment of 15 billion times 5 is 75 billion less AD, so the remaining gap is \$75 billion (1 point). Total 5 points.
16. Model response. (a) Multiplier = $1/(1 - 0.75) = 4$; $4 \times 60 = \$240$ billion (1 point). (b) Remaining gap = $400 - 240 = \$160$ billion; tax multiplier magnitude = 3; tax cut = $160/3 \approx \$53.3$ billion (2 points). (c) The deficit increases by about $60 + 53.3 = \$113.3$ billion before any extra revenue from higher income, because G rises and taxes fall (2 points). Total 5 points.
17. Model response. Benefits: raises disposable income and consumption, shifting AD right and reducing unemployment (1 point); can be enacted quickly through rebates and provides broad stimulus (1 point). Costs/limits: part of the cut is saved so the multiplier is smaller than for spending (1 point); borrowing may crowd out investment and increase the debt, and households that expect future tax increases may save more (1 point); lags may delay the effect until the recession is over and then cause inflation (1 point). A graph or clear reference to AD shifting right is needed for full credit. Total 5 points, accept any two benefits and two costs.

3.8 Multiple-Choice Practice: National Income and Price Determination

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SET A · CORE CONCEPTS

1. C. Lower prices raise the purchasing power of savings, so consumption rises. The choice about substitution describes a single market, not the economy-wide price level. The choice about domestic goods becoming more expensive describes a rising price level, the opposite case.
2. A. Cheaper raw materials lower unit costs at every price level. A rise in the price level is a movement along SRAS, higher wages without productivity raise costs and shift SRAS left, and the last two are demand-side shifters.
3. E. Full price and wage flexibility means the price level does not change real output. Firms can change production, but the change is not caused by the price level. The central bank does not set output, and AD equaling AS is true in any equilibrium, not a reason for verticality.
4. B. Output below potential means cyclical unemployment is positive, so total unemployment exceeds the natural rate. The choices about real GDP above potential and negative cyclical unemployment describe an inflationary gap. Wages tend to fall slowly, so SRAS shifts right, not left.
5. D. A cost shock shifts SRAS left, raising the price level while lowering real GDP. The other choices raise AD (output and prices both rise) or are movements along a curve.
6. B. The multiplier is $1/(1 - 0.75) = 4$, so the AD shift is $4 \times 20 = \$80$ billion. The \$60 billion figure uses the tax multiplier (3), and the \$15 billion figure multiplies by the MPC only.
7. A. Automatic stabilizers work without new legislation. The bridge law, tax-rate cut, and rebate are discretionary fiscal policies, and an interest-rate decision is monetary policy.

SET B · APPLICATIONS AND DATA

8. B. Consumption rises 80 for each 100 of added disposable income, so $MPC = 0.8$ and $MPS = 1 - 0.8 = 0.2$. The value 0.8 is the MPC, and the other choices do not fit the data.
9. D. The intersection lies left of LRAS, so a recessionary gap exists: output is below potential, cyclical unemployment is positive, and wages tend to fall. The choice that SRAS shifts left describes the inflationary-gap adjustment.
10. A. A rising price level with falling output and rising unemployment is stagflation, produced by SRAS shifting left. A fall in AD would lower the price level, and an increase in AD would raise output.
11. E. The gap is 80 and the multiplier is 4, so the increase in G is $80/4 = \$20$ billion. The figure 26.7 is the required tax cut ($80/3$), and \$320 billion multiplies instead of dividing.
12. A. The deficit rose from \$100 billion to \$400 billion because revenue fell and spending rose, as automatic stabilizers do in a downturn. A tax increase would raise revenue, and the debt rises when deficits occur.
13. D. SRAS shifting right means lower per-unit costs, which productivity gains provide. The oil price rise, wage increase, and costlier imported inputs shift SRAS left, and government spending shifts AD.
14. B. Net autonomous change = $40 - 8 = 32$, and the multiplier is 4, so AD rises 128. The \$160 billion answer ignores crowding out, and \$152 billion subtracts the crowding out after applying the multiplier only once.

SET C · EXAM-LEVEL STRETCH

15. E. Both shifts push the price level up. AD raises output while the SRAS decrease lowers it, so the net effect on real GDP depends on the sizes of the shifts.
16. B. Net autonomous change = 6 and the multiplier is 10, so AD rises 60. The \$100 billion ignores crowding out; the \$54 billion applies the MPC to the net change.
17. A. The spending multiplier is 5 ($120/5 = 24$) and the tax multiplier magnitude is 4 ($120/4 = 30$). Since a tax cut is partly saved, a larger change is required. The choice that reverses the two amounts is wrong.
18. D. Raising G shifts AD right, raising output and cutting unemployment but also increasing the price level further. The tax increase and spending cut would deepen the recession, and waiting avoids new inflation but takes time.
19. C. Unit labor cost changes by approximately wage growth minus productivity growth: $8 - 5 = 3$ percent, a cost increase, which shifts SRAS left. Adding the percentages (13) is a common error.
20. E. Recognition, decision, implementation, and impact lags can delay a stimulus until it adds to inflationary pressure instead of fighting a recession. Automatic stabilizers work without delay.

3.9 Free-Response Practice: National Income and Price Determination**QUESTION 1 · AD-AS GRAPH: FALLING CONSUMER CONFIDENCE**

1. 1 point: Axes labeled price level (vertical) and real GDP (horizontal). 1 point: downward-sloping AD, upward-sloping SRAS, and a vertical LRAS at Y_f , all three intersecting at the initial equilibrium with PL_1 and $Y_1 = Y_f$ marked.
2. 1 point: AD_1 shifts left to AD_2 (labeled). 1 point: the new equilibrium is at the intersection of AD_2 and SRAS, with PL_2 below PL_1 and Y_2 below Y_1 (to the left of LRAS), correctly marked on the axes.
3. 1 point: the price level falls. 1 point: real GDP falls (below potential output). 1 point: the unemployment rate rises above the natural rate (cyclical unemployment appears).
4. 1 point: increase government purchases, cut taxes, or increase transfer payments (any one is acceptable). 1 point: explanation that this raises spending directly (G) or raises disposable income and therefore consumption, shifting AD to the right.
5. 1 point: spending multiplier = $1/(1 - 0.75) = 4$. 1 point: required change in G = $60/4 = \$15$ billion (an increase). A correct answer with no work shown earns 1 point only.
6. 1 point: the high unemployment and excess capacity put downward pressure on nominal wages and other input prices. 1 point: lower input costs shift SRAS to the right, lowering the price level further and raising real GDP until it returns to potential output at Y_f .

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QUESTION 2 · MULTIPLIERS AND CLOSING A GAP

7. 1 point: recessionary gap. 1 point: size = $8,000 - 7,700 = \$300$ billion.
9. 1 point: change in $G = 300/5 = \$60$ billion increase (accept the work shown).
11. 1 point: the government purchases option (\$60 billion) changes the budget by less than the tax cut (\$75 billion). 1 point: explanation that part of a tax cut is saved, so the tax multiplier is smaller and a larger change is required.
8. 1 point: multiplier = $1/(1 - 0.8) = 1/0.2 = 5$.
10. 1 point: tax multiplier = $-0.8/0.2 = -4$ (accept magnitude 4). 1 point: tax cut = $300/4 = \$75$ billion.
12. 1 point: crowding out reduces AD by $5 \times 10 = \$50$ billion. 1 point: remaining gap = \$50 billion (the policy closes \$250 billion of the \$300 billion gap).

QUESTION 3 · SUPPLY SHOCK AND POLICY DILEMMA

13. 1 point: axes labeled price level and real GDP, with AD, SRAS, and vertical LRAS (potential output) drawn, intersecting at the initial equilibrium.
14. 1 point: SRAS shifts left (labeled SRAS2). 1 point: new equilibrium shows a higher price level and lower real GDP, to the left of LRAS.
15. 1 point: oil is an input used in many industries, so the cost of production per unit increases at every price level, reducing the quantity supplied at each price level.
16. 1 point: stagflation (cost-push inflation is also acceptable if it is clearly tied to rising prices with falling output).
17. 1 point: expansionary policy (shifting AD right) would reduce unemployment and raise real GDP but increase the price level further. 1 point: contractionary policy would reduce inflation but lower real GDP and raise unemployment further, so both goals cannot be met by shifting AD.
18. 1 point: high unemployment reduces nominal wages and input prices. 1 point: SRAS shifts back to the right, returning real GDP to potential output and the price level to its original level (assuming the oil price returns to normal).

QUESTION 4 · INFLATIONARY GAP AND FISCAL POLICY

19. 1 point: inflationary gap (real GDP is above potential output). 1 point: unemployment of 3.5 percent is below the natural rate of 5 percent, which happens when output exceeds potential and cyclical unemployment is negative.
20. 1 point: gap = \$90 billion and multiplier = $1/(1 - 0.9) = 10$. 1 point: required change = $90/10 = \$9$ billion decrease in government purchases.
21. 1 point: tax multiplier = $-0.9/0.1 = -9$. 1 point: required change = $90/9 = \$10$ billion increase in taxes.
22. 1 point: graph with AD1 shifting left to AD2 and the new equilibrium on LRAS (with correct labels). 1 point: price level falls (or inflation pressure falls) and real GDP falls back to potential output.
23. 1 point: the budget balance improves because spending falls (deficit decreases or surplus increases), since lower G reduces outlays and no offsetting tax change is assumed.
24. 1 point: in a recession, tax revenue falls and transfer payments such as unemployment benefits rise automatically, so the deficit increases (or surplus decreases), cushioning the fall in AD. 1 point: any one lag: recognition, decision, implementation, or impact, with a correct description.

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Chapter 4: The Financial Sector.

9 sections with explanations and worked examples, then 134 practice problems. Answers and full explanations are at the end of the chapter.

4.1 Money, Its Functions, and Measures

Learn what makes something money, how commodity and fiat money differ, and how economists measure the money supply with M1 and M2.

Money is any asset that is generally accepted as payment for goods and services and for settling debts. Without it, people must **barter**, trading goods directly for goods. Barter requires a **double coincidence of wants**: you must find someone who has what you want and also wants what you have. Money removes that search cost, which lets people specialize in what they do best and trade with strangers.

The three functions of money

Medium of exchange: money is accepted in payment, so trade does not require a double coincidence of wants.

Unit of account: money is the common measure in which prices, wages, and debts are stated.

Store of value: money keeps purchasing power from today until a later date (imperfectly, because inflation erodes it).

A memory aid is **MUS**: Medium, Unit, Store. When a question asks which function is at work, ask what the person is doing. Paying for lunch is a medium of exchange. Comparing the price of two cars in dollars is a unit of account. Saving a paycheck for next month is a store of value. Many assets store value (a house, a painting), but only money does it while also being immediately spendable. The medium-of-exchange function is the one that defines money.

Characteristics of good money. Money works best when it is acceptable (widely taken in trade), divisible (can make change), portable, durable, uniform (one unit is identical to another), and limited in supply (so it holds value). Cattle fail on divisibility and portability. Perishable food fails on durability.

Commodity money versus fiat money. **Commodity money** has value in itself apart from its use as money, such as gold coins, silver, or cigarettes in a prison camp. **Representative money** is a paper claim redeemable for a commodity. **Fiat money** has no intrinsic value and is not backed by a commodity. It is money because the government declares it **legal tender** and because people trust that others will accept it. U.S. dollars are fiat money. The value of fiat money depends on keeping its supply limited, because printing too much lowers its purchasing power.

Type	Backed by	Example	Main risk
Commodity money	Intrinsic value of the good	Gold coin, silver	Supply depends on mining and discoveries
Representative money	Promise of redemption in a commodity	Old gold certificates	Run on the commodity if too many claims
Fiat money	Government decree and public trust	Federal Reserve notes, bank deposits	Overissue causes inflation

Liquidity is the ease with which an asset can be converted into spendable money without losing value. Cash is perfectly liquid. A checking balance is almost as liquid. A savings account takes a transfer, a certificate of deposit may carry a penalty for early withdrawal, and a house takes months to sell and costs a commission. The less liquid an asset, the less moneylike it is.

Measuring the money supply. Economists count the most liquid assets as the money supply. **M1** is the narrowest measure and includes currency in circulation (coins and paper money held by the public, not cash in bank vaults), demand deposits (checking accounts), and other checkable deposits. **M2** includes everything in M1 plus less liquid near-moneys: savings deposits, small time deposits (CDs under \$100,000), and retail money market mutual funds. Credit cards are not money. Using a card is a loan from the card issuer that you repay later with money.

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M1 and M2

M1 = currency held by the public + demand deposits + other checkable deposits.

M2 = M1 + savings deposits + small time deposits + retail money market funds.

M2 is always larger than M1, because M1 is contained inside M2. Stocks, bonds, houses, and credit lines are not counted.

EXAMPLE 1: CLASSIFYING ASSETS

Maya does four things in one day: (i) she deposits \$200 in cash into her checking account, (ii) she moves \$500 from checking into a savings account, (iii) she uses a credit card to buy a \$60 jacket, and (iv) she buys \$300 of stock with her checking balance. For each, state what happens to M1 and M2.

SOLUTION

(i) Currency held by the public falls \$200 and checking deposits rise \$200. M1 and M2 do not change.

(ii) Checking falls \$500 (M1 falls \$500) and savings rises \$500 (M2 includes both, so M2 is unchanged).

(iii) A credit card purchase creates a debt, not money. M1 and M2 do not change at purchase.

(iv) Checking falls \$300, so M1 and M2 each fall \$300, because stock is not part of either measure. Ownership of the money passes to the seller.

EXAMPLE 2: COMPUTING M1 AND M2

An economy has these amounts (in billions of dollars): currency in circulation 100; checking deposits 250; other checkable deposits 15; savings deposits 600; small time deposits 120; retail money market funds 160; credit card limits 500; stock market holdings 900. Find M1 and M2.

SOLUTION

$M1 = 100 + 250 + 15 = 365$ billion.

$M2 = M1 + 600 + 120 + 160 = 365 + 880 = 1,245$ billion.

Credit card limits and stock holdings are ignored because they are not money.

EXAMPLE 3: WHICH FUNCTION?

In Zimbabwe in 2008, prices rose so fast that shopkeepers began quoting prices in U.S. dollars and many workers asked to be paid in dollars or goods. Which functions of the Zimbabwean currency were failing?

SOLUTION

Unit of account failed: prices were quoted in a different currency.

Store of value failed: hyperinflation destroyed purchasing power within days.

Medium of exchange was also weakening, since sellers refused the local money. This shows fiat money depends on public trust and a limited supply.

Common mistakes

Do not count credit cards, checks, or the stock of cash in bank vaults as money. A check is an instruction to move deposit money, not money itself. Also remember that moving funds between accounts inside M2 changes M1 but not M2, a favorite exam trap.

Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. A farmer wants shoes, and the cobbler wants a haircut, not wheat. Which problem of barter is this, and how does money solve it?
2. A store lists a laptop at \$900 and a phone at \$600. Which function of money lets a shopper say the laptop costs 1.5 times as much as the phone?
3. Explain why a gold coin is commodity money but a U.S. dollar bill is fiat money.
4. Are credit cards part of M1 or M2? Explain.

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5. Currency in circulation is \$80 billion, checking deposits \$220 billion, savings deposits \$500 billion, small time deposits \$90 billion, and retail money market funds \$110 billion (no other checkable deposits). Calculate M1 and M2.
6. Rank these from most liquid to least liquid: a house, a checking account balance, a savings account balance, a ten-dollar bill. Why does liquidity matter for what counts as money?

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

7. Which of the following is an example of money functioning as a unit of account?
(A) A worker saves a paycheck to buy a car next year
(B) A customer pays for a haircut with cash
(C) A grocery store posts its prices in dollars
(D) A bank holds reserves at the Federal Reserve
(E) A family buys gold as protection from inflation
8. Which of the following is included in M2 but not in M1?
(A) Savings deposits
(B) Currency in circulation
(C) Checking account deposits
(D) Other checkable deposits
(E) Cash in a bank's vault
9. A consumer withdraws \$1,000 from a savings account and deposits it in a checking account. What happens to M1 and M2?
(A) M1 and M2 both rise \$1,000
(B) M1 is unchanged and M2 rises \$1,000
(C) M1 falls \$1,000 and M2 is unchanged
(D) M1 rises \$1,000 and M2 is unchanged
(E) M1 and M2 are both unchanged
10. Fiat money differs from commodity money because fiat money
(A) is backed by a fixed quantity of gold
(B) has no intrinsic value and is accepted because of government decree and public trust
(C) can only be used for government transactions
(D) has value because the paper it is printed on is scarce
(E) always holds its value over time
11. Which asset is the LEAST liquid?
(A) A savings account
(B) A certificate of deposit with an early withdrawal penalty
(C) A checking account
(D) Dollar bills
(E) A house
12. In an economy with severe inflation, people stop accepting the currency and start bartering. Which functions of money have most clearly failed?
(A) Unit of account only
(B) Store of value and medium of exchange
(C) Divisibility and portability only
(D) Store of value only
(E) Legal tender status and unit of account

SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. Table: In billions of dollars, currency in circulation is 150, checking deposits are 300, savings deposits are 700, small time deposits are 100, retail money market funds are 150, and bank vault cash is 40. (a) Calculate M1 and M2. (b) Suppose households shift 100 from savings to checking. Give the new M1 and M2. (c) Explain why M1 is the more liquid measure.
14. A country's government abandons gold backing and declares its paper currency legal tender. Over a decade, the central bank prints large amounts of currency to finance spending. (a) Is the new money commodity or fiat money? (b) Predict what happens to the store-of-value function and explain why. (c) Identify one characteristic of good money that the government must preserve for the currency to keep working.

4.2 Interest Rates, Time Value of Money, and Financial Assets

Learn the difference between nominal and real interest rates, how present and future values work, why bond prices move opposite to interest rates, and how risk and intermediaries shape financial markets.

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An **interest rate** is the price of borrowing money, stated as a percentage of the amount borrowed per year. Lenders receive interest as payment for giving up the use of their funds, and borrowers pay it for the right to spend now. Because money in hand today can be spent or invested, a dollar today is worth more than a dollar promised in the future. This is the **time value of money**.

Nominal and real interest rates

Nominal interest rate: the stated rate, not adjusted for inflation.

Real interest rate = nominal interest rate - expected inflation rate (a close approximation).

Nominal interest rate = real interest rate + expected inflation rate. Lenders and borrowers decide based on the real rate, because it measures the actual change in purchasing power.

When inflation is unexpectedly high, the real rate the lender actually earns is lower than planned. Borrowers gain and lenders lose. When inflation is lower than expected, the reverse happens. A question that says "expected" is asking for the rate people used when they made the loan. A question that gives actual inflation after the fact is asking what really happened.

Future value and present value. If you invest an amount today at interest rate r (as a decimal) for n years with annual compounding, it grows to the **future value**. Reversing the process gives the **present value**, what a future payment is worth today.

Time value of money formulas

Future value: $FV = PV(1 + r)^n$

Present value: $PV = \frac{FV}{(1 + r)^n}$

A higher interest rate lowers the present value of any future payment, because the money could have grown faster elsewhere.

Bonds. A **bond** is a loan to a corporation or government. The borrower promises to pay interest (the coupon) and to return the face value at maturity. A bond already issued can be sold to someone else, and its market price moves opposite to market interest rates. If market rates rise, new bonds pay more interest, so older bonds with lower fixed payments become less attractive and their prices fall. If market rates fall, older bonds pay relatively more and their prices rise. This **inverse relationship between bond prices and interest rates** is central to monetary policy: when the Federal Reserve buys bonds, bond prices rise and interest rates fall.

EXAMPLE 1: REAL INTEREST RATE

A bank offers a one-year loan at a nominal rate of 7%. Borrowers and lenders expect 3% inflation. Actual inflation turns out to be 5%. Find the expected real rate, the actual real rate, and say who benefits.

SOLUTION

Expected real rate = 7% - 3% = 4%.

Actual real rate = 7% - 5% = 2%.

Inflation was higher than expected, so the loan was repaid in dollars worth less than anticipated. The borrower benefits and the lender loses.

EXAMPLE 2: FUTURE AND PRESENT VALUE

(a) How much will \$1,000 invested at 8% grow to in 5 years? (b) What is the present value of \$1,000 received in 2 years if the interest rate is 5%?

SOLUTION

(a) $FV = 1,000(1.08)^5 = 1,000(1.4693) = \$1,469.33$.

(b) $PV = 1,000 / (1.05)^2 = 1,000 / 1.1025 = \$907.03$.

Check: investing \$907.03 at 5% for 2 years returns \$1,000, so the two amounts are equivalent.

EXAMPLE 3: BOND PRICE AND INTEREST RATE

A one-year bond has a face value of \$1,000 and a coupon of \$50, so it pays \$1,050 at maturity. What is its price when the market interest rate is 5%, 10%, and 2%?

SOLUTION

Price = $1,050 / (1 + r)$.

At 5%: $1,050 / 1.05 = \$1,000$.

At 10%: $1,050 / 1.10 = \$954.55$. Price falls when the rate rises.

At 2%: $1,050 / 1.02 = \$1,029.41$. Price rises when the rate falls.

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Why do interest rates differ across loans? A loan with more risk of default, a longer term, or lower liquidity carries a higher rate, because the lender needs compensation. A government bond is a low-risk loan and so pays a lower rate than a loan to a new business. Rates in the economy also move together: when the central bank pushes short-term rates up, most other rates tend to follow.

Stocks. A **stock** is a share of ownership in a corporation. Stockholders earn a return from dividends (a share of profits) and from capital gains if the share price rises. Unlike bonds, stocks promise no fixed payment, and stockholders are paid after bondholders if a firm fails.

Risk and return. Assets differ in risk, return, and liquidity. In general, assets with higher expected returns carry more risk, because investors must be compensated for bearing uncertainty. **Diversification**, holding many different assets, reduces risk without necessarily lowering the expected return.

Asset	Expected return	Risk	Liquidity
Savings account	Low	Very low (insured)	High
Government bond	Low to moderate	Low (rate risk if sold early)	High
Corporate bond	Moderate	Moderate (default risk)	Moderate
Stock	Highest on average	High (price swings)	High to moderate

Financial intermediaries are institutions that channel funds from savers to borrowers: commercial banks, credit unions, mutual funds, insurance companies, and pension funds. They help in three ways: they pool many small deposits into large loans, they spread risk across many borrowers, and they reduce the information and search costs that savers would face lending directly. By linking savers and borrowers, they make investment possible.

Common mistakes

Do not say bond prices and interest rates move together. They move in opposite directions. Also, do not subtract actual inflation when a problem asks for the expected real rate, and remember that interest rates in the formulas are decimals ($5\% = 0.05$).

Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

- Calculate the real interest rate if the nominal rate is 9% and expected inflation is 4%.
- If the nominal interest rate is 6% and inflation turns out to be 8% when it was expected to be 3%, who gains and who loses? Calculate the actual real rate.
- Find the future value of \$100 invested at 6% for 3 years.
- Explain why the price of an existing bond falls when market interest rates rise.
- Name two differences between owning a stock and owning a bond.
- Describe two ways financial intermediaries help savers.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

- A bank charges a nominal interest rate of 8% on a loan. Borrowers and lenders both expect inflation of 3%. What is the expected real interest rate?
 (A) 3% (B) 8% (C) 5% (D) 11% (E) 2.4%
- What is the present value of \$1,100 received one year from now when the interest rate is 10%?
 (A) \$ 990 (B) \$ 1,110 (C) \$ 1,210 (D) \$ 1,000 (E) \$ 1,100
- When market interest rates rise, what happens to the price of existing bonds?
 (A) They fall because new bonds offer higher interest
 (B) They rise because investors want safer assets
 (C) They are unchanged because the coupon is fixed
 (D) They rise because the face value increases
 (E) They fall because the coupon payment is reduced

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10. Which statement about risk and return is most accurate?
- (A) Government bonds usually have the highest expected return
 - (B) Diversification increases risk but raises return
 - (C) Savings accounts have high risk and high return
 - (D) Stocks always outperform bonds
 - (E) Assets with higher expected returns generally carry greater risk
11. Inflation is 6% when 2% was expected, and a loan carries a nominal rate of 5%. Compared with expectations, the lender's real return is
- (A) higher by 4 percentage points
 - (B) lower by 4 percentage points
 - (C) unchanged
 - (D) lower by 1 percentage point
 - (E) higher by 1 percentage point
12. Which best describes the role of a mutual fund as a financial intermediary?
- (A) It creates money by lending out reserves
 - (B) It sets the discount rate
 - (C) It guarantees a fixed return on each deposit
 - (D) It pools funds from many savers to buy a diversified set of assets
 - (E) It issues legal tender

SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. A bond has a face value of \$1,000 and a coupon of \$60, so it pays \$1,060 in one year. (a) Calculate its price when the market interest rate is 6%. (b) The Fed's actions raise the market rate to 8%. Calculate the new price. (c) Calculate the price if the market rate later falls to 4% and explain the pattern.
14. Table: Asset X is a savings account with an expected return of 2% and almost no risk. Asset Y is a stock fund with expected return of 9% and large year-to-year swings. (a) Which asset is more liquid in the sense of keeping its dollar value? (b) Explain why Y has a higher expected return. (c) A lender offers a loan at 10% nominal when expected inflation is 4%. Calculate the expected real rate and explain who is hurt if inflation is actually 7%.

4.3 Banking and Money Creation

Learn how bank balance sheets work, how fractional reserve banking creates money through the money multiplier, and why bank runs happen.

Banks are **financial intermediaries** that accept deposits from savers and lend most of that money to borrowers. Because they lend out more than they keep, banks do something unusual: together they increase the money supply. This lesson shows exactly how, and what limits the process.

The bank balance sheet. A balance sheet lists what a bank owns and what it owes. **Assets** are what the bank owns: reserves, loans, and securities. **Liabilities** are what the bank owes: mainly deposits, which are owed to depositors on demand. **Net worth** (or owners' equity) is assets minus liabilities, so assets always equal liabilities plus net worth. A **T-account** is a simplified balance sheet with assets on the left and liabilities on the right. **Reserves** are the portion of deposits kept as vault cash or on deposit at the Federal Reserve, not loaned out. A loan is an asset to the bank, because the borrower owes the bank.

Reserve definitions

Required reserves = required reserve ratio (RR) x checkable deposits. This is the minimum a bank must hold.

Excess reserves = actual reserves - required reserves. Only excess reserves can be lent.

The Fed set the reserve requirement ratio to 0% in 2020, but AP questions still use positive ratios, so know the calculations.

Fractional reserve banking. Banks keep only a fraction of deposits as reserves and lend the rest, because not all depositors withdraw at once. Suppose a customer deposits \$1,000 in cash and the reserve requirement is 20%. The bank keeps \$200 as required reserves and lends \$800. The borrower spends the \$800, and the seller deposits it in a second bank, which keeps \$160 and lends \$640. The process continues with each loan becoming another deposit, so the money supply grows far beyond the original deposit.

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The simple money multiplier

Money multiplier = $1 / RR$ (the reciprocal of the required reserve ratio).

Maximum change in the money supply = change in excess reserves $\times$ money multiplier.

A deposit of new cash creates excess reserves of deposit $\times (1 - RR)$. If the Fed adds reserves to the banking system, the entire amount is excess.

EXAMPLE 1: ONE BANK'S T-ACCOUNT

First Bank has \$200,000 in checkable deposits and \$50,000 in reserves. The reserve requirement is 10%. (a) How much can it lend? (b) Show the result.

SOLUTION

Required reserves = $0.10 \times 200,000 = \$20,000$.

Excess reserves = $50,000 - 20,000 = \$30,000$, so the bank can lend up to \$30,000.

After lending \$30,000 and the borrower spending it elsewhere, the bank's reserves fall to \$20,000 (equal to required) and its loans rise by \$30,000. The new loan is a new deposit somewhere in the banking system, so the money supply grows by \$30,000 at the first stage and more in later rounds.

EXAMPLE 2: CASH DEPOSIT AND THE MULTIPLIER

A customer deposits \$1,000 in cash in a bank. $RR = 20\%$. Find the multiplier and the maximum total change in the money supply.

Round	New deposit	Required reserves (20%)	New loan
1	1,000	200	800
2	800	160	640
3	640	128	512
4	512	102.40	409.60

SOLUTION

Multiplier = $1 / 0.20 = 5$.

Excess reserves from the deposit = $1,000 - 0.20(1,000) = \$800$.

Maximum increase in the money supply = $800 \times 5 = \$4,000$. Total checking deposits rise by \$5,000, but the \$1,000 of cash that left circulation is subtracted, so the net money supply increases by \$4,000.

Total new loans = \$4,000, the sum of $800 + 640 + 512 +$ and so on.

EXAMPLE 3: FED ADDS RESERVES

The Fed buys \$10 million of securities from banks. $RR = 10\%$. What is the maximum change in the money supply?

SOLUTION

The purchase gives banks \$10 million in new reserves, all of it excess.

Multiplier = $1 / 0.10 = 10$.

Maximum increase = $10 \text{ million} \times 10 = \$100 \text{ million}$.

Why the actual increase is smaller. The formula gives the maximum. Three leakages shrink the real effect. First, banks may hold **excess reserves** rather than lend, especially when borrowers are weak or the bank is nervous. Second, people may hold some of the loans as cash instead of depositing it (a **currency drain**). Third, if few creditworthy people want loans, the expansion stops. When any of these occur, the actual multiplier is lower than $\frac{1}{RR}$.

Change	Effect on the money multiplier	Effect on potential money supply
Higher reserve requirement	Falls	Falls
Lower reserve requirement	Rises	Rises
Banks hold more excess reserves	Falls (actual)	Falls
People hold more cash	Falls (actual)	Falls

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Reading a T-account. When a loan is made, the bank's assets rise (a new loan) and its liabilities rise (the borrower's new deposit), so the balance sheet still balances. When the borrower spends the money, reserves leave for another bank. Tracking which column changes, and by how much, is the skill the exam rewards.

Bank runs and deposit insurance. Because banks keep only a fraction of deposits in reserve, they cannot pay everyone at once. If depositors fear the bank will fail, they rush to withdraw, which is a **bank run**. Even a healthy bank can fail. The **FDIC** (Federal Deposit Insurance Corporation) insures deposits up to \$250,000 per depositor per bank, which removes the reason to panic. The Fed also acts as lender of last resort to solvent banks that face a shortage of cash.

Common mistakes

Do not use the multiplier on the full cash deposit when the question asks for the net change in the money supply; start with excess reserves. Also, a bank cannot lend its required reserves. And remember that a loan creates a deposit, so lending increases the money supply even though no new currency is printed.

Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. A bank has \$500,000 in deposits and the reserve requirement is 12%. How much must it hold as required reserves?
2. Calculate the money multiplier if the reserve requirement is 25%, and explain what it means.
3. A bank has \$8,000 in reserves and \$50,000 in checkable deposits. $RR = 10\%$. Find its excess reserves and the maximum increase in the money supply the banking system could create from them.
4. A customer deposits \$2,000 in cash with $RR = 20\%$. Show the changes in the bank's T-account right after the deposit.
5. Explain why the actual money multiplier is usually smaller than $1/RR$.
6. What is a bank run and how does deposit insurance prevent it?

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

7. If the required reserve ratio is 5%, the simple money multiplier is
(A) 5 (B) 0.05 (C) 95 (D) 20 (E) 10
8. A bank has \$100 million in deposits and \$18 million in reserves. The required reserve ratio is 10%. What is the maximum amount this bank can lend?
(A) \$8 million (B) \$10 million (C) \$18 million
(D) \$90 million (E) \$80 million
9. Which of the following would reduce the ability of banks to create money?
(A) The Fed lowers the reserve requirement (B) The Fed buys bonds from banks
(C) Households deposit all cash they receive (D) The FDIC raises deposit insurance limits
(E) Banks decide to hold more excess reserves
10. A bank's balance sheet shows reserves of \$30, loans of \$170, and deposits of \$180. What is its net worth?
(A) \$20 (B) \$30 (C) \$170 (D) \$200 (E) \$10
11. The Fed adds \$5 million to bank reserves. If $RR = 20\%$ and banks lend all excess reserves, the maximum increase in the money supply is
(A) \$1 million (B) \$5 million (C) \$25 million
(D) \$20 million (E) \$100 million
12. Which of the following best explains why a bank run can occur even at a solvent bank?
(A) Banks hold all deposits as reserves
(B) Banks hold only a fraction of deposits as reserves
(C) The Fed sets interest rates too high
(D) Banks lend all deposits to the government
(E) Deposits are not liabilities

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SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. The banking system has no excess reserves and $RR = 10\%$. A customer deposits \$5,000 in cash. (a) Calculate the excess reserves created at the first bank. (b) Calculate the maximum total change in the money supply. (c) Explain why the actual change will probably be smaller.
14. During a financial panic, depositors withdraw cash and banks respond by holding more excess reserves. (a) Explain what happens to the money supply. (b) Identify the term for the depositors' behavior. (c) Describe one policy that can stop the process.

4.4 The Money Market

Learn how the demand for money and the supply of money determine the nominal interest rate, and how to graph and explain shifts in the money market.

The **money market** is the market in which the demand for money and the supply of money determine the **nominal interest rate**. Its graph puts the nominal interest rate on the vertical axis and the quantity of money on the horizontal axis. Here the interest rate is the price of holding money, since it is what you give up by keeping wealth in cash instead of in an asset that pays interest.

Demand for money. People hold money for three reasons. **Transactions demand** is money held to buy goods and services; it grows with nominal GDP, that is, with the price level and real output. **Precautionary demand** is a cushion for unexpected expenses. **Asset (speculative) demand** is money held as part of a portfolio, in place of bonds, when interest rates are low or bond prices are expected to fall. Keynes called this idea **liquidity preference**, the desire to hold wealth in liquid form.

The money demand curve (**D_m**) slopes downward. When the nominal interest rate is high, the opportunity cost of holding money is high, so people hold less money and buy more bonds and interest-bearing assets. When the rate is low, the opportunity cost is small, so they hold more money. This is a movement along the curve.

What shifts money demand (D_m)

Increase in the price level or in real GDP: transactions demand rises, so D_m shifts right.

Decrease in the price level or in real GDP: D_m shifts left.

Technology that makes money easier to obtain or substitute (ATMs, payment apps, credit cards): demand for holding money falls, D_m shifts left.

A change in the nominal interest rate does NOT shift D_m; it moves you along it.

Supply of money. The money supply (**M_s**) is controlled by the Federal Reserve through its policy tools, not by the interest rate. In the graph, M_s is a **vertical line** at the quantity the Fed chooses. When the Fed increases the money supply, M_s shifts right. When it decreases the supply, M_s shifts left.

Equilibrium. The equilibrium nominal interest rate is where D_m crosses M_s. If the rate is above equilibrium, the quantity of money supplied exceeds the quantity demanded. People holding surplus money buy bonds, which raises bond prices and pushes interest rates down. If the rate is below equilibrium, people want more money than exists, so they sell bonds, bond prices fall, and rates rise.

Money market rules

Vertical axis: nominal interest rate. Horizontal axis: quantity of money.

D_m slopes down; M_s is vertical at the quantity chosen by the Fed.

Surplus of money → people buy bonds → bond prices up → interest rate down. Shortage of money → people sell bonds → bond prices down → interest rate up.

Why this matters. The nominal interest rate set in this market is the starting point for monetary policy. When the Fed shifts the money supply, it changes interest rates, and interest rates change borrowing for investment, homes, and durable goods. Drawing this graph with labeled axes, curves, and equilibrium points earns reliable points on the free-response section.

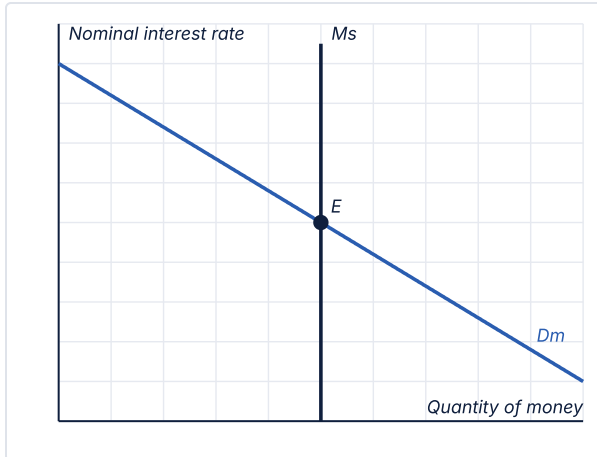
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EXAMPLE 1: FINDING EQUILIBRIUM

In the graph, M_s is fixed at 5 and D_m is $i = 9 - 0.8Q$. Find the equilibrium interest rate (in units on the axis) and explain what happens if the rate is 7.

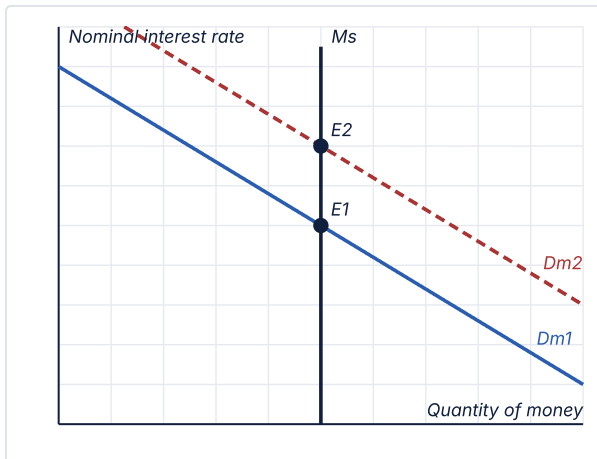
**SOLUTION**

At $Q = 5$, $i = 9 - 0.8(5) = 5$. Equilibrium is at E, where the nominal interest rate is 5 on the axis.

At $i = 7$, the quantity of money demanded is $Q = (9 - 7)/0.8 = 2.5$, but the quantity supplied is 5. There is a surplus of money. People use the extra money to buy bonds, which raises bond prices and lowers the interest rate until it returns to 5.

EXAMPLE 2: MONEY DEMAND INCREASES

The price level rises, with the money supply unchanged. Show and explain the effect on the interest rate.

**SOLUTION**

Higher prices mean people need more money for the same purchases, so transactions demand rises and D_m shifts right from D_{m1} to D_{m2} .

With M_s fixed, the equilibrium moves from E1 to E2. At the old rate there is now a shortage of money, so people sell bonds, bond prices fall, and the interest rate rises (from 5 to 7 on the axis).

The quantity of money stays the same because the Fed has not changed M_s .

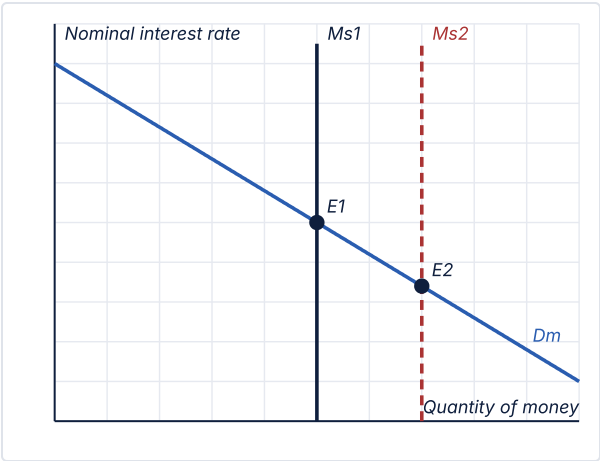
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EXAMPLE 3: THE FED INCREASES THE MONEY SUPPLY

The Fed purchases bonds and the money supply increases from 5 to 7 with D_m unchanged. Describe the effect on the interest rate.



SOLUTION

M_s shifts right from M_{s1} to M_{s2} along the quantity axis.
At the old rate there is a surplus of money. Households and firms buy bonds with the excess, bond prices rise, and the nominal interest rate falls from 5 to 3.4 on the axis ($9 - 0.8(7) = 3.4$).
Lower interest rates raise investment and interest-sensitive consumption, a link to aggregate demand explained in the next lesson.

Event	Curve that shifts	Direction	Nominal interest rate
Price level rises	D_m	Right	Rises
Real GDP falls	D_m	Left	Falls
New payment technology reduces cash demand	D_m	Left	Falls
Fed increases money supply	M_s	Right	Falls
Fed decreases money supply	M_s	Left	Rises

Common mistakes

The money supply curve is vertical, not upward-sloping, and the interest rate does not shift either curve. Always label the vertical axis "nominal interest rate," not "real interest rate" or "price level" in this graph. A change in the interest rate is a movement along D_m , while a change in income or the price level shifts D_m .

Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. List the three motives for holding money and name the one that depends mainly on nominal GDP.
2. Explain why the money demand curve slopes downward.
3. Why is the money supply curve vertical in the money market graph?
4. State what happens to the nominal interest rate, and why, if real GDP rises and the money supply is unchanged.
5. Explain how widespread use of mobile payments, which reduces the need to hold cash, affects money demand and the interest rate if M_s is constant.
6. At an interest rate above equilibrium in the money market, describe the adjustment that returns the market to equilibrium.

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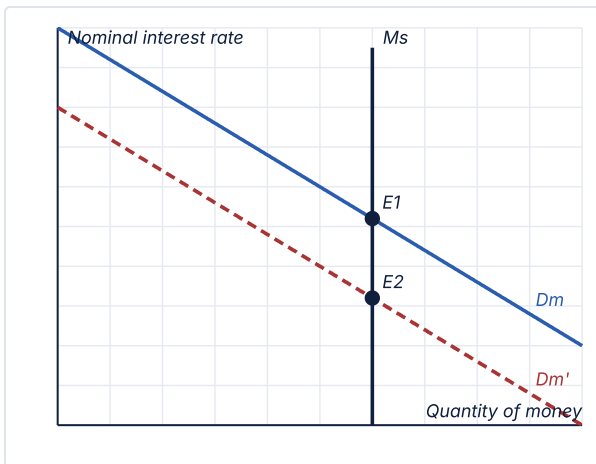
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SET B Exam-Style Multiple Choice

Choose the best answer for each question.

7. The Federal Reserve decreases the money supply. In the money market, the nominal interest rate
 - (A) rises as the money supply curve shifts left
 - (B) falls as the money supply curve shifts left
 - (C) rises as the money demand curve shifts right
 - (D) falls as the money demand curve shifts right
 - (E) is unchanged because the supply curve is vertical
8. Which of the following causes the demand for money to increase?
 - (A) A decrease in real GDP
 - (B) A fall in the nominal interest rate
 - (C) An increase in the price level
 - (D) The introduction of widespread mobile payments
 - (E) An increase in the money supply
9. In the graph shown, the movement from E1 to E2 is best explained by



- (A) an increase in the demand for money
 - (B) a decrease in the demand for money
 - (C) an increase in the money supply
 - (D) a decrease in the money supply
 - (E) a decrease in the interest rate, which shifts the demand curve
10. Why does the money demand curve slope downward?
 - (A) The Fed lowers the supply of money when rates rise
 - (B) Bond prices rise when interest rates rise
 - (C) Inflation falls when interest rates fall
 - (D) Banks increase reserves when rates fall
 - (E) The opportunity cost of holding money falls as the interest rate falls
11. If the nominal interest rate is above the equilibrium rate in the money market, which of the following occurs?
 - (A) People buy bonds, driving bond prices up and interest rates down
 - (B) People sell bonds, driving bond prices down and interest rates up
 - (C) The Fed must raise the money supply
 - (D) Money demand shifts right until equilibrium
 - (E) Banks reduce loans

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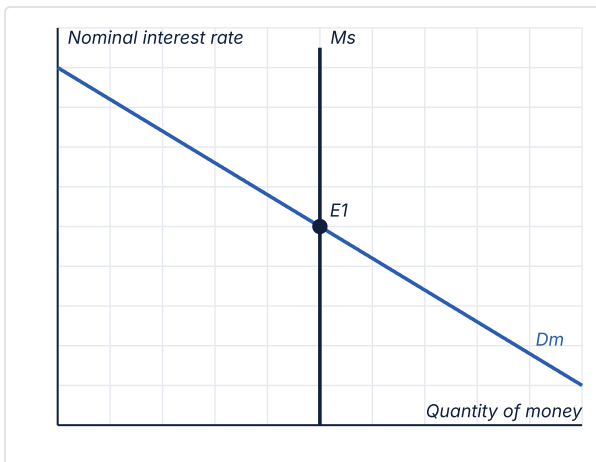
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12. Keynes's liquidity preference theory states that
- (A) the interest rate is determined by saving and investment alone
 - (B) the money supply is determined by the interest rate
 - (C) people prefer bonds to money at all interest rates
 - (D) the interest rate is determined by the demand for and supply of money
 - (E) money demand is perfectly inelastic

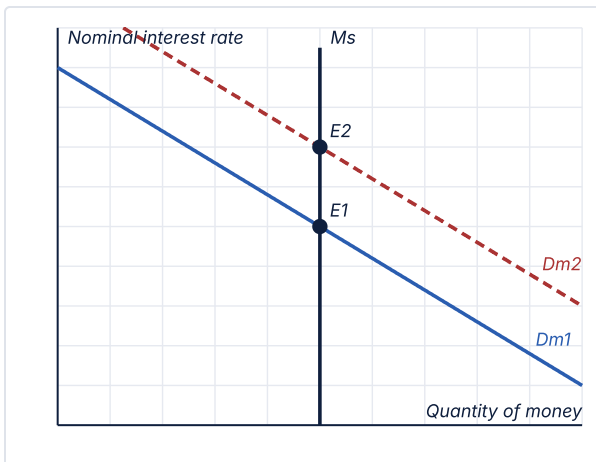
SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. The graph shows the money market in equilibrium at E1 with a money supply of 5. (a) Suppose the Fed conducts policy that raises the money supply to 7. Explain the effect on the nominal interest rate. (b) Explain how the bond market produces this result. (c) Suppose instead the price level rises with M_s constant. State the effect on the interest rate.



14. The graph shows $Dm1$ and $Dm2$ with M_s at 5. (a) Identify which curve represents the demand for money after real GDP falls, and justify. (b) State the new equilibrium rate relative to the old. (c) What would the Fed have to do to M_s to restore the original rate? Explain.



4.5 The Federal Reserve and Monetary Policy Tools

Learn how the Fed is organized, what its dual mandate requires, how each policy tool changes bank reserves and interest rates, and how monetary policy reaches aggregate demand.

The **Federal Reserve** (the Fed) is the central bank of the United States. Created in 1913, it is the institution that controls the nation's money supply and conducts monetary policy. **Monetary policy** is the Fed's use of its tools to change the money supply and interest rates in order to influence the economy.

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Structure. The Fed has three main parts. The **Board of Governors** in Washington has seven members, nominated by the President and confirmed by the Senate, each serving a staggered 14-year term; the Chair serves a renewable four-year term. Long terms help insulate the Fed from short-term political pressure. Twelve regional **Federal Reserve Banks** serve districts across the country. The **Federal Open Market Committee (FOMC)** makes the key decisions about interest rates and open market operations. It has 12 voting members: the seven governors, the president of the New York Fed, and four of the other eleven regional bank presidents on a rotating basis.

Mandate and functions. Congress gave the Fed a **dual mandate**: maximum employment and stable prices. The Fed defines stable prices as 2% inflation over time. Its other roles include supervising banks, acting as a **lender of last resort** to banks facing a liquidity shortage, clearing payments, and acting as the government's bank.

The Fed's policy tools

Open market operations (OMO): buying or selling government securities. Buying adds reserves to banks; selling removes reserves.

Discount rate: the interest rate the Fed charges banks that borrow reserves directly from it.

Reserve requirement: the minimum fraction of deposits banks must hold in reserve (currently 0%, so rarely used).

Interest on reserve balances (IORB): the rate the Fed pays banks for reserves held at the Fed.

Why independence matters. Politicians often prefer low interest rates before an election, even when low rates risk inflation. Insulating the Fed from the elected branches lets it focus on long-run price stability. The Fed remains accountable to Congress, which sets its mandate and receives its reports.

The federal funds rate. Banks lend reserves to each other overnight. The interest rate on these loans is the **federal funds rate**. The FOMC sets a target range for it, and the Fed uses its tools to push the actual rate into that range. The federal funds rate is the Fed's main policy rate, and changes in it spread to other rates such as those for mortgages, business loans, and car loans.

How each tool works. In an **open market purchase**, the Fed buys securities from banks and pays by crediting their reserve accounts. Reserves rise, banks lend more, and the money supply increases while the federal funds rate falls. In an **open market sale**, banks give up reserves, which lowers the money supply and raises rates. Lowering the **discount rate** makes it cheaper for banks to borrow from the Fed. Lowering the **reserve requirement** frees reserves for lending, and raises the money multiplier. Raising **IORB** makes holding reserves more attractive, so banks lend less unless they are offered higher rates, which pushes the federal funds rate up and other rates with it. Lowering IORB works in reverse.

Goal	Policy type	OMO	Discount rate	Reserve requirement	IORB	Money supply	Interest rates
Fight recession	Expansionary (easy)	Buy securities	Lower	Lower	Lower	Increases	Fall
Fight inflation	Contractionary (tight)	Sell securities	Raise	Raise	Raise	Decreases	Rise

Transmission to aggregate demand

Expansionary policy: money supply up → nominal interest rate down → investment (and interest-sensitive consumption) up → AD shifts right → real GDP up, price level up, unemployment down.

Contractionary policy: money supply down → interest rate up → investment down → AD shifts left → real GDP down, inflation reduced.

Lower U.S. interest rates also tend to depreciate the dollar, raising net exports, which adds to the AD increase.

EXAMPLE 1: OPEN MARKET PURCHASE

The Fed buys \$20 million of government securities from commercial banks. The required reserve ratio is 10%. What is the maximum change in the money supply?

SOLUTION

The purchase credits banks with \$20 million of new reserves, all of it excess.

Multiplier = $1 / 0.10 = 10$.

Maximum change = 20 million × 10 = \$200 million increase in the money supply.

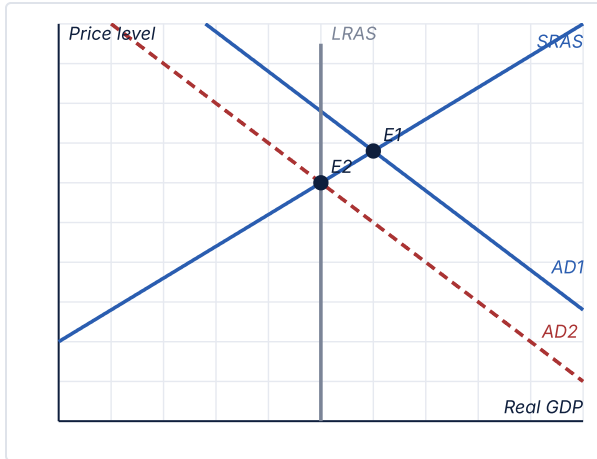
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EXAMPLE 2: FIGHTING INFLATION

The economy is producing above full employment (output 6, LRAS at 5, price level 6.8). Describe and graph the Fed's response.

**SOLUTION**

The Fed pursues contractionary policy: it sells securities, raises the discount rate, or raises IORB.

Bank reserves fall, so the money supply decreases and the nominal interest rate rises.

Higher rates reduce investment and interest-sensitive consumption, so AD shifts left from AD1 to AD2.

Output returns to the full-employment level (5) and the price level falls back from 6.8 to 6, closing the inflationary gap.

EXAMPLE 3: IORB

The Fed raises IORB from 4.4% to 4.9%. Predict the effect on bank lending, the federal funds rate, and AD.

SOLUTION

Banks can earn 4.9% risk-free on reserves, so they will lend only if they receive a higher rate than before.

Lending falls and the federal funds rate and other market rates rise.

Higher rates reduce investment and consumption, so AD shifts left. This is contractionary policy.

Common mistakes

The Fed does not set the nominal interest rate for the whole economy by decree; it targets the federal funds rate and uses its tools to reach it. Do not confuse the discount rate (Fed to banks) with the federal funds rate (bank to bank). Remember that the Fed buys bonds to expand the money supply, because it pays for them with new reserves.

Practice**SET A Check Your Understanding**

Answer each question in a few sentences or show your calculation.

1. State the composition of the FOMC and say why the Board of Governors has 14-year terms.
2. What are the two parts of the Fed's dual mandate?
3. The Fed sells \$5 million of securities to banks. RR = 20%. What is the maximum change in the money supply?
4. Define the federal funds rate and distinguish it from the discount rate.
5. Describe, with each step, how an open market purchase leads to higher real GDP.
6. Which two tools would the Fed use to raise the federal funds rate? Explain one.

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SET B Exam-Style Multiple Choice

Choose the best answer for each question.

7. Which of the following is a contractionary monetary policy action?
- (A) The Fed lowers the discount rate
 - (B) The Fed sells government securities in the open market
 - (C) The Fed lowers the reserve requirement
 - (D) The Fed buys government securities
 - (E) The Fed lowers interest on reserve balances
8. Who votes on the Fed's open market operations?
- (A) The Board of Governors only
 - (B) The Treasury Secretary
 - (C) The President
 - (D) The FOMC
 - (E) Congress
9. The Fed buys \$30 million in securities. If the reserve requirement is 25%, the maximum increase in the money supply is
- (A) \$ 7.5 million
 - (B) \$ 30 million
 - (C) \$ 75 million
 - (D) \$ 300 million
 - (E) \$ 120 million
10. Which of the following best describes the federal funds rate?
- (A) The rate banks charge each other for overnight loans of reserves
 - (B) The rate the Fed charges banks for loans
 - (C) The rate paid on savings accounts
 - (D) The rate charged on 30-year mortgages
 - (E) The rate set by Congress for Treasury bonds
11. An increase in the Fed's interest on reserve balances is most likely to
- (A) increase the money multiplier
 - (B) increase the supply of loans
 - (C) reduce lending by banks and increase interest rates
 - (D) lower the federal funds rate
 - (E) shift AD to the right
12. Starting from a recession, expansionary monetary policy is expected to lead to which sequence?
- (A) Money supply increases, interest rate falls, investment rises, AD shifts right
 - (B) Money supply decreases, interest rate rises, investment falls, AD shifts left
 - (C) Money supply increases, interest rate rises, investment rises, AD shifts right
 - (D) Money supply increases, interest rate falls, investment falls, AD shifts left
 - (E) Money supply is unchanged, interest rate falls, investment rises, AD shifts right

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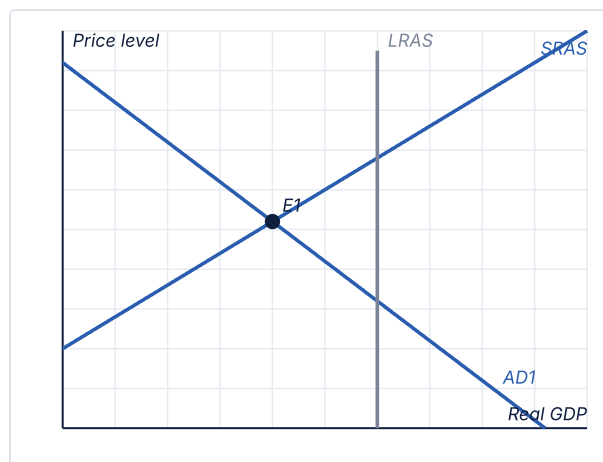
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SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. The graph shows an economy in recession, with output at 4 and full employment at 6. (a) Identify the type of gap. (b) Describe an open market operation that the Fed could use and its effect on the money supply and the interest rate. (c) Explain how the policy changes AD, real GDP, and the price level, and show the change on the graph.



14. The Fed raises the discount rate. (a) Explain the effect on bank borrowing from the Fed. (b) Explain the effect on the money supply. (c) Starting from an inflationary gap, describe the effect on the price level. (d) State one reason the Fed might also use open market operations instead.

4.6 Loanable Funds Market

Learn how saving and borrowing determine the real interest rate, how to graph shifts in demand and supply, and why government deficits crowd out private investment.

The **loanable funds market** shows how the real interest rate is determined by the interaction of borrowers and savers. The horizontal axis shows the quantity of loanable funds (money lent and borrowed), and the vertical axis shows the **real interest rate**, the price of borrowing adjusted for inflation. This market explains the interest rate that guides saving and investment in the long run, while the money market explains the short-run nominal rate.

Demand for loanable funds. Borrowers demand loanable funds to finance investment in capital, homes, durable goods, and government deficits. The demand curve (**D**) slopes downward: at a lower real interest rate, more projects have a return greater than the cost of borrowing, so more funds are demanded. Borrowers include businesses, households, and the government.

Supply of loanable funds. Savers supply loanable funds: households, firms with retained earnings, the government when it runs a surplus, and foreigners who invest in the country. The supply curve (**S**) slopes upward: a higher real interest rate rewards saving more, so people save more and supply more funds.

Equilibrium and shifters

Equilibrium real interest rate: where demand for loanable funds equals supply of loanable funds.

Demand shifts right: larger government deficits, higher expected profit from investment (optimism, new technology), lower taxes on investment returns.

Supply shifts right: higher private saving (thrift, tax incentives for saving), government budget surplus, inflows of foreign savings.

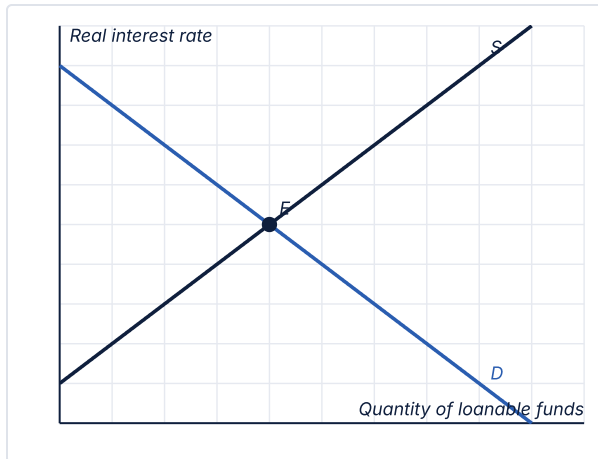
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EXAMPLE 1: EQUILIBRIUM

Demand is $r = 9 - Q$ and supply is $r = 1 + Q$ (Q in billions, r in percent). Find equilibrium.

**SOLUTION**

Set demand equal to supply: $9 - Q = 1 + Q$, so $2Q = 8$ and $Q = 4$.

Substitute: $r = 9 - 4 = 5$, which equals $1 + 4$. The real interest rate is 5% and 4 billion is lent.

Government deficits and crowding out. When the government spends more than it collects in taxes, it must borrow by selling bonds. This raises the demand for loanable funds, shifting D right. The real interest rate rises. The higher rate discourages private firms and households from borrowing, so private investment falls. This effect is called **crowding out**. Because investment builds the capital stock, crowding out can reduce long-run economic growth.

Crowding out

Crowding out: higher government borrowing raises the real interest rate and reduces private investment.

Chain: deficit up $\rightarrow$ demand for loanable funds right $\rightarrow$ real interest rate up $\rightarrow$ private investment down $\rightarrow$ capital stock and long-run growth lower.

Crowding out is partial: total borrowing rises, but private borrowing falls.

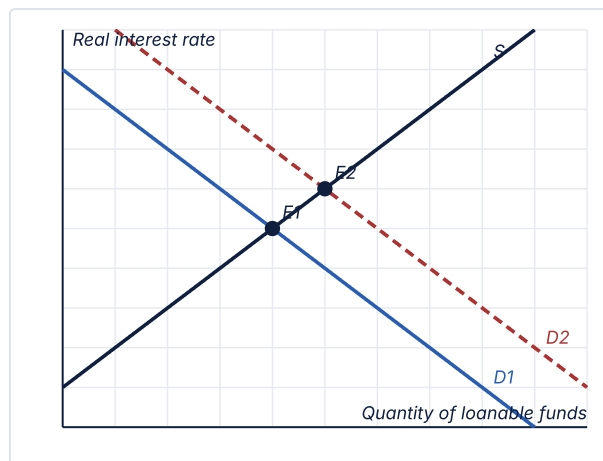
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EXAMPLE 2: A LARGER DEFICIT

Demand increases to $r = 11 - Q$ because of a larger deficit, with supply unchanged at $r = 1 + Q$. Find the new equilibrium and describe crowding out.

**SOLUTION**

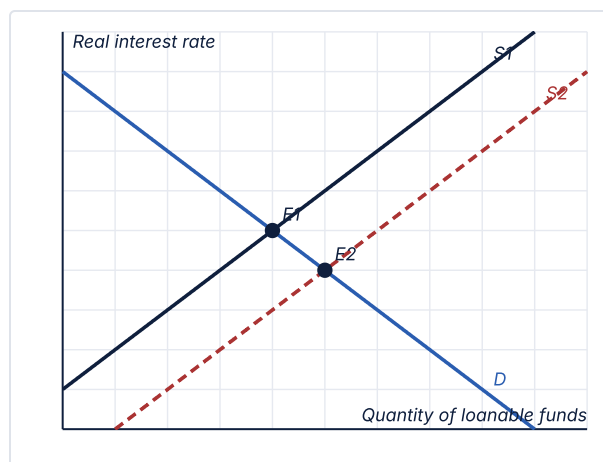
$11 - Q = 1 + Q$, so $Q = 5$ and $r = 6$.

The real interest rate rises from 5% to 6% and the quantity of loanable funds rises from 4 to 5.

Part of the increase is government borrowing, and the higher rate discourages private borrowing for investment, so private investment falls (crowding out).

EXAMPLE 3: A RISE IN SAVING

Households become more thrifty, and supply increases to $r = -1 + Q$. Demand is still $r = 9 - Q$. Describe the new equilibrium.

**SOLUTION**

Set $9 - Q = -1 + Q$, so $Q = 5$ and $r = 4$.

The real interest rate falls from 5% to 4% and the quantity of loanable funds rises from 4 to 5.

Lower rates encourage more investment, which can increase the capital stock and raise long-run growth.

Why savers and borrowers respond to the real rate. Lenders care about the purchasing power of what they will be repaid, and borrowers care about the real cost of what they owe. A saver who earns 6% nominal while inflation is 4% gains only 2% in purchasing power. A firm choosing whether to build a factory compares the expected return on the project to the real cost of funds. That is why the vertical axis uses the real interest rate, and why higher expected inflation by itself does not change the real equilibrium.

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Event	Curve	Shift	Real interest rate	Quantity of loanable funds
Government deficit grows	Demand	Right	Rises	Rises
Business optimism raises investment demand	Demand	Right	Rises	Rises
Households save more	Supply	Right	Falls	Rises
Foreign savings flow in	Supply	Right	Falls	Rises
Government runs a surplus	Supply	Right	Falls	Rises

Connecting to the other markets. If the Fed changes the money supply, the nominal rate moves in the money market in the short run. Over time, the real interest rate is pulled toward the rate that clears the loanable funds market. Always say which market and which rate (nominal or real) you are discussing. A graph of the loanable funds market is labeled "real interest rate" on the vertical axis, and the money market graph is labeled "nominal interest rate".

Common mistakes

The loanable funds graph is not the same as the money market. Do not draw a vertical supply curve here, because savers respond to the real interest rate. Do not forget that deficits increase demand (not decrease supply). And when a student writes "crowding out," the answer should say that private investment declines because the interest rate rose.

Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. Name two groups who supply loanable funds and two groups who demand them.
2. Why does the demand for loanable funds slope downward?
3. The government increases its budget deficit. Explain the effect on the real interest rate and on private investment.
4. A new technology raises the expected profit from investment. Which curve shifts, in which direction, and what happens to the real interest rate?
5. Demand is $r = 12 - Q$ and supply is $r = 2 + Q$. Calculate the equilibrium interest rate and quantity.
6. Explain how an inflow of foreign savings affects the loanable funds market.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

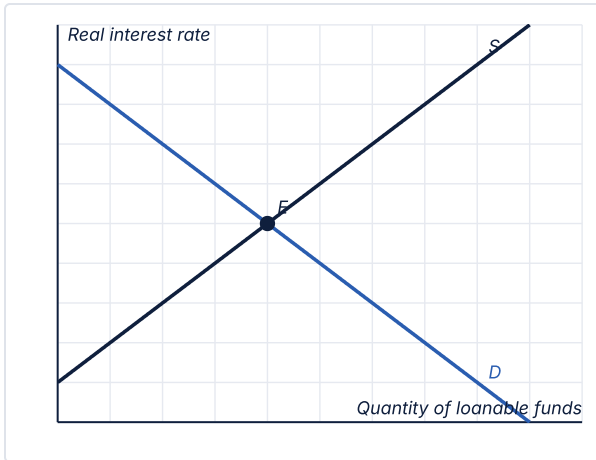
7. An increase in the government's budget deficit will most likely cause which of the following in the loanable funds market?
 - (A) Demand shifts right and the real interest rate rises
 - (B) Supply shifts right and the real interest rate falls
 - (C) Demand shifts left and the real interest rate falls
 - (D) Supply shifts left and the real interest rate rises
 - (E) No shift because deficits do not affect savers
8. Crowding out refers to
 - (A) a decline in government spending caused by a recession
 - (B) a decline in imports caused by a depreciation
 - (C) an increase in saving caused by higher taxes
 - (D) a decline in private investment caused by higher interest rates from government borrowing
 - (E) an increase in the money supply caused by a deficit
9. A government budget surplus will
 - (A) increase the demand for loanable funds and raise the real interest rate
 - (B) decrease the supply of loanable funds and raise the real rate
 - (C) increase the supply of loanable funds and lower the real interest rate
 - (D) decrease the demand for loanable funds and raise the real rate
 - (E) have no effect on the real interest rate

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10. In the graph shown, a decrease in the real interest rate from 5 would occur if



- (A) demand for loanable funds increased
 (B) the government increased its deficit
 (C) business optimism increased
 (D) supply of loanable funds decreased
 (E) supply of loanable funds increased
11. Which of the following best describes the real interest rate in the loanable funds market?
- (A) The rate charged by the Fed to banks
 (B) The nominal interest rate minus the expected inflation rate
 (C) The interest rate on government bonds only
 (D) The nominal interest rate plus the expected inflation rate
 (E) The rate at which banks lend to one another
12. Households expect a recession and increase their saving. In the loanable funds market, the most likely result is
- (A) a lower real interest rate and a higher quantity of loanable funds
 (B) a higher real interest rate and a lower quantity of loanable funds
 (C) a higher real interest rate and a higher quantity of loanable funds
 (D) a lower real interest rate and a lower quantity of loanable funds
 (E) no change in the real interest rate

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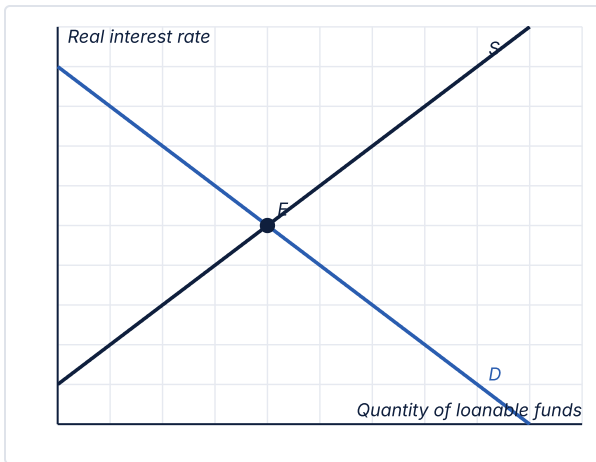
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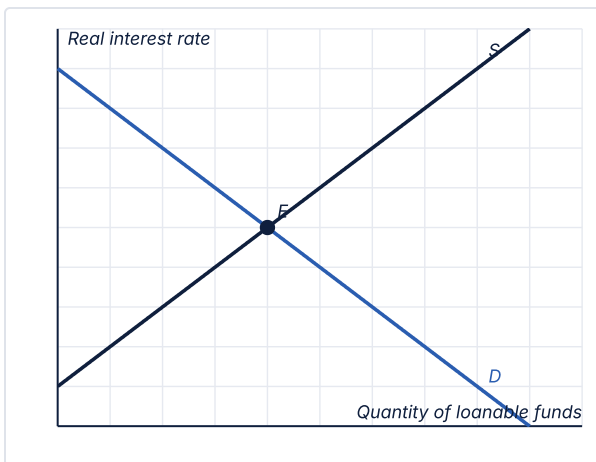
SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. The graph shows the loanable funds market in equilibrium at E. (a) Suppose the government cuts taxes without cutting spending, so the deficit rises. Explain the effect on the real interest rate and the quantity of loanable funds. (b) Explain what happens to private investment. (c) Identify one long-run consequence of that change in investment.



14. The graph shows loanable funds with demand D and supply S. (a) Suppose a wave of business optimism raises expected returns on new factories. Explain the effect on the real interest rate. (b) Starting again from equilibrium, a country receives large inflows of foreign savings. Explain the effect on the real interest rate. (c) If both occurred at once, what could be said for certain about the quantity of loanable funds, and why is the real interest rate ambiguous?

**4.7 Monetary Policy in Practice**

Learn how easy and tight money work, what the Fed does when rates hit zero, why lags and traps limit policy, and how to combine the money market, loanable funds, and AD-AS graphs.

Monetary policy in practice is more complicated than moving a curve on a graph. This lesson covers the stance of policy, the tools used when ordinary tools stop working, the problems of timing, and how to combine the money market, loanable funds, and AD-AS graphs in a complete answer.

Easy and tight money. **Easy money** (expansionary or loose policy) aims to lower interest rates and increase the money supply to fight unemployment and recession. **Tight money** (contractionary policy) aims to raise interest rates and slow growth of the money supply to fight inflation. Policy is judged "easy" or "tight" relative to what the economy needs, not just by the level of the interest rate. A nominal rate of 3% is easy if inflation is 6% (real rate of -3%) and tight if inflation is 0%.

Targets. The Fed can target the interest rate or the money supply but cannot control both, because the money market curves determine one from the other. Today the Fed targets the federal funds rate and lets the money supply adjust. If it targeted the money supply, the interest rate would move with every change in money demand.

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Unconventional tools. When the federal funds rate is near zero it cannot be lowered further, so the Fed has used other tools.

Quantitative easing (QE) is large-scale purchase of long-term government bonds and mortgage-backed securities, which raises their prices, lowers long-term interest rates, and adds reserves to the banking system. **Forward guidance** is communication about the likely future path of rates. By promising low rates for a long time, the Fed lowers expected future short-term rates, which reduces long-term rates today and can raise expected inflation, which lowers the real rate.

Quantitative easing and forward guidance

QE: the Fed buys long-term securities (not just short-term ones) to push down long-term rates when the policy rate is near zero.

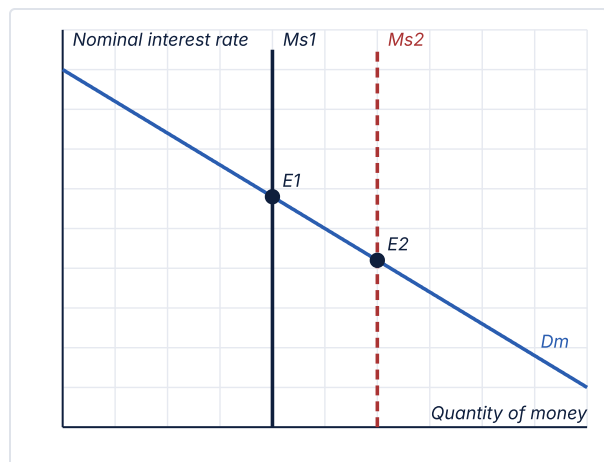
Forward guidance: the Fed announces its likely future policy to influence expectations, and so current long-term rates.

The liquidity trap. A **liquidity trap** occurs when interest rates are so low that additional money injected by the Fed is simply held by banks and households rather than lent or spent. People expect rates to rise (bond prices to fall), so they prefer to hold money. D_m becomes nearly horizontal at a very low rate, so shifting M_s right has little effect on the interest rate or on spending. In such conditions monetary policy loses its effectiveness and fiscal policy may be needed.

Lags and limits. Monetary policy works with delays: a **recognition lag** (data arrive late), a **decision lag**, and an **impact lag** because investment plans and spending take months to adjust. Policy can also fail if banks hold excess reserves instead of lending, if borrowers are fearful, or if the exchange rate response goes the other way. The Fed's advantages are independence, speed relative to Congress, and flexibility in making small steps.

EXAMPLE 1: MONEY MARKET UNDER EASY POLICY

The economy is in recession. The Fed buys bonds and the money supply increases from 4 to 6 on the graph, with D_m unchanged at $i = 9 - 0.8Q$. Find the change in the interest rate.



SOLUTION

At $Q = 4$: $i = 9 - 3.2 = 5.8$. At $Q = 6$: $i = 9 - 4.8 = 4.2$.

The nominal interest rate falls 1.6 units (5.8 to 4.2).

Because inflation expectations are stable, the real interest rate falls too, so borrowing for investment rises.

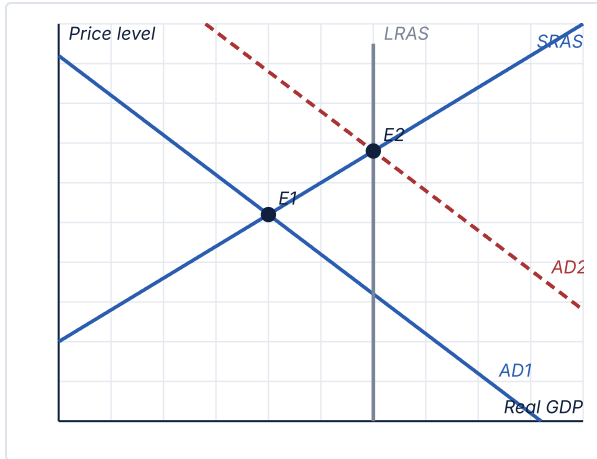
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EXAMPLE 2: EFFECT ON AD-AS

Continuing from Example 1, show the effect on the economy, which starts in recession (output 4, full employment 6).

**SOLUTION**

The lower interest rate raises investment and interest-sensitive consumption, shifting AD right from AD1 to AD2.

Real GDP rises from 4 to 6 (full employment) and the price level rises from 5.2 to 6.8.

Unemployment falls, and the recessionary gap is closed.

EXAMPLE 3: FORWARD GUIDANCE AND THE REAL RATE

The federal funds rate is 0.25% and expected inflation is 1%. The Fed's announcement of a long period of low rates raises expected inflation to 3% while the nominal rate stays at 0.25%. Find the change in the real rate.

SOLUTION

Before: $0.25\% - 1\% = -0.75\%$.

After: $0.25\% - 3\% = -2.75\%$.

The real rate fell by 2 percentage points, which encourages borrowing and spending even though the nominal rate could not go lower.

The four-step policy chain

Money market: M_s shifts, so the nominal interest rate changes.

Loanable funds: the change in rates moves the quantity of funds demanded, so investment changes.

AD-AS: investment (and interest-sensitive consumption) changes, so AD shifts and output and prices respond.

Policy stance	Fed action	Interest rate	AD	Used when
Easy	Buy bonds, lower IORB, discount rate	Falls	Right	Recession, high unemployment
Tight	Sell bonds, raise IORB, discount rate	Rises	Left	Inflation above target
Unconventional	QE, forward guidance	Long-term rates fall	Right	Policy rate near zero

Combining three graphs. A complete analysis of a policy has four steps. (1) Money market: the Fed changes M_s , so the nominal interest rate changes. (2) Loanable funds: lower interest rates raise the quantity of loanable funds demanded (a movement along demand), so investment rises. (3) AD-AS: higher investment shifts AD right, which raises real GDP and the price level. (4) Check the labels. The shifts must be consistent: a rightward M_s shift gives a lower rate in the first graph and a rightward AD shift in the third.

Exam tip

In FRQs, name each curve that shifts, state the direction, and state the result. A frequent error is to say the Fed "lowers interest rates" without showing the M_s shift. Also say whether the rate is nominal (money market) or real (loanable funds), and do not draw the shift for AD unless you have explained the investment link.

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Practice

SET A Check Your Understanding

Answer each question in a few sentences or show your calculation.

1. Distinguish between easy money and tight money and give one economic condition in which each is appropriate.
2. Why can the Fed not target both the money supply and the interest rate at the same time?
3. Explain how quantitative easing differs from an ordinary open market purchase.
4. Describe a liquidity trap and why it weakens monetary policy.
5. The nominal interest rate is 4% and expected inflation is 6%. Is policy easy or tight? Calculate the real rate.
6. Name the three lags in monetary policy and say why lags make policy harder.

SET B Exam-Style Multiple Choice

Choose the best answer for each question.

7. A liquidity trap is best described as a situation in which
 - (A) interest rates are high and borrowing is low
 - (B) banks are unable to lend due to bank runs
 - (C) inflation is rising despite falling output
 - (D) the government cannot borrow
 - (E) an increase in the money supply fails to lower interest rates or raise spending
8. Which action is an example of forward guidance?
 - (A) The Fed announces it expects to keep interest rates near zero for several years
 - (B) The Fed lowers the reserve requirement
 - (C) The Fed sells long-term bonds
 - (D) The Fed raises the discount rate
 - (E) The Fed lends to a failing bank
9. Which of the following would be a result of expansionary monetary policy in a recession?
 - (A) A higher nominal interest rate and leftward AD
 - (B) Lower investment and a lower price level
 - (C) A lower nominal interest rate, higher investment, and rightward AD shift
 - (D) A lower real GDP and lower inflation
 - (E) A higher interest rate and a higher exchange value of the dollar
10. The nominal interest rate is 2% and expected inflation is 5%. Monetary policy is best described as
 - (A) tight, because the nominal rate is positive
 - (B) easy, because the real interest rate is negative
 - (C) tight, because the real rate is 7%
 - (D) neutral, because the nominal rate is low
 - (E) easy, because the nominal rate is below 5%, regardless of the real rate
11. Compared with fiscal policy, an advantage of monetary policy is that it
 - (A) can be changed quickly by the FOMC without legislative approval
 - (B) has no lags
 - (C) directly changes government purchases
 - (D) never causes crowding out or inflation
 - (E) is always more effective in a liquidity trap
12. To increase spending when short-term rates are already near zero, the Fed could
 - (A) raise the discount rate
 - (B) sell securities
 - (C) raise reserve requirements
 - (D) buy long-term securities through quantitative easing
 - (E) raise the federal funds rate target

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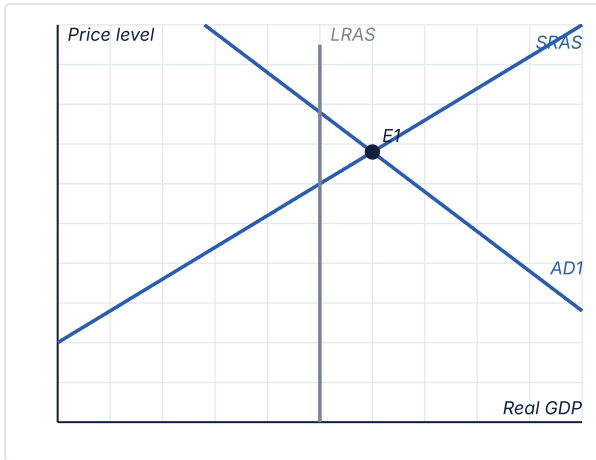
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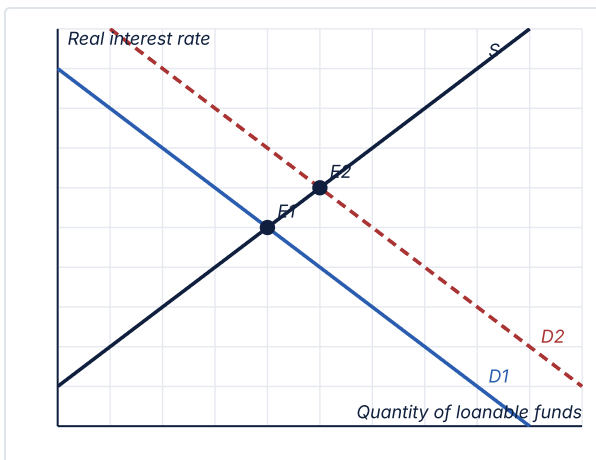
SET C Apply and Extend

Respond in complete sentences. Label graphs fully and show all work.

13. The graph shows an economy producing above full employment. (a) Identify the gap. (b) State the Fed action in the open market, and its effect on the money supply, the nominal interest rate, and investment. (c) Show on the graph what happens to AD, and the effect on real GDP and the price level. (d) State one lag that could weaken the policy.



14. In the loanable funds graph, a larger government deficit shifts demand from D1 to D2. (a) State the effect on the real interest rate and private investment. (b) Explain how the Fed could try to offset the effect on investment and what it risks. (c) In a liquidity trap, why might this offset fail?

**4.8 Multiple-Choice Practice: The Financial Sector**

Twenty AP-style multiple-choice questions on money, banking, the Federal Reserve, interest rates, and the loanable funds market.

Directions: Each question has five choices. Choose the best answer, then read the explanation, which also shows why the most tempting wrong answer fails. Several items use graphs.

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SET A Core Concepts

Choose the best answer. Items with graphs or tables use the data shown.

1. Maria puts part of her paycheck in a drawer to spend on a vacation six months from now. Which function of money does this illustrate?
(A) Medium of exchange (B) Unit of account (C) Liquidity
(D) Store of value (E) Legal tender
2. Which of the following is included in M2 but NOT in M1?
(A) Savings account deposits (B) Coins and paper currency held by the public
(C) Checking account deposits (D) Other checkable deposits
(E) Cash in bank vaults
3. The market interest rate on newly issued bonds rises. Existing bonds with fixed payments will experience
(A) a rise in price (B) a fall in price
(C) no change in price because coupons are fixed (D) a rise in face value
(E) a rise in coupon payments
4. If the required reserve ratio is 20%, the simple money multiplier is
(A) 0.2 (B) 2 (C) 4 (D) 20 (E) 5
5. The Federal Reserve buys government securities from banks. Which of the following is the most likely immediate result?
(A) Bank reserves decrease and the federal funds rate rises
(B) The discount rate rises
(C) Bank reserves increase and the federal funds rate falls
(D) The reserve requirement rises
(E) Government spending increases
6. In the money market, an increase in the price level will cause
(A) the supply of money to increase and the nominal interest rate to fall
(B) the demand for money to decrease and the nominal interest rate to fall
(C) the supply of money to decrease and the nominal interest rate to rise
(D) a movement along the demand curve with no change in the interest rate
(E) the demand for money to increase and the nominal interest rate to rise
7. A larger federal budget deficit financed by selling bonds will, other things equal, cause the real interest rate to
(A) fall, because the supply of loanable funds increases
(B) fall, because the demand for loanable funds decreases
(C) rise, because the supply of loanable funds decreases
(D) rise, because the demand for loanable funds increases
(E) remain unchanged

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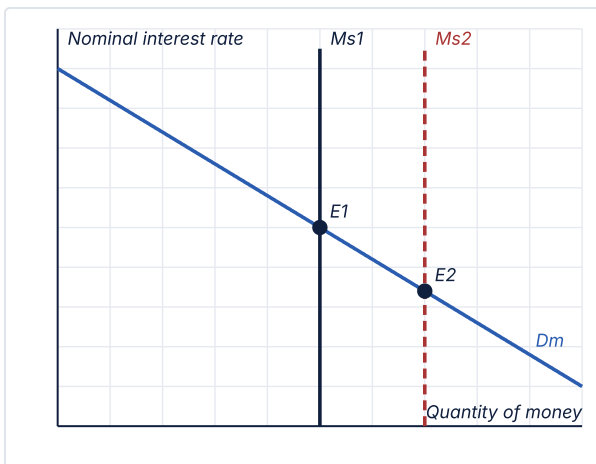
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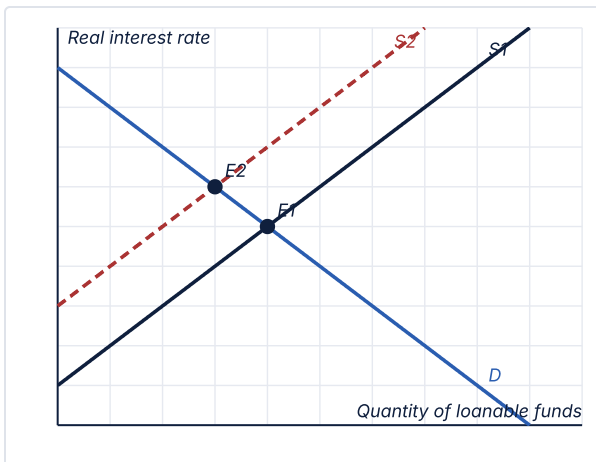
SET B Applications and Data

Choose the best answer. Items with graphs or tables use the data shown.

8. A bank's balance sheet shows checkable deposits of \$400,000 and total reserves of \$90,000. The required reserve ratio is 10%. What is the maximum amount the bank can lend?
 (A) \$ 40,000 (B) \$ 90,000 (C) \$ 50,000 (D) \$ 360,000 (E) \$ 310,000
9. The graph shows a movement from E1 to E2 in the money market. Which of the following best explains it?



- (A) The Fed purchased government securities
 (B) The Fed sold government securities
 (C) The price level fell
 (D) Real GDP increased
 (E) Mobile payments reduced the demand for money
10. A loan has a nominal interest rate of 9%. Expected inflation is 3%, but actual inflation is 5%. The actual real interest rate is
 (A) 6% (B) 2% (C) 3% (D) 14% (E) 4%
11. The graph shows the loanable funds market. The movement from E1 to E2 could be caused by



- (A) an increase in household saving
 (B) a decrease in household saving
 (C) a government budget surplus
 (D) an inflow of foreign savings
 (E) a decrease in the budget deficit
12. The Fed raises the discount rate. Banks respond by borrowing less from the Fed. The most likely effect on the money supply and interest rates is
 (A) a lower money supply and higher interest rates
 (B) a higher money supply and lower interest rates
 (C) a lower money supply and lower interest rates
 (D) a higher money supply and higher interest rates
 (E) no effect on either

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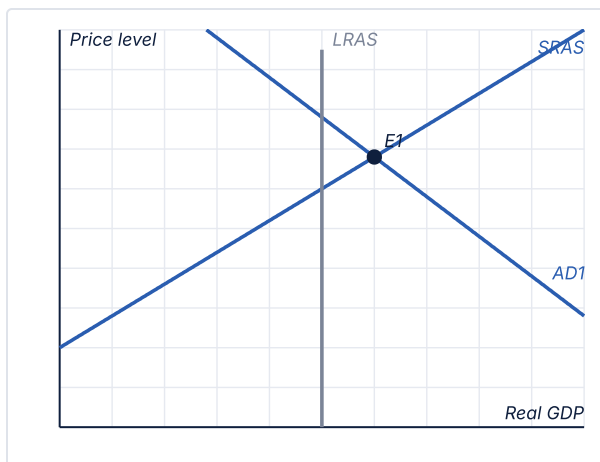
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13. The Fed buys \$40 million in government securities when the required reserve ratio is 20%. The maximum increase in the money supply is
 (A) \$ 8 million (B) \$ 40 million (C) \$ 160 million
 (D) \$ 200 million (E) \$ 800 million
14. A bond promises to pay \$2,000 one year from now. If the market interest rate is 4%, its present value is closest to
 (A) \$ 1,840 (B) \$ 2,000 (C) \$ 1,923 (D) \$ 2,080 (E) \$ 1,960

SET C Exam-Level Stretch

Choose the best answer. Items with graphs or tables use the data shown.

15. Which of the following is the best reason that the FDIC reduces the likelihood of bank runs?
 (A) Banks hold 100 percent reserves
 (B) Depositors know their funds are insured up to a limit
 (C) The FDIC raises the discount rate
 (D) The FDIC prevents banks from lending
 (E) The FDIC sets the federal funds rate
16. The economy is at point E1 in the graph. Which Fed action is most appropriate, and what is the expected result?



- (A) Sell bonds; AD shifts left and the price level falls
 (B) Buy bonds; AD shifts right and output falls
 (C) Sell bonds; AD shifts right and output rises
 (D) Buy bonds; AD shifts left and the price level falls
 (E) Lower the discount rate; AD shifts left
17. Which statement about a liquidity trap is correct?
 (A) Interest rates are very high and savers hold bonds
 (B) Banks lend all of their excess reserves
 (C) Money demand is perfectly inelastic
 (D) Additional money injected by the central bank is held rather than spent, so policy has little effect
 (E) Aggregate demand rises rapidly with each Fed purchase
18. Suppose U.S. interest rates rise relative to those abroad. In the short run, which of the following is most likely?
 (A) Foreign investors buy more U.S. assets, the dollar appreciates, and net exports fall
 (B) Foreign investors sell U.S. assets and the dollar depreciates
 (C) The dollar depreciates and net exports rise
 (D) Net exports rise because imports become cheaper
 (E) The dollar is unaffected because trade is not tied to rates
19. A customer deposits \$5,000 in cash into a bank. The reserve requirement is 10%. Assuming banks lend all excess reserves and all loans are redeposited, the maximum increase in the money supply is
 (A) \$ 4,500 (B) \$ 5,000 (C) \$ 45,000 (D) \$ 50,000 (E) \$ 500

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20. The Fed lowers the interest rate it pays on reserve balances. Compared with before, banks will most likely
- (A) hold more reserves at the Fed and raise market rates
 - (B) reduce loans and raise the federal funds rate
 - (C) hold more cash than before and reduce lending
 - (D) make fewer loans and lower the money supply
 - (E) make more loans, which lowers market interest rates

4.9 Free-Response Practice: The Financial Sector

Four free-response questions on money creation, the money market, open market operations, and loanable funds.

Each question is worth about 5 points. Points are awarded for correct calculations with work shown, correctly labeled graphs, and explanations that name the curve that shifts, the direction, and the result. Use the model answers to check each scoring point.

QUESTION 1 Money creation

Assume the banking system has no excess reserves, the required reserve ratio is 25%, banks lend all excess reserves, and all loans are redeposited in checking accounts. A customer deposits \$20,000 in cash into a checking account at First Bank.

1. (a) Calculate the required reserves and the excess reserves First Bank holds after the deposit.
2. (b) Calculate the simple money multiplier.
3. (c) Calculate the maximum total change in the money supply that can result from the deposit.
4. (d) Explain one reason the actual change in the money supply could be smaller than your answer to (c).

QUESTION 2 The money market

The economy is in a recession. The Federal Reserve decides to use monetary policy to increase real GDP.

5. (a) Draw a correctly labeled graph of the money market, showing the equilibrium nominal interest rate before policy.
6. (b) Show on your graph the effect of the Fed's policy, and state the effect on the nominal interest rate.
7. (c) Explain how the bond market produces the change in the interest rate that you identified in (b).
8. (d) Explain how the change in the interest rate affects aggregate demand and real GDP.

QUESTION 3 Open market operations

Inflation is rising, and the economy is producing above full employment. The required reserve ratio is 10%.

9. (a) Identify an open market operation the Fed should conduct, and state the effect on bank reserves.
10. (b) If the Fed sells \$30 million of securities, calculate the maximum change in the money supply.
11. (c) Explain the effect of the Fed's action on the price of existing bonds and on the federal funds rate.
12. (d) Explain the effect on aggregate demand and the price level.

QUESTION 4 Loanable funds and crowding out

The government passes a large tax cut without reducing spending, increasing the budget deficit. The country's economy is at full employment.

13. (a) Draw a correctly labeled graph of the loanable funds market showing the initial equilibrium real interest rate.
14. (b) Show the effect of the larger deficit and state the effect on the real interest rate.
15. (c) Explain what happens to private investment, and give the name of this effect.
16. (d) Explain one long-run consequence of the change in investment.

Answers Chapter 4: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

4.1 Money, Its Functions, and Measures

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SET A · CHECK YOUR UNDERSTANDING

1. This is the double coincidence of wants problem: a trade only works if each side wants what the other offers. Money solves it because the farmer can sell wheat for money to anyone and then use money to buy shoes from the cobbler. Money serves as the medium of exchange.
2. The unit of account function. Prices are stated in the same unit, so relative values are easy to compare. Without a common unit, a shopper would need a separate exchange rate for every pair of goods.
3. A gold coin is valuable for its metal even if it stopped being money, so it is commodity money. A dollar bill is only paper with little intrinsic value. People accept it because the government declares it legal tender and because they trust others to accept it too.
4. No. A credit card is a way to borrow, not an asset that stores purchasing power. The purchase is paid for later with money from a deposit account, and only that deposit is counted in the money supply.
5. $M1 = 80 + 220 = 300$ billion dollars. $M2 = 300 + 500 + 90 + 110 = 1,000$ billion dollars. Savings, time deposits, and money market funds are in M2 only.
6. Ten-dollar bill, checking balance, savings balance, house. Money must be usable as a medium of exchange at once, so the most liquid assets form M1, near-moneys are added in M2, and illiquid assets like a house are excluded.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Posting prices in dollars is the unit of account function, a common measure for stating value. Saving a paycheck is store of value, and paying cash is medium of exchange. Gold as inflation protection is also store of value, so it is the best distractor.
8. A. M2 adds savings deposits, small time deposits, and retail money market funds to M1. Currency, checking, and other checkable deposits are all already in M1. Cash in bank vaults is not counted in either measure, which makes it the tempting wrong choice.
9. D. Checking is in M1 and savings is not, so M1 rises by \$1,000. Both accounts are inside M2, so M2 does not change. Choosing that both rise forgets that savings leaves M2 as checking enters it.
10. B. Fiat money is valued as a medium of exchange, not for what it is made of. Gold backing describes older representative money. Fiat money can lose value through inflation, so the claim that it always holds value is false.
11. E. Selling a house takes time and involves large costs, so it is far less liquid than the other assets. A CD with a penalty is less liquid than savings, but the loss is small compared to the costs of selling a house.
12. B. Rapid inflation destroys the ability to hold purchasing power (store of value), and sellers who refuse the money show it has stopped being a reliable medium of exchange. Store of value alone ignores the barter evidence.

SET C · APPLY AND EXTEND

13. (a) 1 point: $M1 = 150 + 300 = 450$. 1 point: $M2 = 450 + 700 + 100 + 150 = 1,400$. Vault cash is excluded. (b) 1 point: $M1 = 550$ and $M2 = 1,400$. M1 rises 100 and M2 is unchanged because savings and checking are both in M2. (c) 1 point: M1 contains only assets that can be spent immediately (currency and checkable deposits), while M2 adds savings and time deposits that may require a transfer or a penalty before spending.
14. (a) 1 point: Fiat money, because it has no intrinsic value and is not redeemable in a commodity. (b) 1 point: The store of value weakens. 1 point: Printing too much increases the quantity of money relative to goods, which raises prices and lowers the purchasing power of each unit. (c) 1 point: Limited supply (scarcity) so that the money holds its value. Acceptability would also be correct, since people must continue to trust it.

4.2 Interest Rates, Time Value of Money, and Financial Assets**SET A · CHECK YOUR UNDERSTANDING**

1. Real rate = $9\% - 4\% = 5\%$. The lender expects to gain 5% in purchasing power after inflation.
2. Actual real rate = $6\% - 8\% = -2\%$. The borrower gains because the loan is repaid with dollars that buy less, and the lender loses. The lender expected a real return of 3%.
3. $FV = 100(1.06)^3 = 100(1.191016) = \$119.10$. The extra \$19.10 is interest earned, including interest on earlier interest.
4. Newly issued bonds pay the higher rate, so an old bond with a lower fixed payment is less attractive. Buyers will only purchase it at a lower price, which raises its effective yield to match the market rate.
5. A stock is an ownership share whose return (dividends and capital gains) is uncertain, while a bond is a loan with fixed interest and a promised face value at maturity. Bondholders are paid before stockholders if a firm fails.
6. They pool many small savings into larger loans and they spread risk across many borrowers, so a single default does not wipe out a saver. They also lower the cost of finding and monitoring borrowers.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Real rate = nominal - expected inflation = $8\% - 3\% = 5\%$. Adding the two (11%) reverses the relationship, and 8% is just the nominal rate.
8. D. $PV = 1,100 / 1.10 = \$1,000$. Multiplying by 1.10 (\$1,210) computes a future value, the wrong direction.
9. A. Existing fixed payments are worth less when new bonds pay more, so prices fall. The coupon itself is not reduced, so the last choice misreads the mechanism.
10. E. Investors demand compensation for risk. Stocks outperform on average but not always, so the 'always' claim is false.
11. B. Expected real rate = $5 - 2 = 3\%$. Actual real rate = $5 - 6 = -1\%$. The lender receives 4 points less than expected, and the borrower benefits.
12. D. Mutual funds pool savings and diversify. Creating money through reserves describes commercial banks, and the discount rate is set by the central bank.

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SET C · APPLY AND EXTEND

13. (a) 1 point: $1,060 / 1.06 = \$1,000$. (b) 1 point: $1,060 / 1.08 = \$981.48$. (c) 1 point: $1,060 / 1.04 = \$1,019.23$. 1 point: Bond prices and interest rates move in opposite directions, because the fixed payments are worth more when new bonds pay less.
14. (a) 1 point: X (the savings account), because its dollar value is stable and easy to access. (b) 1 point: Investors need extra compensation, a risk premium, for bearing uncertainty. (c) 1 point: Expected real rate = $10\% - 4\% = 6\%$. 1 point: With 7% inflation the actual real rate is 3%, so the lender is hurt and the borrower benefits.

4.3 Banking and Money Creation**SET A · CHECK YOUR UNDERSTANDING**

- Required reserves = $0.12 \times 500,000 = \$60,000$. The remaining reserves, if any, are excess.
- Multiplier = $1 / 0.25 = 4$. Each dollar of new excess reserves can support up to \$4 of additional money in the banking system if all loans are redeposited.
- Required = $0.10 \times 50,000 = \$5,000$, so excess = $8,000 - 5,000 = \$3,000$. The multiplier is 10, so the maximum increase = $3,000 \times 10 = \$30,000$.
- Assets: reserves rise by \$2,000. Liabilities: checkable deposits rise by \$2,000. Of the new reserves, \$400 are required and \$1,600 are excess and available to lend.
- Banks may keep excess reserves instead of lending, people hold some money as cash instead of redepositing it, and there may not be enough qualified borrowers. Each leakage reduces the amount of new deposits created in each round.
- A bank run is when many depositors try to withdraw at once because they fear losses, which exhausts the bank's reserves since it lends most deposits. Deposit insurance guarantees funds up to a limit, so depositors have no reason to rush.

SET B · EXAM-STYLE MULTIPLE CHOICE

- D. Multiplier = $1 / 0.05 = 20$. Using 5 confuses the ratio with the multiplier.
- A. Required reserves = \$10 million, so excess = $18 - 10 = \$8$ million. The bank cannot lend its required reserves, which is why \$18 million is wrong.
- E. Holding excess reserves leaves less to lend, which breaks the deposit-loan-deposit chain. Lower reserve requirement, Fed purchases, and full redepositing all increase creation.
- A. Assets are $30 + 170 = 200$. Net worth = assets - liabilities = $200 - 180 = \$20$.
- C. Multiplier = 5, and all \$5 million is excess, so $5 \times 5 = \$25$ million. Unlike a cash deposit, a Fed injection of reserves is entirely excess.
- B. With fractional reserves a bank cannot pay all depositors at once. Holding all deposits as reserves would make a run harmless.

SET C · APPLY AND EXTEND

13. (a) 1 point: Required = $0.10 \times 5,000 = 500$, so excess = \$4,500. (b) 1 point: Multiplier = 10. 1 point: $4,500 \times 10 = \$45,000$ maximum increase. (c) 1 point: Banks may hold excess reserves, people may keep some loans as cash, or borrowers may be scarce, any of which reduces new deposits.
14. (a) 1 point: The money supply falls, because withdrawals remove deposits and the added excess reserves mean banks lend less, so the actual multiplier shrinks. (b) 1 point: A bank run. (c) 1 point: Deposit insurance (FDIC) or Federal Reserve lending to banks as lender of last resort reassures depositors or supplies cash.

4.4 The Money Market**SET A · CHECK YOUR UNDERSTANDING**

- The motives are transactions, precautionary, and asset (speculative) demand. Transactions demand depends mainly on nominal GDP, since higher prices or output require more money to carry out purchases.
- The nominal interest rate is the opportunity cost of holding money. At high rates, holding cash gives up more interest, so people hold less money and more bonds. At low rates, people are willing to hold more money.
- The Fed decides the quantity of money, and it does not change automatically when the interest rate changes. So the supply is the same quantity at every interest rate, a vertical line.
- Higher real GDP raises transactions demand, so D_m shifts right. With M_s fixed there is a shortage of money at the old rate, so people sell bonds, bond prices fall, and the nominal interest rate rises.
- The need to hold money for transactions falls, so D_m shifts left. At the old rate there is a surplus of money, so people buy bonds and the nominal interest rate falls.
- There is a surplus of money, because the quantity supplied exceeds the quantity demanded. People use surplus money to buy bonds, raising bond prices and lowering interest rates until the quantity demanded equals the quantity supplied.

SET B · EXAM-STYLE MULTIPLE CHOICE

- A. A leftward M_s shift creates a shortage at the old rate, pushing the rate up. The vertical shape does not mean the rate is fixed; it means the Fed chooses the quantity.
- C. Higher prices raise transactions demand, shifting D_m right. A fall in the interest rate moves you along D_m , which is the best distractor, and mobile payments reduce demand.
- B. D_m shifts left from D_m to D_m' , lowering the interest rate with M_s unchanged. A money supply change would move the vertical line, and it does not here.
- E. The interest rate is the cost of holding non-interest-earning money. The statement about bond prices is reversed, as bond prices fall when rates rise.

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11. A. Surplus money is used to buy bonds, which raises their prices and reduces interest rates. The second choice describes the adjustment from a rate below equilibrium.
12. D. Liquidity preference means people value liquid money, and the interest rate adjusts to equate money demand and money supply. Saving and investment determine the real rate in the loanable funds model, which is a different market.

SET C · APPLY AND EXTEND

13. (a) 1 point: M_s shifts right and the nominal interest rate falls. (b) 1 point: At the old rate there is a surplus of money, so people buy bonds, bond prices rise, and the interest rate falls. (c) 1 point: Higher prices raise transactions demand, shifting D_m right, so the nominal interest rate rises.
14. (a) 1 point: D_{m1} (the lower curve), because lower real GDP lowers transactions demand, shifting D_m left. (b) 1 point: The interest rate falls from the D_{m2} equilibrium to the D_{m1} equilibrium, here 7 to 5 on the axis. (c) 1 point: The Fed would need to decrease the money supply (shift M_s left) to push the rate back up; for this example M_s would move from 5 to 2.5.

4.5 The Federal Reserve and Monetary Policy Tools

SET A · CHECK YOUR UNDERSTANDING

1. The FOMC has 12 voting members: seven governors, the New York Fed president, and four other regional presidents on a rotating basis. Long staggered terms reduce political pressure so the Fed can make decisions that are unpopular in the short run.
2. Maximum employment and stable prices (defined as about 2% inflation). Policy often involves trade-offs between the two goals in the short run.
3. Banks pay with reserves, so reserves fall by \$5 million. The multiplier is 5, so the money supply falls by up to $5 \times 5 = \$25$ million.
4. The federal funds rate is the rate banks charge each other for overnight loans of reserves, and it is the Fed's target. The discount rate is the rate the Fed charges banks that borrow directly from it.
5. The Fed buys securities, so bank reserves rise. The money supply increases and the interest rate falls. Lower rates increase investment and consumption, so AD shifts right and real GDP rises.
6. It could sell securities and raise the interest on reserve balances. Selling securities removes reserves from banks, so there are fewer reserves to lend and the price of borrowing reserves rises.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. Selling securities removes reserves and reduces the money supply. The others are all expansionary.
8. D. The FOMC includes seven governors plus five regional presidents. The Board alone does not vote on OMO, and the executive branch does not direct them.
9. E. Multiplier = $1/0.25 = 4$, and $30 \times 4 = \$120$ million. Choosing \$7.5 million divides by 4 rather than multiplying.
10. A. It is the interbank overnight rate. The rate charged by the Fed to banks is the discount rate, the best distractor.
11. C. Banks earn more by holding reserves, so lending declines and rates rise. This is contractionary, so AD shifts left, not right.
12. A. Each step follows from the previous. The second choice breaks the money-interest link, since more money lowers rates.

SET C · APPLY AND EXTEND

13. (a) 1 point: A recessionary gap (output below full employment). (b) 1 point: The Fed buys government securities, increasing bank reserves, increasing the money supply and lowering the interest rate. (c) 1 point: Investment and consumption rise, so AD shifts right. 1 point: Real GDP rises toward 6 and the price level rises, closing the gap. The graph shows AD shifting right to cross SRAS at the LRAS.
14. (a) 1 point: Banks borrow less from the Fed because it costs more. (b) 1 point: Reserves and lending fall, so the money supply decreases and market rates rise. (c) 1 point: Higher rates reduce investment, AD shifts left, and the price level falls or rises more slowly. (d) 1 point: OMO are flexible, precise, and quickly reversible, and the discount rate is mostly a backup tool.

4.6 Loanable Funds Market

SET A · CHECK YOUR UNDERSTANDING

1. Supply comes from households that save and from foreign investors. Demand comes from businesses borrowing to invest and from the government when it runs a deficit.
2. At a lower real interest rate, borrowing is cheaper, so more investment projects earn enough to cover the cost of funds. The quantity of loanable funds demanded rises as the real rate falls.
3. Government borrowing increases the demand for loanable funds, so the real interest rate rises. The higher rate discourages private borrowing, so private investment falls. This is crowding out.
4. The demand for loanable funds shifts right because firms want to borrow more. With supply unchanged, the real interest rate rises and the quantity of funds lent rises.
5. Set $12 - Q = 2 + Q$, so $2Q = 10$ and $Q = 5$. Then $r = 12 - 5 = 7$. The equilibrium real interest rate is 7% and the quantity of loanable funds is 5.
6. Foreign savers add to the supply of loanable funds, so the supply curve shifts right. The real interest rate falls and the quantity of funds lent rises, which can support more domestic investment.

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SET B · EXAM-STYLE MULTIPLE CHOICE

7. A. The government competes for funds, shifting demand right and raising the real rate. A left shift in supply would also raise the rate, but deficits operate through demand.
9. C. A surplus is public saving, so supply shifts right and the real rate falls. A surplus does not raise demand; it adds to saving, which is why the second choice fails.
11. B. Real = nominal - expected inflation. The sum describes the nominal rate, and the Fed rates are discount and federal funds rates.
8. D. Government borrowing raises the real interest rate, and the higher rate reduces private investment. The other options describe different effects.
10. E. A rightward supply shift lowers the equilibrium real rate. The other changes raise it.
12. A. Supply shifts right, so the real rate falls and the quantity rises along demand. The second choice reverses the shift.

SET C · APPLY AND EXTEND

13. (a) 1 point: Demand for loanable funds shifts right. 1 point: The real interest rate rises and the quantity of funds lent increases. (b) 1 point: Private investment falls because of the higher interest rate (crowding out). (c) 1 point: A smaller capital stock slows long-run economic growth and productivity.
14. (a) 1 point: Demand shifts right, so the real rate rises. (b) 1 point: Supply shifts right, so the real rate falls. (c) 1 point: The quantity of loanable funds rises, because both shifts increase it. 1 point: The rate depends on which shift is larger; demand pushes it up and supply pushes it down.

4.7 Monetary Policy in Practice**SET A · CHECK YOUR UNDERSTANDING**

1. Easy money lowers interest rates and expands the money supply, and is used in a recession. Tight money raises interest rates and slows money growth, and is used when inflation is above target.
2. In the money market, the interest rate is determined by money demand and the money supply. If the Fed fixes the quantity, the rate moves when demand changes. If it fixes the rate, it must change the quantity to offset demand shifts.
3. QE involves much larger purchases of long-term securities, including mortgage-backed securities, used when the policy rate is near zero. An ordinary operation targets short-term rates and is smaller.
4. In a liquidity trap, interest rates are near zero and people hold extra money rather than spend it. Money demand is nearly flat, so more money does not lower the rate further, and AD barely changes.
5. Real rate = $4\% - 6\% = -2\%$. This is easy, since borrowing has a negative real cost and encourages spending.
6. They are recognition, decision, and impact lags. By the time the policy takes effect, the economy may have changed, so the action could worsen the cycle.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. E. When rates are near zero and people hold extra cash, policy has little effect. A bank run is a different problem.
9. C. Easy money lowers rates and stimulates investment. The second choice describes contractionary effects.
11. A. The Fed can act at a meeting, but monetary policy still has impact lags. Fiscal policy often requires Congress.
8. A. Forward guidance is communication about future policy to shape expectations. The others are actual operations.
10. B. Real rate = $2 - 5 = -3\%$, so borrowing is cheap in real terms. The last option has the right label for the wrong reason.
12. D. QE lowers long-term rates when short-term rates cannot fall. The others are contractionary or limited.

SET C · APPLY AND EXTEND

13. (a) 1 point: An inflationary gap (output 6 exceeds full employment 5). (b) 1 point: The Fed sells securities, so the money supply decreases and the nominal interest rate rises, lowering investment. (c) 1 point: AD shifts left, so real GDP falls to 5 and the price level falls (or inflation slows). (d) 1 point: A recognition, decision, or impact lag means the effects may arrive after conditions change.
14. (a) 1 point: The real interest rate rises (5 to 6) and private investment falls (crowding out). (b) 1 point: The Fed could buy securities to increase the money supply and lower the interest rate. 1 point: It risks higher inflation if the economy is near full employment. (c) 1 point: With rates near zero, additional money does not lower rates or raise lending, so policy has little effect.

4.8 Multiple-Choice Practice: The Financial Sector**SET A · CORE CONCEPTS**

1. D. Holding money to spend later is the store of value function. Medium of exchange applies at the time of the purchase, so it is the closest wrong choice.
3. B. Buyers can get higher interest on new bonds, so existing bonds must sell for less. Fixed coupons are the reason the price must adjust, not a reason for no change.
5. C. Buying securities credits banks with reserves, increasing the supply of reserves and lowering the federal funds rate. A reserve decrease is the effect of a sale.
7. D. The government competes with private borrowers, shifting demand right. A fall in supply would also raise the rate but is not the mechanism for deficits.
2. A. Savings deposits are near-moneys added in M2. Vault cash is in neither measure, which is why the last choice fails.
4. E. $1 / 0.20 = 5$. A multiplier of 4 comes from using 25% instead.
6. E. Higher prices raise transactions demand, shifting Dm right. The Fed controls Ms, so the supply shifts are wrong.

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SET B · APPLICATIONS AND DATA

8. C. Required reserves are \$40,000, so excess reserves are $90,000 - 40,000 = \$50,000$. \$40,000 is the required amount, not the excess.
10. E. Actual real rate = $9\% - 5\% = 4\%$. Using expected inflation gives 6%, the rate people anticipated.
12. A. Borrowing from the Fed becomes costly, so reserves and lending fall, tightening policy. The second choice describes an expansion.
14. C. $PV = 2,000 / 1.04 = \$1,923.08$. The \$2,080 choice compounds forward, which is future value.
9. A. The vertical supply curve shifted right, which is an increase in the money supply caused by a Fed purchase. Demand-side causes would shift D_m , which stays fixed here.
11. B. Supply shifts left, raising the real rate and reducing the quantity. Savings increases and surpluses shift supply right.
13. D. The reserves are all excess and the multiplier is 5, so $40 \times 5 = \$200$ million. \$8 million divides by 5 rather than multiplying.

SET C · EXAM-LEVEL STRETCH

15. B. If depositors are protected, they have no reason to rush to withdraw. The Fed, not the FDIC, sets rates, and banks still hold fractional reserves.
16. A. Output exceeds full employment, so the Fed needs contractionary policy: selling bonds raises rates, reduces investment, and shifts AD left. The right-shift choices have the wrong sign for the policy.
17. D. At near-zero rates, people hold money instead of lending, so the money demand curve is nearly flat. High rates are the opposite condition.
18. A. Higher returns attract capital, raising demand for dollars, which appreciates the currency and cuts net exports. The depreciation choices describe the reverse.
19. C. Excess reserves are $5,000 - 500 = \$4,500$; times the multiplier of 10 gives \$45,000. \$50,000 applies the multiplier to the whole deposit and ignores the cash that left circulation.
20. E. Reserves earn less, so lending becomes relatively more attractive and rates fall. Holding more reserves is the opposite response.

4.9 Free-Response Practice: The Financial Sector**QUESTION 1 · MONEY CREATION**

1. (a) 1 point: Required reserves = $0.25 \times 20,000 = \$5,000$. 1 point: Excess reserves = $20,000 - 5,000 = \$15,000$.
3. (c) 1 point: Maximum change = excess reserves $\times$ multiplier = $15,000 \times 4 = \$60,000$ (the \$20,000 of cash left circulation, so total deposits rise by \$80,000 but the net money supply rises by \$60,000).
2. (b) 1 point: Multiplier = $1 / 0.25 = 4$.
4. (d) 1 point: Banks may hold excess reserves instead of lending, people may keep part of their loans as cash instead of depositing it, or too few creditworthy borrowers may exist, any of which reduces the multiplier effect.

QUESTION 2 · THE MONEY MARKET

5. (a) 1 point: Axes labeled nominal interest rate (vertical) and quantity of money (horizontal). 1 point: Downward-sloping money demand, a vertical money supply, and the equilibrium rate labeled where they cross.
6. (b) 1 point: Money supply shifts right (e.g., via open market purchases). 1 point: The nominal interest rate falls.
7. (c) 1 point: At the old rate there is a surplus of money, so people buy bonds, raising bond prices and lowering interest rates until the quantity of money demanded equals the new quantity supplied.
8. (d) 1 point: Lower rates raise investment and interest-sensitive consumption, so AD shifts right and real GDP rises (and the price level rises).

QUESTION 3 · OPEN MARKET OPERATIONS

9. (a) 1 point: The Fed should sell government securities. 1 point: Bank reserves fall.
11. (c) 1 point: Selling bonds lowers their price, which raises interest rates; the federal funds rate rises because reserves are scarcer.
10. (b) 1 point: Multiplier = 10, so the change is $30 \text{ million} \times 10 = \$300$ million decrease in the money supply.
12. (d) 1 point: Higher interest rates reduce investment and consumption, so AD shifts left, reducing real GDP and the price level (or slowing inflation).

QUESTION 4 · LOANABLE FUNDS AND CROWDING OUT

13. (a) 1 point: Axes labeled real interest rate and quantity of loanable funds. 1 point: Downward-sloping demand, upward-sloping supply, and equilibrium labeled.
15. (c) 1 point: Private investment falls, because the higher real rate makes borrowing more expensive; this is crowding out.
14. (b) 1 point: Demand shifts right. 1 point: The real interest rate rises.
16. (d) 1 point: Lower investment slows growth of the capital stock, which lowers long-run productivity and economic growth.

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Chapter 5: Long-Run Consequences of Stabilization Policies.

8 sections with explanations and worked examples, then 120 practice problems. Answers and full explanations are at the end of the chapter.

5.1 Monetary and Fiscal Policy Combinations

Learn how fiscal and monetary actions move interest rates, investment and aggregate demand, and how to follow a policy through three linked graphs.

Stabilization policy means using the government's budget (**fiscal policy**) and the central bank's control of the money supply (**monetary policy**) to steer aggregate demand toward full employment. The two tools work through different channels, and they affect interest rates and investment in opposite ways. To see the long-run consequences you must follow every policy through three linked graphs: the money market, the loanable funds market, and AD-AS.

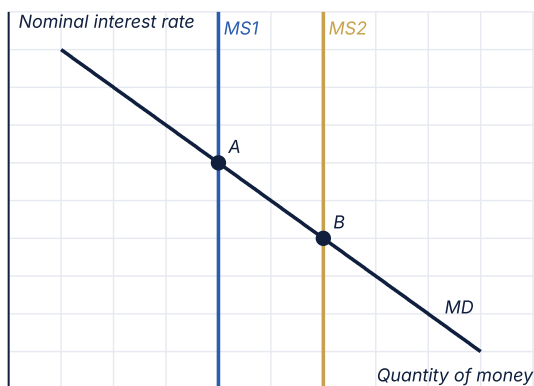
The three-graph rule

Monetary policy starts in the MONEY MARKET (nominal interest rate). Fiscal policy starts in the LOANABLE FUNDS market (real interest rate).

Whatever happens to the interest rate changes investment, and investment is part of AD, so finish in AD-AS.

Expansionary = pushes AD right. Contractionary = pushes AD left.

Monetary policy chain. Suppose the Fed buys bonds (an open market purchase), lowers the discount rate, or lowers reserve requirements. Bank reserves rise, the money supply shifts right, and the nominal interest rate falls along a downward-sloping money demand curve. A lower rate raises interest-sensitive spending (business investment, housing, durable goods). Because lower domestic rates also reduce demand for the currency, the exchange rate depreciates and net exports rise. Aggregate demand shifts right. A contractionary policy reverses every step.

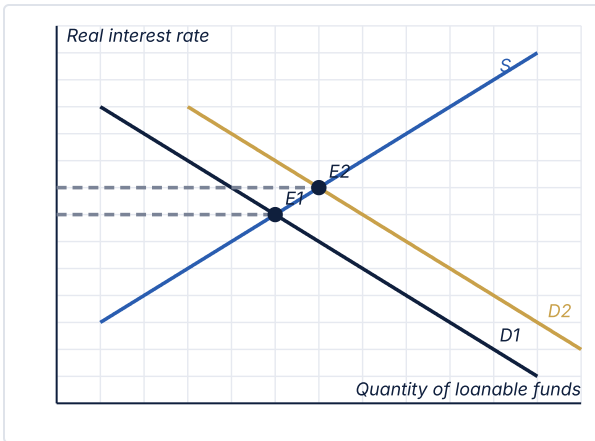


Fiscal policy chain. Suppose Congress raises government spending or cuts taxes without raising other revenue. The deficit grows, so the Treasury sells bonds and competes with private firms for the same pool of savings. In the loanable funds market the demand for loanable funds shifts right, the real interest rate rises, and the quantity of private investment falls. This effect is called **crowding out**. The fiscal stimulus still raises AD (through the spending multiplier), but crowding out shrinks the net effect.

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A larger deficit shifts demand for loanable funds right (D1 to D2): the real interest rate rises and private borrowing is crowded out.

Crowding out

Crowding out: government borrowing raises the real interest rate and reduces private investment (and interest-sensitive consumption).

Effect on AD: net AD change = multiplier $\times$ initial fiscal change, minus the AD lost to the higher interest rate.

Crowding out is smaller when the economy has idle resources and savers are plentiful, and larger near full employment.

Why crowding out matters in the long run. Investment adds to the capital stock, and capital raises long-run aggregate supply. If deficits persistently reduce investment, the economy ends up with less capital and slower growth of potential output than it would otherwise have. Conversely, a policy that lowers real interest rates and raises investment can expand potential output over time. This is the long-run consequence of the policy mix: stabilization policy changes AD in the short run, but its composition (consumption, government spending, or investment) shapes the economy's productive capacity.

Policy mixes. Governments rarely pick one tool alone. The effect of a mix on AD, output and the price level depends on which tool dominates, while the effect on the interest rate depends on how the tools push it.

Fiscal policy	Monetary policy	Effect on AD	Effect on real interest rate	Effect on investment
Expansionary (deficit)	Expansionary	Large increase	Ambiguous (fiscal pushes up, monetary pushes down)	Ambiguous
Expansionary (deficit)	Contractionary	Ambiguous	Rises sharply	Falls (heavy crowding out)
Contractionary (surplus)	Expansionary	Ambiguous	Falls sharply	Rises
Contractionary (surplus)	Contractionary	Large decrease	Ambiguous	Ambiguous

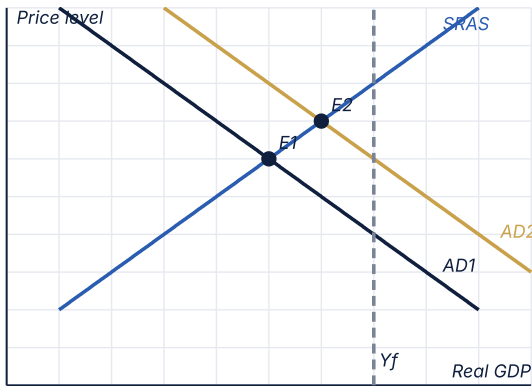
A mix of contractionary fiscal policy and expansionary monetary policy is the classic recipe for reducing a deficit without causing a recession: the lower interest rates keep investment strong while spending is cut. Two expansionary tools together deliver the strongest boost to AD, which suits a deep recession.

Short-run versus long-run results in AD-AS. In a recession the economy sits at a short-run equilibrium to the left of full-employment output (a recessionary gap). If policymakers do nothing, nominal wages eventually fall, SRAS shifts right, and the price level falls back to the long-run equilibrium. If policymakers act, AD shifts right and output returns to full employment faster, at a higher price level than the do-nothing path. If they overshoot, output exceeds potential, an inflationary gap opens, and wages and input prices rise until SRAS shifts left, leaving output at potential but with a higher price level. This is the sense in which AD policies change prices, not long-run output.

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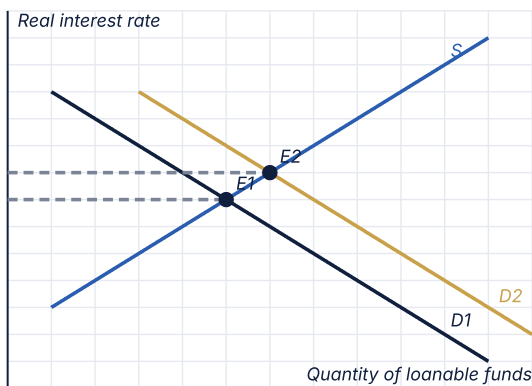
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EXAMPLE 1: FISCAL EXPANSION AND CROWDING OUT

The economy is in a recessionary gap. Congress passes a large tax cut financed by selling bonds. Using the loanable funds graph, explain what happens to the real interest rate and private investment, and what this means for AD.



A larger deficit shifts demand for loanable funds right (D1 to D2): the real interest rate rises and private borrowing is crowded out.

SOLUTION

Step 1: A larger deficit means the government demands more loanable funds, so demand shifts right from D1 to D2.

Step 2: With the supply of savings unchanged, the equilibrium real interest rate rises (from 7 to 8 in the graph) and the quantity of funds lent rises only from 5 to 6, less than the full shift in demand.

Step 3: The higher real interest rate reduces interest-sensitive private investment. That is crowding out.

Step 4: The tax cut raises consumption (AD shifts right) but crowding out partly offsets this, so the AD increase is smaller than the simple multiplier predicts.

EXAMPLE 2: SIZING THE STIMULUS WITH CROWDING OUT

Real GDP is \$80 billion below potential. The MPC is 0.8. Economists estimate that the higher interest rate from borrowing will reduce AD by \$20 billion. By how much must government spending rise to close the gap?

SOLUTION

Step 1: Multiplier = $1/(1 - \text{MPC}) = 1/0.2 = 5$.

Step 2: Needed net change in AD = \$80 billion. Gross change must cover the crowding-out loss: $\$80 + \$20 = \$100$ billion.

Step 3: Government spending increase = $\$100 \text{ billion} / 5 = \$20$ billion.

Step 4: Without the crowding-out estimate, the answer would be \$16 billion ($80/5$), so ignoring crowding out leaves the economy short of full employment.

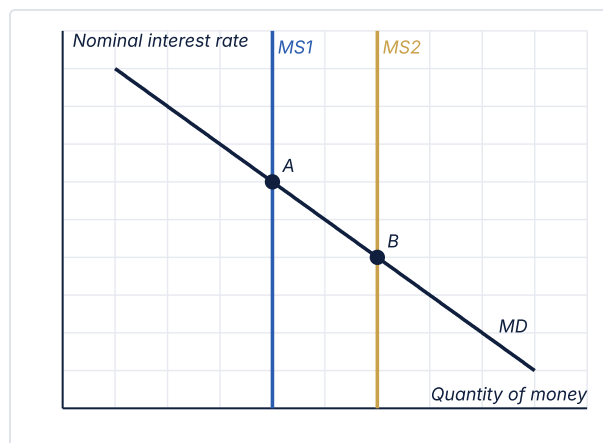
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EXAMPLE 3: FED EASING IN THE MONEY MARKET

The Fed buys government bonds during a recession. Trace the effect through the money market to AD.

**SOLUTION**

Step 1: Open market purchases raise bank reserves, so the money supply shifts right from MS1 to MS2.

Step 2: The nominal interest rate falls from 6 to 4 (point A to B) along money demand.

Step 3: Lower rates increase investment and interest-sensitive consumption, and the dollar depreciates, raising net exports.

Step 4: AD shifts right, so real GDP and the price level rise in the short run.

Common mistakes

(1) Using the money market to analyze a deficit: deficits shift loanable funds demand, not money demand. (2) Saying crowding out means the government spends too much and the multiplier is zero: crowding out only reduces, not eliminates, the effect. (3) Forgetting that expansionary monetary policy lowers the interest rate while expansionary fiscal policy raises it, so a mix has an ambiguous interest rate. (4) Mixing nominal interest rate (money market) with real interest rate (loanable funds), and forgetting to end in AD-AS.

Practice**SET A Check Your Understanding**

Answer each item in a few sentences or with a short calculation.

1. Name the three graphs you should draw to analyze an expansionary open market operation, and state what shifts in each.
2. Define crowding out and state the market in which it is shown.
3. Congress raises taxes and uses the revenue to run a budget surplus. What happens to demand for loanable funds, the real interest rate and investment?
4. The MPC is 0.75 and the government raises spending by \$30 billion. Ignoring crowding out, what is the change in AD? If crowding out removes \$25 billion of AD, what is the net change?
5. A country combines a tax cut with contractionary monetary policy. Predict the direction of the real interest rate and of investment, and explain the effect on AD.
6. Explain why a policy mix of contractionary fiscal and expansionary monetary policy can reduce a deficit without causing a recession.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following is the most direct effect of a larger federal budget deficit financed by borrowing from the public?
- (A) The money supply shifts right
(B) Demand for loanable funds shifts right
(C) Supply of loanable funds shifts right
(D) Money demand shifts left
(E) Long-run aggregate supply shifts right
8. The Fed lowers the discount rate during a recession. Which sequence is correct?
- (A) Money supply falls, interest rate rises, AD falls
(B) Money supply rises, interest rate falls, investment rises, AD rises
(C) Money supply rises, interest rate rises, AD rises
(D) Money demand rises, interest rate rises, investment rises
(E) Money supply rises, interest rate falls, SRAS shifts right
9. Expansionary fiscal policy and expansionary monetary policy are used together. What happens to AD and the interest rate?
- (A) AD rises; the interest rate change is ambiguous
(B) AD rises; the interest rate definitely rises
(C) AD rises; the interest rate definitely falls
(D) AD is ambiguous; the interest rate definitely falls
(E) AD falls; the interest rate rises
10. Compared with a case with no crowding out, crowding out causes the effect of a tax cut on real GDP to be
- (A) larger because investment rises
(B) smaller because the interest rate rises
(C) unchanged because taxes affect only consumption
(D) larger because the multiplier increases
(E) smaller because the money supply falls
11. Which policy mix is most likely to increase private investment?
- (A) Higher government spending and tighter money
(B) Tax cut and tighter money
(C) Government surplus and an expansionary monetary policy
(D) Higher government spending and an expansionary monetary policy
(E) Tax cut and no change in monetary policy
12. In the long run, persistent crowding out of private investment is most likely to
- (A) reduce the capital stock and slow growth of potential GDP
(B) raise the natural rate of unemployment immediately
(C) shift the long-run Phillips curve left
(D) increase the supply of loanable funds
(E) raise the money supply

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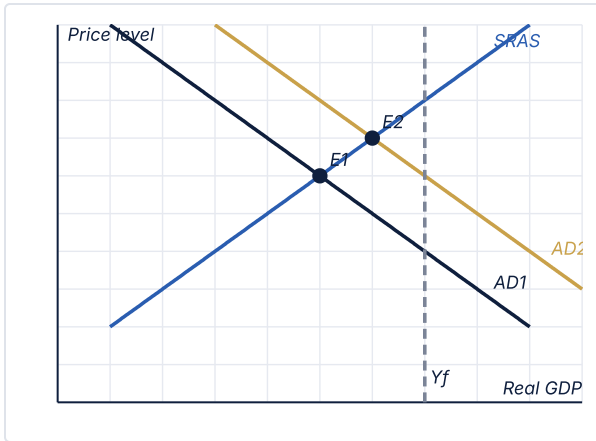
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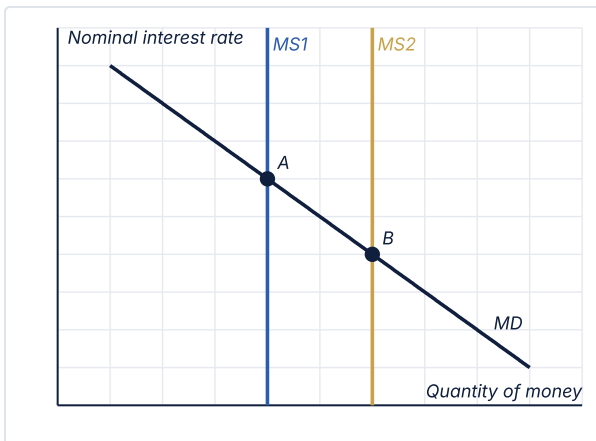
SET C Apply and Extend

Answer fully, labeling any graph you draw. Model responses show scoring points.

13. The economy is in a recessionary gap. (a) Draw an AD-AS graph showing the short-run equilibrium and the full-employment output. (b) Congress increases government spending financed by borrowing. Show the effect on AD and label the new equilibrium. (b2) Draw the loanable funds market showing the effect on the real interest rate. (c) Explain why the increase in AD is smaller than the simple multiplier predicts.



14. Starting with output at potential, the Fed lowers reserve requirements and the government simultaneously passes a balanced-budget tax cut offset by lower government spending (no change in the deficit). (a) Draw and label the money market effect. (b) Explain the effect on AD. (c) Explain whether crowding out occurs and why.

**5.2** The Phillips Curve

Understand the short-run trade-off between unemployment and inflation, why it disappears in the long run, and what shifts the curve.

The **Phillips curve** shows the relationship between the unemployment rate and the inflation rate. It is the AD-AS model translated into rates: instead of real GDP on the horizontal axis and the price level on the vertical, we plot unemployment and the inflation rate. Because output and unemployment move in opposite directions (Okun's law), and the price level and inflation move together, the two models tell the same story from different angles.

Short-run Phillips curve (SRPC)

The SRPC slopes DOWN: lower unemployment goes with higher inflation, and higher unemployment goes with lower inflation.

Moving along the SRPC is caused by a shift of AD. AD right: unemployment down, inflation up. AD left: unemployment up, inflation down.

Each SRPC is drawn for a given expected inflation rate and given SRAS.

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The short-run trade-off. In the 1960s policymakers treated the SRPC as a menu: accept more inflation and you can have lower unemployment. The logic matches the upward-sloping SRAS curve. When AD increases, firms raise output and hire more workers (unemployment falls) while the price level rises (inflation). When AD decreases, output falls, unemployment rises, and inflation slows. In a deep recession the inflation rate can drop sharply or even become negative (deflation).

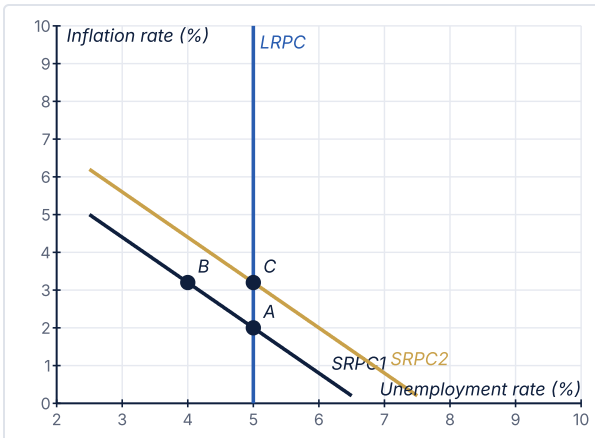
The long run: no trade-off. In the long run the economy produces at full-employment output, and unemployment equals the **natural rate of unemployment** (frictional plus structural unemployment, with cyclical unemployment equal to zero). Long-run aggregate supply is vertical at potential output, so changes in AD change the price level but not output. The matching **long-run Phillips curve (LRPC)** is a vertical line at the natural rate. Any inflation rate is consistent with the natural rate, so monetary and fiscal policy cannot permanently lower unemployment below it by accepting more inflation.

Long-run Phillips curve (LRPC)

Vertical at the natural rate of unemployment, matching vertical LRAS.

Shifts when the natural rate changes (for example, due to labor market institutions or demographics), the same way LRAS shifts when potential output changes.

Friedman: there is a temporary trade-off but no permanent trade-off.



Natural rate of unemployment = 5%. A to B: AD increase moves up the SRPC1. B to C: expected inflation rises, SRPC shifts up to SRPC2, and unemployment returns to 5% at higher inflation.

Expectations and shifts of the SRPC. Workers and firms set wages and prices based on the inflation they expect. Suppose the central bank pushes unemployment below the natural rate. Inflation rises above what people expected, so real wages fall and firms hire more. Once workers see the higher inflation, they negotiate higher nominal wages. SRAS shifts left, output returns to potential, and unemployment returns to the natural rate, but now at a higher inflation rate. The SRPC has shifted up. Under **adaptive expectations** people form expectations from recent past inflation, so adjustment is gradual and the SRPC shifts step by step. Under **rational expectations** people use all available information, so adjustment can be rapid and the trade-off may vanish almost at once if the policy is anticipated.

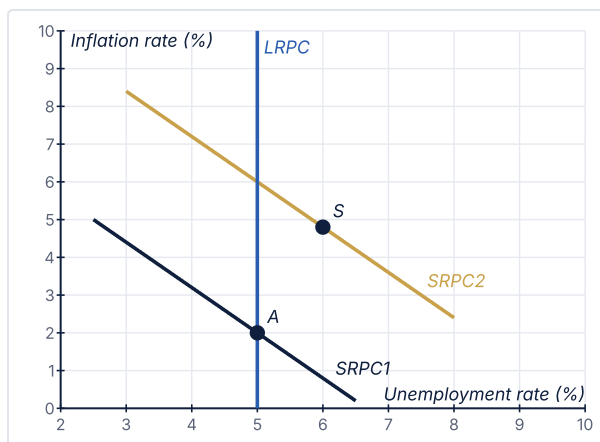
Cause	Effect on SRAS / AD	Effect on SRPC
Higher expected inflation	SRAS shifts left (higher wage demands)	SRPC shifts up/right
Lower expected inflation	SRAS shifts right	SRPC shifts down/left
Negative supply shock (oil price rise)	SRAS shifts left	SRPC shifts up/right: stagflation
Positive supply shock or productivity gain	SRAS shifts right	SRPC shifts down/left
Change in AD	AD shifts	Movement ALONG the SRPC
Natural rate of unemployment changes	LRAS shifts	LRPC shifts

Supply shocks and stagflation. The oil price increases of the 1970s raised production costs, shifting SRAS left. Output fell (unemployment rose) and the price level rose (inflation rose) at the same time. This is **stagflation**, which a stable downward-sloping Phillips curve cannot explain. In Phillips curve terms the entire SRPC shifted up and to the right. Keynesian demand management faces a dilemma during stagflation: boosting AD fights unemployment but worsens inflation, while cutting AD does the reverse.

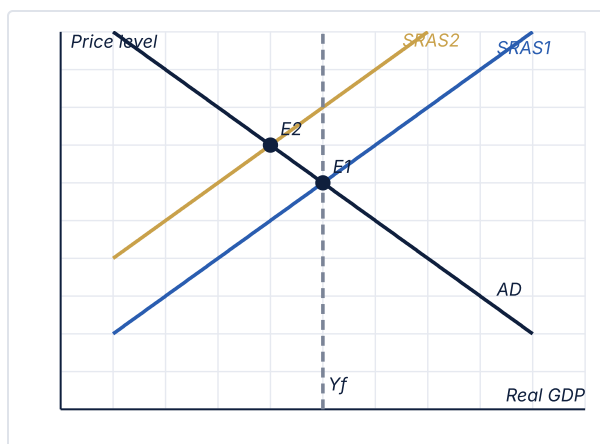
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Disinflation and its costs. Disinflation is a fall in the inflation rate (prices still rise, just more slowly), not a fall in the price level. To bring down inflation, a central bank can tighten money and shift AD left, moving down the SRPC along higher unemployment. If people's expectations of inflation are slow to fall (adaptive), the economy must tolerate a long period of unemployment above the natural rate before expected inflation falls and the SRPC shifts down. Credible policy that lowers expectations quickly makes disinflation cheaper. Early 1980s U.S. policy is the standard example: inflation fell substantially but with severe recession.



The AD-AS graph above shows the same supply shock: SRAS shifts left from SRAS1 to SRAS2, so real GDP falls below Y_f and the price level rises from E_1 to E_2 .

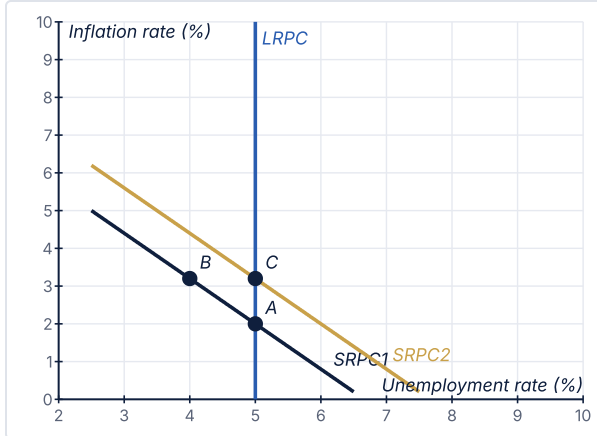
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EXAMPLE 1: OVERHEATING AND THE SRPC

The economy is at point A (natural rate 5%, inflation 2%). The central bank expands the money supply and unemployment falls to 4% with inflation at 3.2%. If the bank keeps unemployment at 4% over time, what happens? Use the graph.



Natural rate of unemployment = 5%. A to B: AD increase moves up the SRPC1. B to C: expected inflation rises, SRPC shifts up to SRPC2, and unemployment returns to 5% at higher inflation.

SOLUTION

Step 1: The AD increase moves the economy from A to B along SRPC1.

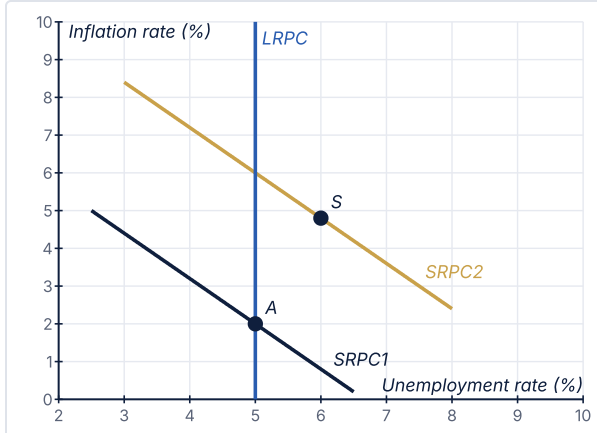
Step 2: Actual inflation (3.2%) exceeds expected inflation (2%). Workers revise expectations upward, demanding higher wages.

Step 3: SRAS shifts left, SRPC1 shifts up to SRPC2, and unemployment returns to 5% at point C with inflation of 3.2%.

Step 4: To hold unemployment at 4%, the bank must keep increasing AD, so inflation keeps accelerating: no long-run trade-off.

EXAMPLE 2: A NEGATIVE SUPPLY SHOCK

An embargo raises oil prices. Describe the effect on the AD-AS equilibrium and the Phillips curve, and say why the policy response is difficult.

**SOLUTION**

Step 1: Higher input costs shift SRAS left. Output falls below potential and the price level rises.

Step 2: Unemployment rises above 5% and inflation rises, so the economy moves from A to S, on a new, higher SRPC2.

Step 3: Expansionary policy would lower unemployment but raise inflation further; contractionary policy would lower inflation but deepen the recession.

Step 4: If policymakers do nothing, wages fall due to high unemployment, SRAS shifts back right, and the economy returns to A.

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EXAMPLE 3: MOVING ALONG OR SHIFTING?

For each event decide whether it moves the economy along the SRPC or shifts it. (i) Government spending cut shifts AD left. (ii) Workers expect higher inflation. (iii) Productivity growth speeds up.

SOLUTION

- (i) Along the SRPC: unemployment rises and inflation falls because the cause is an AD shift.
(ii) The SRPC shifts up/right: higher expected inflation raises wage demands and shifts SRAS left.
(iii) The SRPC shifts down/left: SRAS shifts right, so both unemployment and inflation can fall together (and LRAS shifts right if potential output rises).

Common mistakes

(1) Saying the LRPC is horizontal: it is vertical at the natural rate. (2) Confusing disinflation (slower inflation) with deflation (falling prices). (3) Treating any rise in inflation as a shift of the SRPC: if AD caused it, it is a movement along the curve. (4) Forgetting that expectations shift the SRPC but not the LRPC. (5) Placing the LRPC at zero unemployment: the natural rate is positive.

Practice**SET A Check Your Understanding**

Answer each item in a few sentences or with a short calculation.

1. State the slope of the SRPC and the slope of the LRPC, and explain each in terms of AD-AS.
2. The natural rate of unemployment is 5% and actual unemployment is 6.5%. In what direction will AD policy move inflation, and what type of unemployment accounts for the 1.5 points above 5%?
3. Explain how an increase in expected inflation affects the SRPC and the LRPC.
4. Define stagflation and explain which curve shifts in the AD-AS and Phillips curve models during a negative supply shock.
5. Distinguish adaptive from rational expectations and explain which implies a costlier disinflation.
6. An economy moves from point ($u = 5\%$, inflation = 2%) to ($u = 4\%$, inflation = 3.2%). Calculate the slope of the SRPC and use it to predict inflation when $u = 3\%$.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following events shifts the short-run Phillips curve to the right?
(A) A decrease in government spending
(B) An increase in the money supply
(C) An increase in expected inflation
(D) A decrease in the natural rate of unemployment
(E) A rise in the reserve requirement
8. A rise in the price of imported oil will most likely cause
(A) a movement down along the SRPC
(B) a vertical shift of the LRPC
(C) the SRPC to shift outward
(D) a decrease in both inflation and unemployment
(E) a decrease in expected inflation
9. The long-run Phillips curve is vertical at the natural rate of unemployment because in the long run
(A) wages and prices adjust, so output returns to potential regardless of the inflation rate
(B) inflation is always zero
(C) unemployment cannot change
(D) the Fed controls unemployment
(E) firms never change employment

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10. Starting from long-run equilibrium, the central bank conducts a contractionary policy. In the short run the economy moves
- (A) up the SRPC to lower unemployment
 - (B) down the SRPC to higher unemployment and lower inflation
 - (C) right along the LRPC
 - (D) along the LRPC to a lower natural rate
 - (E) to the left of the LRPC with higher inflation
11. Which of the following would shift the long-run Phillips curve to the left?
- (A) Higher expected inflation
 - (B) A decrease in the natural rate of unemployment
 - (C) A decrease in AD
 - (D) An increase in oil prices
 - (E) An increase in the money supply
12. Disinflation differs from deflation because disinflation is
- (A) a fall in the price level
 - (B) a decrease in the rate of inflation while prices continue to rise
 - (C) a rise in the unemployment rate
 - (D) a shift of the LRPC
 - (E) an increase in real wages

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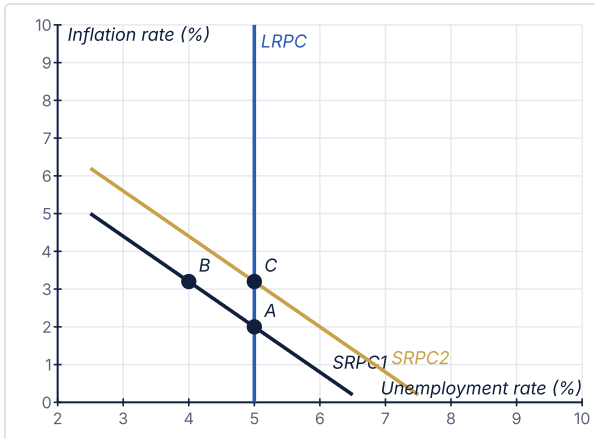
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SET C Apply and Extend

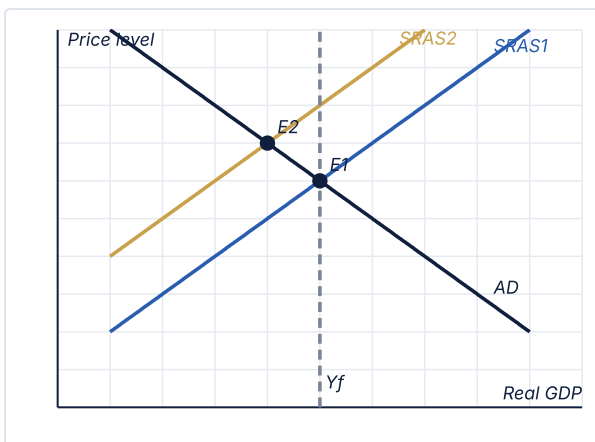
Answer fully, labeling any graph you draw. Model responses show scoring points.

13. The economy is in long-run equilibrium with a natural rate of 5% and inflation of 2%. (a) Draw the SRPC and LRPC and label the initial point. (b) Show the effect of an unexpected expansionary monetary policy, in the short run. (c) Show and explain what happens in the long run if the Fed does not change policy further. (d) Explain what would happen if the Fed tried to keep unemployment at the new low level.



Natural rate of unemployment = 5%. A to B: AD increase moves up the SRPC1. B to C: expected inflation rises, SRPC shifts up to SRPC2, and unemployment returns to 5% at higher inflation.

14. A negative supply shock hits an economy at full employment. (a) On an AD-AS graph, show the short-run result. (b) State the effect on unemployment and inflation. (c) On a Phillips curve graph, show what shifts. (d) Explain what policymakers face and what happens if they do nothing.

**5.3 Government Deficits, Debt, and Crowding Out**

Distinguish the deficit from the debt, measure the debt burden, and analyze crowding out and Ricardian offsets in the loanable funds market.

When the government spends more than it collects in taxes, it runs a budget deficit and must borrow. Understanding the difference between a flow (the deficit) and a stock (the debt), and how borrowing interacts with the loanable funds market, is central to evaluating fiscal policy over the long run.

Deficit versus debt

Budget deficit (a flow, per year) = government spending - tax revenue in that year. A surplus is the opposite (revenue greater than spending).

National debt (a stock) = the total of past deficits minus past surpluses: all Treasury bonds outstanding.

A deficit adds to the debt; a surplus reduces it. A smaller deficit still adds to the debt.

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The deficit changes with the business cycle even without any policy change. In a recession tax revenue falls (income and profits fall) and transfer payments such as unemployment benefits rise through the **automatic stabilizers**, so the deficit grows. In an expansion the reverse happens. Economists therefore separate the **cyclical deficit** from the **structural deficit**, the part that would remain at full employment. Wars and recessions have produced the largest peacetime and wartime deficits in U.S. history, and the deficit swung from deep deficits in the early 1990s to surpluses in 1998 to 2001, before large deficits returned.

Measuring the debt. The raw dollar debt is a poor measure because the economy grows and prices rise. The better measure is the **debt-to-GDP ratio**: debt divided by nominal GDP. The ratio rises when the debt grows faster than GDP and falls when GDP grows faster than the debt. This is why a country can run deficits for years and still see its ratio fall: from the 1950s to the 1970s the U.S. ran small deficits while nominal GDP grew faster than debt. Another useful measure is the cost of **interest payments** as a share of the budget or of GDP, which depends on both the size of the debt and interest rates.

Measure	What it tells you	Moves when
Deficit (\$ and % of GDP)	Borrowing in one year	Spending, taxes, business cycle change
Debt (\$)	Total owed from past borrowing	Deficits and surpluses accumulate
Debt/GDP	Debt burden relative to ability to pay	Debt or nominal GDP changes
Interest/GDP	Cost of servicing the debt	Debt size or interest rates change

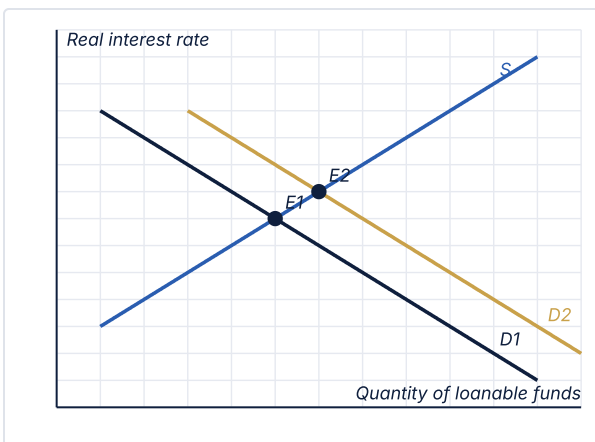
Who holds the debt? The debt is owed both to domestic holders (households, banks, the Federal Reserve, government trust funds such as Social Security) and to foreign holders. Debt owed to domestic holders is partly a transfer within the country: interest paid is income for domestic bondholders. Debt held by foreigners requires a transfer of resources abroad, because interest flows out of the country, though foreign lending also adds to the funds available for investment at home.

Crowding out in the loanable funds market

Deficit finance: government demand for loanable funds shifts right.

Result: higher real interest rate, lower private investment, less capital for the future, lower long-run growth of potential GDP.

Mitigation: a recession with idle savings, foreign capital inflows, or a central bank holding rates down.



Government deficit: demand for loanable funds rises (D1 to D2), raising the real rate from 7 to 8 and crowding out private investment.

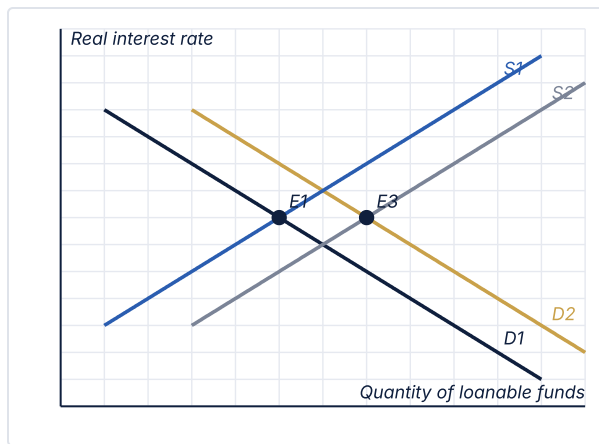
The burden on future generations. A debt can burden the future in several ways. First, interest payments must be financed by taxes or by more borrowing, which may force higher taxes or lower spending on other programs. Second, if deficits crowd out investment, the next generation inherits less capital and lower productive capacity. Third, high debt reduces the government's flexibility to respond to future emergencies. However, borrowing that finances productive investment (education, infrastructure, research) can raise future output enough to offset these costs, and debt used to escape a deep recession can raise the incomes of the same generation that borrowed. The size of the burden depends on what the borrowing buys and on whether the debt is growing faster than the economy.

Ricardian equivalence. Some economists argue that the crowding out effect is weaker than the simple graph suggests. If households realize that today's deficit means higher taxes tomorrow, they save more today in order to pay those taxes. Private saving rises by the amount of the deficit, shifting the supply of loanable funds right, and the real interest rate does not change. In the extreme **Ricardian** case, the method of financing (tax or debt) does not matter. Most evidence suggests the offset is partial: households are not fully forward looking and many are borrowing constrained.

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Ricardian case: private saving rises ($S1$ to $S2$) as much as the deficit, so the real interest rate stays at 7.

EXAMPLE 1: DEBT-TO-GDP ARITHMETIC

A country has debt of \$20 trillion and nominal GDP of \$25 trillion. It runs a \$1 trillion deficit and nominal GDP grows 4%. Find the debt-to-GDP ratio before and after, and explain what happened.

SOLUTION

Step 1: Initial ratio = $20/25 = 0.80$, or 80%.

Step 2: New debt = $20 + 1 = \$21$ trillion. New GDP = $25 \times 1.04 = \$26$ trillion.

Step 3: New ratio = $21/26 = 0.808$, or about 80.8%.

Step 4: The ratio rose slightly: the debt grew by 5%, faster than the 4% GDP growth. If the deficit had been \$0.5 trillion, debt would have grown 2.5% and the ratio would have fallen even though a deficit existed.

EXAMPLE 2: INTEREST BURDEN

The debt is \$20 trillion, the average interest rate on it is 3%, and GDP is \$25 trillion. Compute annual interest payments as a share of GDP, then repeat if the average rate rises to 5%.

SOLUTION

Step 1: Interest = $0.03 \times 20 = \$0.6$ trillion; share of GDP = $0.6/25 = 2.4\%$.

Step 2: At 5%, interest = $0.05 \times 20 = \$1.0$ trillion; share of GDP = $1/25 = 4.0\%$.

Step 3: The same debt costs 1.6 percentage points of GDP more, which must come from higher taxes, lower spending or more borrowing. Debt is more dangerous when interest rates rise.

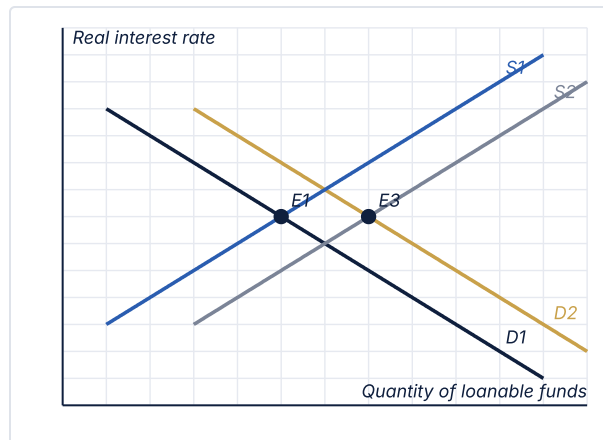
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EXAMPLE 3: DEFICIT WITH AND WITHOUT RICARDIAN BEHAVIOR

In the loanable funds market the demand for funds shifts right by 2 units because of a deficit. Compare the outcomes when households do not change saving and when they save 2 more units.



Ricardian case: private saving rises ($S1$ to $S2$) as much as the deficit, so the real interest rate stays at 7.

SOLUTION

Step 1: No change in saving ($E1$ to $E2$ in the first graph): the real interest rate rises from 7 to 8 and total funds lent rise only from 5 to 6, so private investment falls from 5 to 4 (government takes 2 of the 6).

Step 2: Full Ricardian response ($E1$ to $E3$): supply shifts right by 2 as well. The interest rate stays 7 and total funds lent rise from 5 to 7.

Step 3: Private investment remains $7 - 2 = 5$, unchanged, so there is no crowding out.

Step 4: Real-world behavior lies between these polar cases.

Common mistakes

(1) Confusing deficit and debt: a surplus is needed to reduce the debt; a smaller deficit only slows its growth. (2) Assuming debt in dollars rising means the burden is rising: check debt/GDP. (3) Saying crowding out always occurs in a recession: with idle savings it may be small. (4) Treating government debt as an asset of the household sector; in a closed economy interest is partly a transfer. (5) Drawing a deficit as a shift of the supply of loanable funds: deficit spending raises demand (or lowers public saving).

Practice**SET A Check Your Understanding**

Answer each item in a few sentences or with a short calculation.

1. A government collects \$3.0 trillion in taxes and spends \$3.8 trillion in a year. State the deficit, and say what happens to the national debt.
2. Explain why the debt-to-GDP ratio can fall in a year when the government runs a deficit.
3. Draw or describe the loanable funds effect of a larger deficit and name the result for private investment.
4. Debt is \$12 trillion, GDP is \$16 trillion, and the average interest rate is 2.5%. Calculate debt/GDP and interest as a percent of GDP.
5. Explain Ricardian equivalence and how it changes the crowding out prediction.
6. Give two ways the national debt can burden future generations and one reason the burden might be small.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following is a correct statement about the budget deficit and the national debt?
 - (A) The deficit is the sum of all past debts
 - (B) A budget surplus reduces the national debt
 - (C) The debt falls whenever the deficit falls
 - (D) The deficit is a stock and the debt is a flow
 - (E) A deficit has no effect on the debt
8. Deficit spending financed by borrowing in a closed economy, with no change in saving behavior, most likely causes
 - (A) a decrease in the real interest rate
 - (B) a decrease in private investment
 - (C) an increase in the supply of loanable funds
 - (D) an increase in net exports
 - (E) a decrease in the demand for loanable funds
9. The debt-to-GDP ratio will decline over time if
 - (A) the deficit is positive
 - (B) nominal GDP grows faster than the debt
 - (C) interest rates rise
 - (D) the debt is held by foreigners
 - (E) the government cuts taxes
10. Under Ricardian equivalence, a tax cut financed by government borrowing will
 - (A) raise the real interest rate substantially
 - (B) raise private saving, leaving the interest rate and investment unchanged
 - (C) raise consumption by the full amount of the tax cut
 - (D) decrease the debt
 - (E) raise the money supply
11. Which factor would most increase the burden of a given national debt?
 - (A) A fall in interest rates
 - (B) Faster growth of real GDP
 - (C) A rise in the interest rate the government must pay
 - (D) Use of the borrowing to build productive infrastructure
 - (E) A decline in the deficit
12. During a severe recession the federal deficit increases even without any new law. This is mainly due to
 - (A) discretionary fiscal policy
 - (B) automatic stabilizers
 - (C) crowding out
 - (D) Ricardian behavior
 - (E) a rise in the money supply

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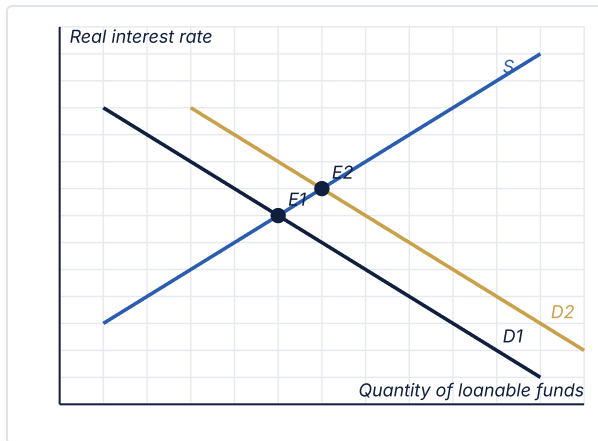
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SET C Apply and Extend

Answer fully, labeling any graph you draw. Model responses show scoring points.

13. Use the loanable funds graph. (a) Show the effect of a larger government deficit on the real interest rate and on the quantity of private investment. (b) Explain how this affects potential GDP in the long run. (c) Suppose households anticipate higher taxes and save more. Show and explain how this changes the result of (a).



Government deficit: demand for loanable funds rises ($D1$ to $D2$), raising the real rate from 7 to 8 and crowding out private investment.

14. A country's debt is \$30 trillion and nominal GDP is \$20 trillion. (a) Calculate debt/GDP. (b) If the government runs a \$1.2 trillion deficit and nominal GDP grows 3%, calculate the new ratio and state whether it rose or fell. (c) Explain what would happen to interest payments if interest rates rise and give one policy that reduces the burden of the debt.

5.4 Economic Growth and Productivity

Identify the sources of economic growth, calculate growth and doubling times, and show growth on the PPC and AD-AS graphs.

Economic growth is a sustained increase in an economy's output over time, usually measured as the percentage change in real GDP or, for living standards, in real GDP per capita. Short-run stabilization policy manages the business cycle; growth determines how well off people are over decades. Because growth compounds, a small difference in the growth rate produces a very large difference in income.

Growth rate and the Rule of 70

Growth rate (%) = $(\text{new real GDP} - \text{old real GDP}) / \text{old real GDP} \times 100$.

Rule of 70: years to double = $70 / \text{annual growth rate (\%)}$.

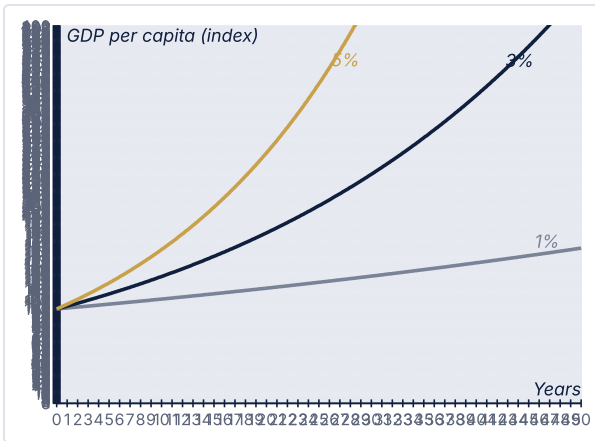
Compounding: GDP after n years = $\text{GDP today} \times (1 + g)^n$, where g is the growth rate as a decimal.

At 1% growth, income doubles in about 70 years; at 2% it takes 35 years; at 3.5% it takes 20 years. A country growing at 5% for 50 years ends up with income about 11 times higher, while a 1% grower ends up only 64% higher. This is why economists regard growth as the most important long-run issue.

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Compounding: small growth-rate differences become huge gaps over decades (index = 100 at year 0).

What produces growth? Real output rises when an economy has more inputs or uses inputs more effectively. Economists organize the sources into four groups, which are the determinants of long-run aggregate supply:

- ◆ **Physical capital:** factories, machinery, equipment and infrastructure. More capital per worker (capital deepening) or better-quality capital raises productivity. It requires investment, which is financed by saving.
- ◆ **Human capital:** the knowledge, skills and health of workers, built through education, training and experience. A better educated workforce can use more advanced capital.
- ◆ **Technology** (technological progress): new products, better production methods and better ways to organize work. Growth accounting studies find technology to be the largest single contributor to growth in advanced economies, because it makes all other inputs more productive and avoids diminishing returns.
- ◆ **Natural resources and labor force growth:** more or better land, minerals and energy, and a larger working-age population or higher labor force participation, raise total output, but growth in GDP per person requires productivity gains.

Productivity

Labor productivity = real GDP / total hours worked (output per worker or per hour).

Rising productivity is the key to rising real wages and GDP per capita over the long run.

Growth in GDP per capita = productivity growth, adjusted for changes in hours worked per person.

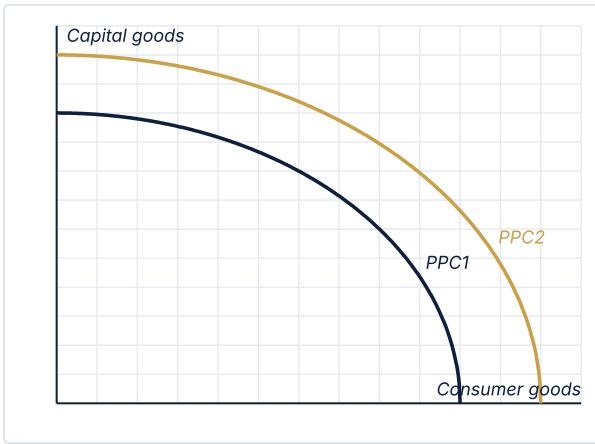
Institutions matter too. Secure property rights, an honest legal system, stable money, political stability, open trade and competitive markets give people and firms the incentive to invest, learn and innovate. Countries with the same resources can grow at very different speeds because of institutions. Low-income countries often have an advantage called **convergence**: because their capital is scarce, each new machine adds a lot, and they can adopt technology already invented, so they may grow faster than rich countries if institutions allow.

Showing growth with graphs. Economic growth appears in three equivalent ways. On the production possibilities curve, growth is an outward shift: society can produce more of both goods. On the AD-AS graph, it is a rightward shift of long-run aggregate supply (LRAS), and short-run supply shifts with it. In the Phillips curve model, a rightward shift of LRAS does not itself change the natural rate of unemployment, though improved labor market institutions can shift the LRPC left. Growth does not require continuous inflation: if AD is unchanged, growth lowers the price level.

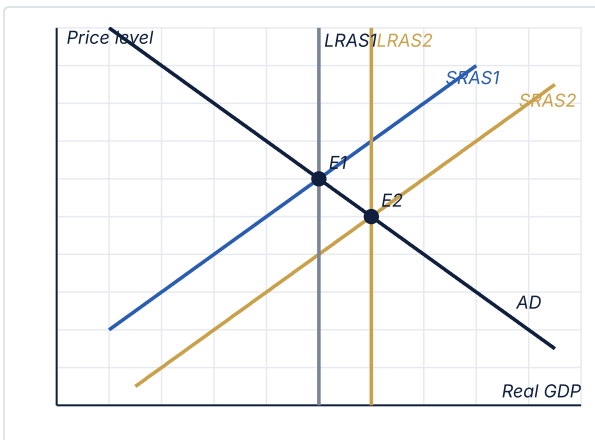
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Economic growth shifts the PPC outward. More capital goods today allow a larger PPC tomorrow.



Growth: LRAS shifts right (potential output rises), SRAS shifts right with it, and the price level falls if AD is unchanged.

Growth policy	Mechanism	Possible cost or trade-off
Subsidize education and training	Raises human capital and productivity	Budget cost, long lag
Investment tax credits, lower interest rates, more national saving	More physical capital per worker	Lower current consumption, possible deficit
Research and development funding, patents	Faster technology	Costs now, benefits later; monopoly power from patents
Protect property rights, free trade, stable money	Better incentives and lower risk	Adjustment costs for displaced workers
Infrastructure spending	Lowers firms' costs, raises capital	May crowd out private investment if debt-financed

Growth has an **opportunity cost**: to build capital, society must give up some current consumption (movement along the PPC toward capital goods). Countries that invest a larger share of output usually grow faster. Growth also brings possible drawbacks, such as environmental damage, resource depletion and income inequality, which is why growth is a goal weighed against others.

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EXAMPLE 1: RULE OF 70 AND COMPOUNDING

Real GDP per capita grows 2.5% per year in Country X and 5% per year in Country Y. (a) How long does income take to double in each? (b) If both start at \$10,000, approximately what are incomes after 28 years?

SOLUTION

Step 1: Doubling time $X = 70/2.5 = 28$ years; $Y = 70/5 = 14$ years.

Step 2: After 28 years, X has doubled once: \$20,000.

Step 3: Y has doubled twice ($28 = 2 \times 14$): $\$10,000 \times 4 = \$40,000$.

Step 4: The 2.5-point gap in growth produces a twofold income difference in 28 years.

EXAMPLE 2: COMPUTING GROWTH AND PRODUCTIVITY

Real GDP rises from \$4,000 billion to \$4,160 billion while total hours worked rise from 100 billion to 101 billion. Find the growth rate of real GDP, labor productivity in each year, and productivity growth.

SOLUTION

Step 1: Growth = $(4,160 - 4,000)/4,000 = 4\%$.

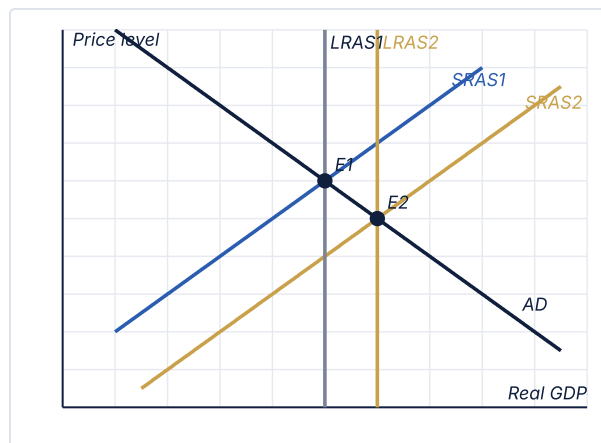
Step 2: Productivity year 1 = $4,000/100 = \$40$ per hour. Year 2 = $4,160/101 = \$41.19$ per hour.

Step 3: Productivity growth = $(41.19 - 40)/40 = 2.97\%$, about 3%.

Step 4: Most of the 4% growth came from higher productivity (3%) rather than more hours (1%), which is what raises living standards.

EXAMPLE 3: GROWTH IN THE PPC AND AD-AS

A country invests heavily in education and R&D. Show the effect on the PPC and on AD-AS, and say what happens to the price level.



Growth: LRAS shifts right (potential output rises), SRAS shifts right with it, and the price level falls if AD is unchanged.

SOLUTION

Step 1: Human capital and technology raise productive capacity. The PPC shifts outward, parallel or biased toward the good that benefits most.

Step 2: LRAS shifts right from LRAS1 to LRAS2, and SRAS also shifts right.

Step 3: With AD unchanged, equilibrium output rises from 5 to 6 and the price level falls from 6 to 5.

Step 4: Real GDP per capita rises, so the standard of living improves.

Common mistakes

(1) Applying the Rule of 70 with the growth rate as a decimal (use 2.5, not 0.025). (2) Mixing nominal and real GDP: growth must be real. (3) Drawing growth as a rightward shift of AD or only SRAS: growth is a shift of LRAS (and the PPC). (4) Forgetting that growth in total GDP is not growth per person when the population is also growing. (5) Claiming that an increase in the money supply can permanently raise growth: it shifts AD, not LRAS.

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Practice

SET A Check Your Understanding

Answer each item in a few sentences or with a short calculation.

1. Use the Rule of 70 to find the doubling time of real GDP growing at 3.5% and at 1.4% per year.
2. List the four sources of long-run growth and give one government policy for each of two of them.
3. Real GDP per capita was \$50,000 last year and \$51,500 this year. Calculate the growth rate and the years to double at that rate.
4. Explain why a country that invests a high share of GDP in capital goods may have lower consumption now but higher consumption later.
5. Show which curve shifts when productivity improves permanently and explain the effect on the price level when AD is constant.
6. Explain how institutions such as property rights and an independent judiciary can affect growth.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. Real GDP per capita grows at 7% per year. About how long will it take to double?
(A) 5 years (B) 7 years (C) 10 years (D) 14 years (E) 70 years
8. Which of the following would most likely shift the long-run aggregate supply curve to the right?
(A) Lower income taxes that raise consumption
(B) An increase in the money supply
(C) A rise in the productivity of workers due to education
(D) A decrease in government spending
(E) Higher expected inflation
9. An outward shift of a country's production possibilities curve could be caused by
(A) moving from an inefficient point to a point on the curve
(B) an increase in unemployment
(C) an increase in the capital stock
(D) a decrease in the labor force
(E) an increase in the price level
10. Growth accounting studies find that which of the following is generally the largest contributor to growth in advanced economies?
(A) Population growth (B) Technological progress (C) Natural resources
(D) Government spending (E) The money supply
11. Labor productivity is best defined as
(A) total hours worked (B) nominal GDP per person (C) real GDP per hour worked
(D) the unemployment rate (E) the capital stock
12. A country wants to speed up long-run growth. Which policy is most consistent with that goal?
(A) Raising the reserve requirement
(B) Increasing public and private investment in education and research
(C) Reducing the supply of loanable funds
(D) Imposing import quotas to protect domestic firms
(E) Printing money to finance spending

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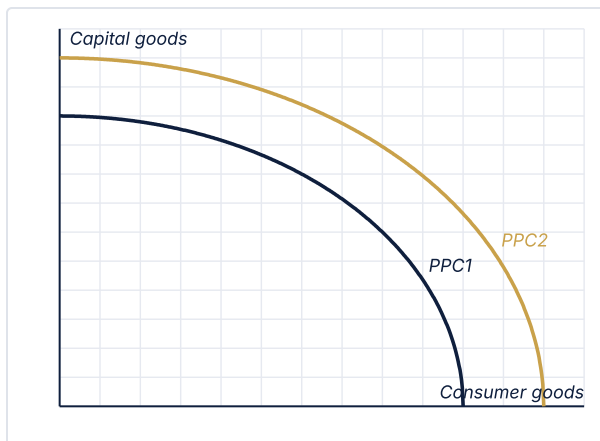
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SET C Apply and Extend

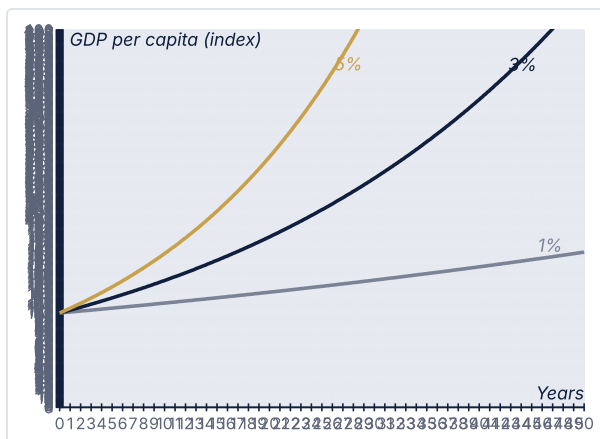
Answer fully, labeling any graph you draw. Model responses show scoring points.

13. A country raises its national saving rate and uses the funds to build capital. (a) Use the PPC to show the effect on the capital-good/consumer-good trade-off today and in the future. (b) Show the long-run effect on the AD-AS graph, including the price level. (c) Explain one opportunity cost and one benefit.



Economic growth shifts the PPC outward. More capital goods today allow a larger PPC tomorrow.

14. Two countries both start with real GDP per capita of 100. Country A grows at 1% and Country B grows at 4% per year. (a) Using the Rule of 70, find the doubling time of each. (b) Compute approximately the ratio of B's income to A's after 70 years. (c) Explain two reasons why B may be growing faster.



Compounding: small growth-rate differences become huge gaps over decades (index = 100 at year 0).

5.5 Supply-Side Policy and Policy Debates

Evaluate supply-side policies and the Laffer curve, and compare Keynesian, classical and monetarist views on rules versus discretion.

Economists disagree about how powerful stabilization policy is, whether it should be used actively, and whether policies that affect supply can accomplish more than policies that affect demand. This lesson explains the supply-side approach and the main schools of thought, which differ mostly on two issues: how quickly wages and prices adjust, and whether government should fine-tune the economy.

Supply-side economics

Policies that aim to raise aggregate SUPPLY (potential output) through incentives to work, save, invest and innovate, rather than managing aggregate demand.

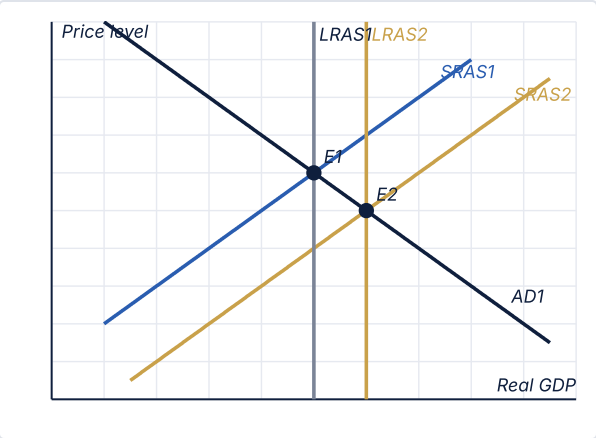
Tools: lower marginal tax rates, lower taxes on capital gains and business profits, deregulation, free trade, investment incentives. Intended result: LRAS shifts right, growth rises, the price level falls (or rises less).

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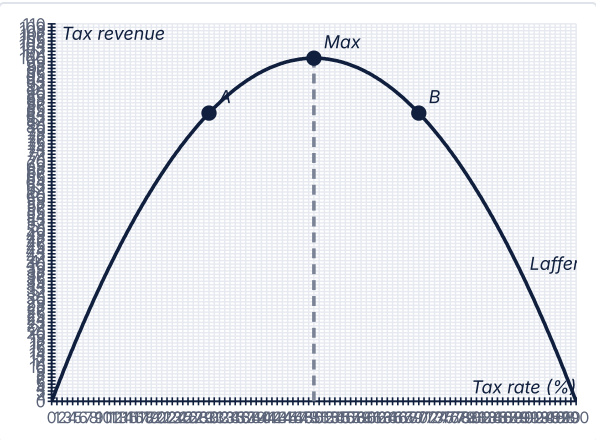
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Lower marginal tax rates raise the after-tax reward for working, saving and investing, so people supply more labor and capital. Corporate tax cuts and investment tax credits raise the return on capital. **Deregulation** (removing rules that raise firms' costs) and reduced barriers to entry increase competition and lower costs. These policies may shift SRAS and LRAS to the right. In contrast to a demand-side stimulus, which raises output only temporarily and raises the price level, successful supply-side policy raises output and puts downward pressure on prices.



Supply-side policy: if lower taxes and deregulation raise potential output, LRAS shifts right and the price level falls.

The Laffer curve. Arthur Laffer illustrated that tax revenue is zero at a 0% tax rate (no tax) and also at a 100% rate (no one has an incentive to earn taxable income), so there is some rate in between that maximizes revenue. If the tax rate is on the high side of the peak, a tax cut can raise revenue because the economic activity it encourages (the tax base) grows by more than the rate falls. If the rate is below the peak, a tax cut reduces revenue. Most economists believe that U.S. rates have been below the revenue-maximizing point, so tax cuts reduce revenue unless they have big effects on growth, which is why large tax cuts in the 1980s and in 2001 and 2017 were followed by larger deficits.



A stylized Laffer curve: revenue is zero at 0% and 100% rates and highest at a rate in between (here 50%). Cutting the rate from B helps revenue; cutting from A lowers it.

Demand-side (Keynesian)	Supply-side
Focus: aggregate demand and the short run	Focus: aggregate supply and the long run
Tax cuts raise disposable income and consumption	Tax cuts raise incentives to work and invest
Spending multiplier is central	Effects work through productivity and capacity
Output rises, price level rises	Output rises, price level falls or stays low
Can run deficits to close output gaps	Concern with deficits, which crowd out saving

Schools of thought. Each school uses the AD-AS model but chooses different assumptions.

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- ◆ **Keynesian:** wages and prices are sticky downward, so recessions can persist and the economy may stay below potential for years. Active fiscal and monetary policy can speed recovery. Government should run deficits in recessions and surpluses in expansions.
- ◆ **Classical / new classical:** wages and prices are flexible, so the economy self-corrects quickly to full employment. Output is determined by supply, and demand policy mainly changes the price level. With rational expectations, anticipated policy has no real effect.
- ◆ **Monetarist** (Milton Friedman): the money supply is the main determinant of nominal GDP and inflation. Money is **neutral in the long run**: a larger money supply raises the price level proportionally but does not change real output. Monetarists favor a steady, predictable growth rate of the money supply rather than discretionary changes.

Rules versus discretion

Discretion: policymakers adjust policy as conditions change (Keynesian view). Advantage: flexibility. Risk: lags in recognition, decision and impact, political pressure, and mistakes that destabilize.

Rules: policymakers commit to a rule such as constant money growth, an inflation target, or a balanced budget. Advantage: credibility and predictable expectations. Risk: inflexibility in a crisis.

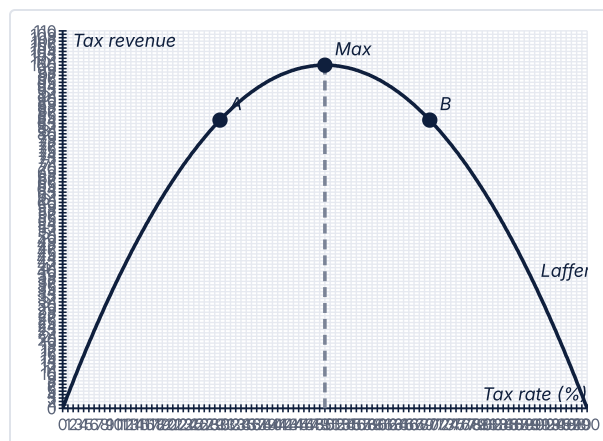
Long-run neutrality of money: in the long run changes in the money supply affect the price level, not real GDP or unemployment.

Evidence on lags supports caution. Policy takes time to recognize, enact and work. Monetary policy can be changed quickly, but its effects on spending take months. Fiscal policy requires legislation, and spending takes effect slowly. Policy that is poorly timed can push AD up just as the economy recovers on its own, creating inflation, an effect called procyclical policy.

Public policy and growth. Most schools agree on the long-run drivers of growth: investment in human and physical capital, technology, and stable institutions. They disagree on the role of demand policy. Keynesians stress avoiding prolonged recessions that waste capital and skills; supply-siders focus on tax and regulatory incentives; monetarists on a stable price level. The AP exam expects you to link each view to the correct graph and to explain, with a graph, how a policy changes the price level, output, and unemployment.

EXAMPLE 1: LAFFER CURVE REASONING

Using the Laffer curve shown, tax revenue is given by $R = x(100 - x)/25$ for tax rate x (in percent). (a) Find revenue at $x = 30, 50$ and 70 . (b) Is a cut from 70% to 50% revenue increasing? (c) Is a cut from 30% to 20% revenue increasing?



A stylized Laffer curve: revenue is zero at 0% and 100% rates and highest at a rate in between (here 50%). Cutting the rate from B helps revenue; cutting from A lowers it.

SOLUTION

Step 1: $R(30) = 30 \times 70/25 = 84$; $R(50) = 50 \times 50/25 = 100$; $R(70) = 70 \times 30/25 = 84$.

Step 2: Cutting from 70 to 50 raises revenue from 84 to 100 : yes, because 70% is on the prohibitive (right) side of the peak.

Step 3: Cutting from 30 to 20 gives $R(20) = 20 \times 80/25 = 64$, which is less than 84 : no, because 30% is on the left side of the peak.

Step 4: Whether a tax cut pays for itself depends on where the economy is on the curve.

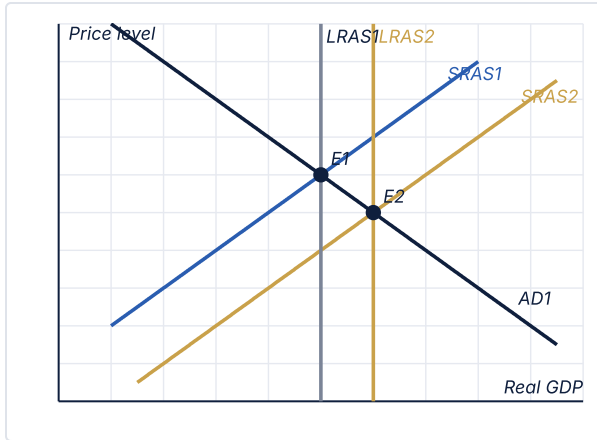
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EXAMPLE 2: A SUPPLY-SIDE PACKAGE

Congress cuts the corporate tax rate and removes burdensome regulation. Show the effects on the AD-AS model and compare the result to a demand-side tax cut for households.



Supply-side policy: if lower taxes and deregulation raise potential output, LRAS shifts right and the price level falls.

SOLUTION

Step 1: Corporate tax cuts and deregulation raise the return on investment and lower costs, so firms invest and capital grows.

Step 2: LRAS shifts right (LRAS1 to LRAS2) and SRAS shifts right.

Step 3: Equilibrium moves from E1 to E2: real GDP rises and the price level falls.

Step 4: A household tax cut shifts AD right, raising output and the price level only temporarily; wages would then rise and SRAS would shift left to full employment at a higher price level.

EXAMPLE 3: LONG-RUN NEUTRALITY OF MONEY

The money supply permanently doubles. The economy starts at full employment. Describe the short- and long-run effects.

SOLUTION

Step 1: Short run: AD shifts right as interest rates fall; output rises above potential and the price level rises.

Step 2: Output above potential tightens the labor market. Nominal wages rise, SRAS shifts left.

Step 3: Long run: output returns to potential and unemployment to the natural rate. The price level is higher.

Step 4: Money is neutral in the long run: real variables are unchanged, only nominal variables (price level, nominal wages) are higher.

Common mistakes

(1) Believing every tax cut raises revenue: only cuts from rates above the revenue-maximizing point do. (2) Mixing up monetary neutrality with zero short-run effects: money affects output in the short run. (3) Treating supply-side policy as an AD shift. (4) Claiming monetarists oppose all monetary policy: they favor rules. (5) Saying classical economists think recessions never happen; they think the economy corrects quickly.

Practice**SET A Check Your Understanding**

Answer each item in a few sentences or with a short calculation.

1. Define supply-side economics and give two policies it recommends.
2. On the Laffer curve, explain why tax revenue is zero at a 100% tax rate.
3. A tax rate is below the revenue-maximizing rate. What happens to revenue if the rate is cut further?
4. State what 'money is neutral in the long run' means and explain how AD-AS illustrates it.
5. Contrast Keynesian and classical views of how fast the economy returns to full employment, and the policy implication.

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6. Give one advantage and one disadvantage of policy rules compared with discretion.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following best describes a supply-side policy?
- (A) Increasing government purchases
 - (B) Cutting marginal tax rates to encourage work and investment
 - (C) Buying bonds on the open market
 - (D) Raising unemployment benefits
 - (E) Lowering the discount rate
8. On a Laffer curve, a tax cut will increase tax revenue only if the initial tax rate is
- (A) below the rate that maximizes revenue
 - (B) above the rate that maximizes revenue
 - (C) exactly zero
 - (D) exactly 100 percent and unemployment is falling
 - (E) the same as the inflation rate
9. According to monetarists, the best monetary policy is to
- (A) adjust the money supply to stabilize unemployment
 - (B) raise taxes when inflation is high
 - (C) maintain a steady, predictable growth rate of the money supply
 - (D) target a specific level of the exchange rate
 - (E) use fiscal policy only
10. A permanent increase in the money supply, starting from full employment, will in the long run
- (A) raise real GDP and lower unemployment
 - (B) raise the price level and leave real GDP at potential
 - (C) lower the price level
 - (D) lower real GDP
 - (E) raise the natural rate
11. Which of the following is an argument for rules rather than discretion?
- (A) Policy lags can make discretionary policy destabilizing
 - (B) Rules allow policy to respond to every shock
 - (C) Discretion allows faster action in a crisis
 - (D) Rules reduce the credibility of policy
 - (E) Rules raise the natural rate
12. Deregulation of an industry is most likely to
- (A) shift AD right only
 - (B) shift SRAS and LRAS right through lower costs and more competition
 - (C) shift LRAS left
 - (D) increase the natural rate of unemployment
 - (E) reduce real GDP

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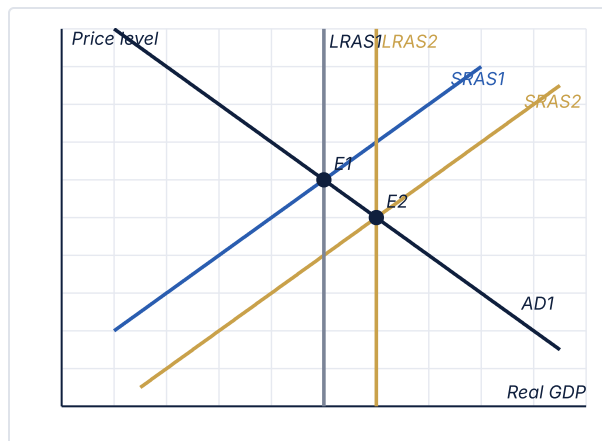
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SET C Apply and Extend

Answer fully, labeling any graph you draw. Model responses show scoring points.

13. (a) Draw an AD-AS graph for an economy at full employment. (b) Show the effect of a supply-side tax cut that raises potential output and label the new price level and output. (c) Compare to a demand-side stimulus of the same size on the price level in the short run. (d) Explain one risk of relying on tax cuts if the economy is on the left side of the Laffer curve.



Supply-side policy: if lower taxes and deregulation raise potential output, LRAS shifts right and the price level falls.

14. A central bank announces a permanent rule of 3% annual money growth. (a) Explain how a rule could improve policy credibility. (b) Describe a situation in which the rule could hurt the economy. (c) Describe the long-run effect on real GDP of a one-time 10% increase in the money supply.

5.6 Putting Stabilization Policy Together

Apply an integrated routine to recession, inflation and stagflation cases using AD-AS, money market, loanable funds and Phillips curve graphs.

This lesson puts the toolkit together. For any macroeconomic scenario you will be asked to identify the problem, choose a fiscal and/or monetary response, and trace the short-run and long-run consequences through the AD-AS model, the money market, the loanable funds market and the Phillips curve. Use the same disciplined routine every time.

- 1 **Diagnose the gap** Compare short-run equilibrium output with full-employment output (Y_f). Below Y_f is a recessionary gap (unemployment above the natural rate). Above Y_f is an inflationary gap (unemployment below the natural rate).
- 2 **Choose the policy direction** Recessionary gap: expansionary policy. Inflationary gap: contractionary policy. For a supply shock the choice is a trade-off.
- 3 **Pick the tool and its first market** Monetary tools (open market operations, discount rate, reserve requirement) begin in the money market. Fiscal tools (government spending, taxes, transfers) begin with AD directly and, when financed by borrowing, in the loanable funds market.
- 4 **Follow the interest rate** Interest rates change investment, which changes AD. The nominal rate is in the money market, the real rate in loanable funds.
- 5 **Finish in AD-AS and the Phillips curve** Show the shift, the new short-run equilibrium, and then the self-correction in the long run. Translate to unemployment and inflation.

Policy response summary

Recession: expansionary fiscal (spending up, taxes down) and/or expansionary monetary (buy bonds, lower discount rate or reserve requirement). AD right, output up, unemployment down, price level up.

Inflation: contractionary fiscal and/or monetary. AD left, output down, price level down or slower inflation.

Stagflation: SRAS left. Policy cannot fix both; fiscal or monetary expansion fights unemployment but adds to inflation, contraction does the opposite.

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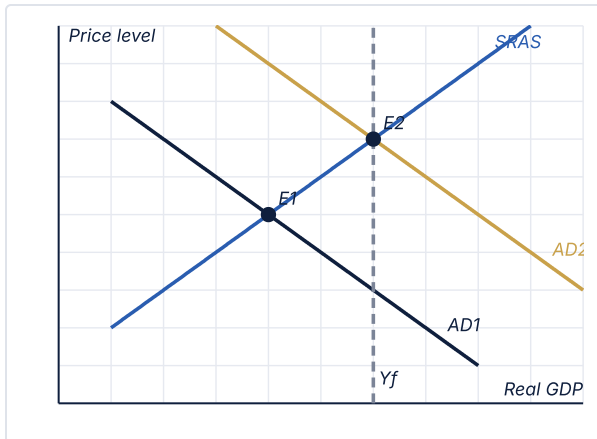
Gaps and self-correction

Recessionary gap: $Y < Y_f$, $u >$ natural rate. Left alone, wages fall and SRAS shifts right.

Inflationary gap: $Y > Y_f$, $u <$ natural rate. Left alone, wages rise and SRAS shifts left.

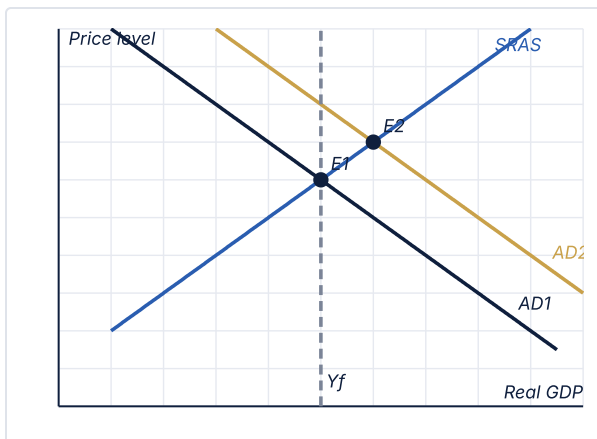
In both cases the long-run equilibrium is at Y_f ; only the price level differs.

Case 1: Recession. Output is below Y_f . If policymakers wait, high unemployment pushes wages down, SRAS shifts right and the economy returns to Y_f at its original price level, but this can take a long time. Policy can speed up the adjustment. Expansionary monetary policy (open market purchases) shifts the supply of money right, lowers the nominal interest rate, raises investment and net exports and shifts AD right. Expansionary fiscal policy shifts AD right through the multiplier, but if deficit-financed it raises the real interest rate in loanable funds and partly crowds out investment. In the Phillips curve model, the economy moves up the SRPC: lower unemployment, higher inflation.



Recessionary gap: expansionary policy shifts AD from AD1 to AD2 and restores Y_f at a higher price level.

Case 2: Inflationary gap. Output is above Y_f and unemployment is below its natural rate. If policymakers wait, rising wages shift SRAS left and the economy returns to Y_f at a higher price level. Contractionary policy (selling bonds, raising taxes, cutting spending) shifts AD left, lowering inflation at the cost of less output in the short run (down the SRPC). Contractionary fiscal policy also shifts loanable funds demand left, lowering the real interest rate and encouraging investment, which helps long-run growth.



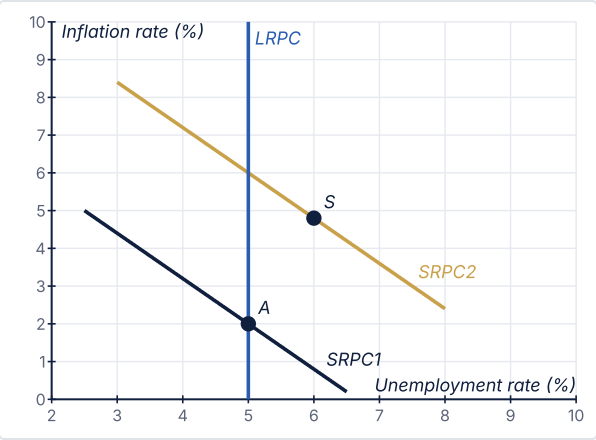
Inflationary gap: AD2 intersects SRAS beyond Y_f . Contractionary policy shifts AD back to AD1.

Case 3: Stagflation. A negative supply shock shifts SRAS left. Output falls below Y_f while the price level rises. Unemployment and inflation both rise, shifting the SRPC out. Policymakers face a dilemma, and the choice of policy reveals priorities. Without policy, high unemployment eventually reduces wages and SRAS shifts back, but this may be slow. A positive supply policy that increases productivity or lowers costs would be best since it shifts SRAS and the SRPC the right way.

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Scenario	Policy	Money market	Loanable funds	AD-AS short run	Long run
Recession	Fed buys bonds	MS right, i falls	Supply of funds right, r falls	AD right	Output at Yf, higher price level than before
Recession	Deficit spending	No direct effect	Demand right, r rises	AD right (less due to crowding out)	Higher debt, possible less investment
Inflation	Fed sells bonds	MS left, i rises	Supply left, r rises	AD left	Lower inflation, output at Yf
Inflation	Tax increase	No direct effect	Demand left or public saving up, r falls	AD left	More investment, more capital
Stagflation	Do nothing	No change	No change	SRAS left	Wages fall, SRAS right, return to Yf

Long-run consequences. Policy that only shifts AD cannot change potential output in the long run; it changes the price level and the mix of output. The long-run effects are therefore about (1) the price level, (2) the debt and interest rates, which affect investment, and (3) expectations, which shift the SRPC. Persistent expansion raises expected inflation and shifts the SRPC up, leaving unemployment at the natural rate with higher inflation.

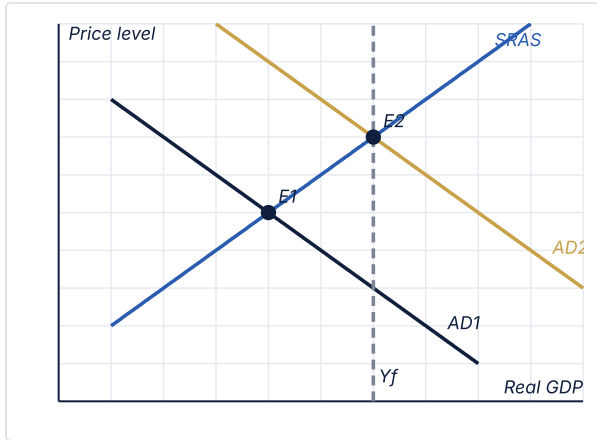
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EXAMPLE 1: CLOSING A RECESSIONARY GAP

An economy at E_1 has output 4 and Y_f is 6. The central bank buys bonds. Trace the policy through the three graphs and state final price level and output in the short run.



Recessionary gap: expansionary policy shifts AD from AD_1 to AD_2 and restores Y_f at a higher price level.

SOLUTION

Step 1: Money market: reserves rise, MS shifts right, and the nominal interest rate falls.

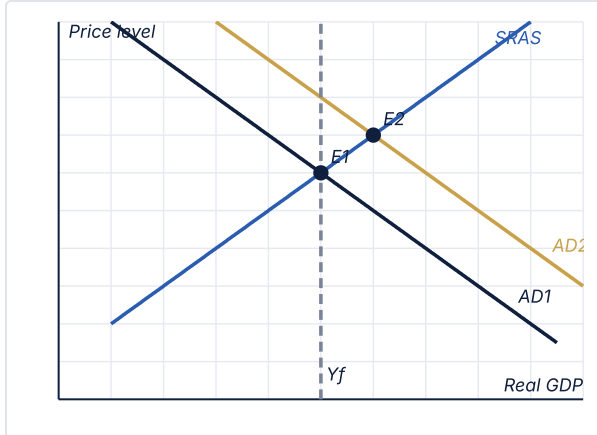
Step 2: Lower rates raise investment and net exports, so AD shifts from AD_1 to AD_2 .

Step 3: AD-AS: new equilibrium E_2 has output 6 (Y_f) and price level 7, up from 5.

Step 4: Phillips curve: the economy moves up the SRPC to lower unemployment and higher inflation. Since output is at Y_f , no further correction is needed.

EXAMPLE 2: FIGHTING INFLATION WITH FISCAL POLICY

An economy at E_2 has output 6 while Y_f is 5. The government raises taxes. Explain the effect on AD, the loanable funds market, and the long run.



Inflationary gap: AD_2 intersects $SRAS$ beyond Y_f . Contractionary policy shifts AD back to AD_1 .

SOLUTION

Step 1: Higher taxes reduce disposable income, so consumption and AD fall: AD shifts left from AD_2 to AD_1 .

Step 2: Output returns to Y_f (5) and the price level falls from 7 to 6.

Step 3: Loanable funds: if the tax increase reduces the deficit (higher public saving), the supply of funds rises, lowering the real interest rate and raising investment.

Step 4: Long run: higher investment raises capital and LRAS growth. Without action, wages would rise and $SRAS$ would shift left, leaving output at Y_f at a still higher price level.

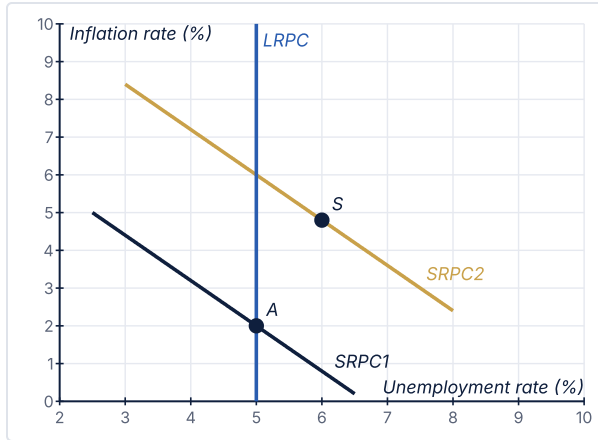
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EXAMPLE 3: STAGFLATION CHOICE

An oil shock moves the economy from A to S. The unemployment rate is 6% and inflation is 4.8%. The central bank can expand or contract. Compare.

**SOLUTION**

Step 1: Expansion shifts AD right: unemployment moves toward 5%, inflation climbs above 4.8%.

Step 2: Contraction shifts AD left: inflation falls, but unemployment rises above 6%.

Step 3: Expansion also risks raising expected inflation, shifting the SRPC up again.

Step 4: Waiting lets wages fall and SRAS shift back, so the economy slides back to A (2% inflation, 5% unemployment) without policy, at the cost of a longer period of unemployment.

Exam tip

On a free-response policy question: (1) name the gap, (2) state the policy with its tool (e.g., 'open market purchase', not just 'lower rates'), (3) say which curve shifts and the direction, (4) label the new equilibrium and give the direction of output and price level, (5) say what happens to the interest rate and investment, and (6) describe long-run adjustment if asked. Always label axes and the Y_f line.

Practice**SET A Check Your Understanding**

Answer each item in a few sentences or with a short calculation.

1. An economy has unemployment of 8% and the natural rate is 5%. Identify the gap and an appropriate monetary policy.
2. Explain why the long-run result of an AD-increasing policy is a higher price level but no change in real GDP.
3. Describe how contractionary fiscal policy changes the loanable funds market when it reduces the deficit.
4. In a stagflation, explain what happens to the SRPC and why policymakers face a dilemma.
5. The Fed raises the discount rate and sells bonds. Trace the effect through the money market and AD-AS.
6. Explain why a policy that raises expected inflation can move the economy to a worse position in the long run.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. An economy is in a recessionary gap. Which combination of policies would shift AD the most?
 - (A) Higher taxes and higher interest rates
 - (B) Lower taxes and an open market purchase
 - (C) Higher government spending and an open market sale
 - (D) Lower spending and lower taxes
 - (E) Lower taxes and sale of bonds
8. The Fed sells government bonds to the public. In the money market,
 - (A) the money supply shifts right
 - (B) money demand shifts left
 - (C) the nominal interest rate rises
 - (D) the nominal interest rate falls
 - (E) the demand for loanable funds shifts right
9. If the economy is in an inflationary gap and policymakers do nothing, in the long run
 - (A) SRAS shifts right and the price level falls
 - (B) SRAS shifts left and the price level rises further, with output returning to potential
 - (C) AD shifts left
 - (D) LRAS shifts left
 - (E) unemployment rises permanently
10. Which of the following causes stagflation?
 - (A) An increase in AD
 - (B) A decrease in AD
 - (C) An increase in the price of a key input like oil
 - (D) An increase in the money supply
 - (E) A decrease in taxes
11. Contractionary fiscal policy that reduces a deficit will most likely cause the real interest rate to
 - (A) rise because demand for funds rises
 - (B) fall because demand for loanable funds falls
 - (C) remain unchanged
 - (D) rise because supply falls
 - (E) fall because the money supply rises
12. Starting at full employment, a permanent rise in expected inflation will shift
 - (A) the LRPC to the right
 - (B) the SRPC up and to the right
 - (C) the SRPC down
 - (D) AD to the left
 - (E) LRAS to the left

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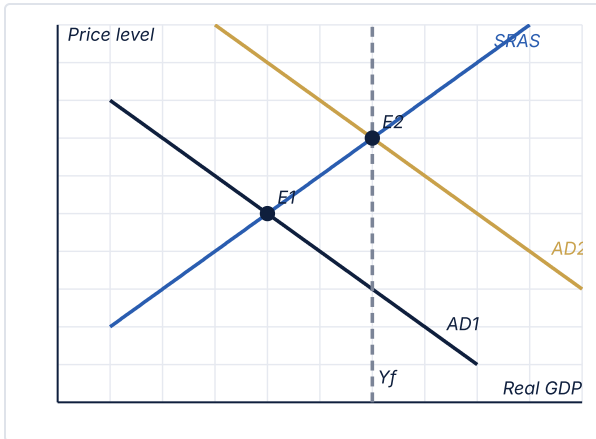
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SET C Apply and Extend

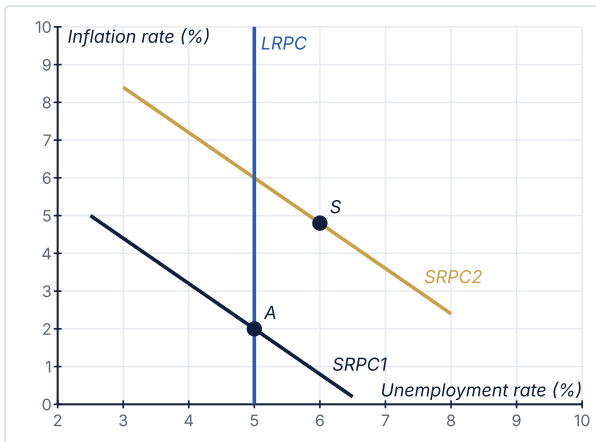
Answer fully, labeling any graph you draw. Model responses show scoring points.

13. The economy is in a recessionary gap. (a) Draw the AD-AS graph and label Y_f , SRAS, AD1 and E1. (b) Name one monetary and one fiscal policy to close the gap and show the effect on AD. (c) For the monetary policy, explain the effect in the money market on the nominal interest rate. (d) For the fiscal policy financed by borrowing, explain the effect in the loanable funds market and what it implies for the policy's strength.



Recessionary gap: expansionary policy shifts AD from AD_1 to AD_2 and restores Y_f at a higher price level.

14. An economy at natural unemployment of 5% experiences an oil price shock. (a) On a Phillips curve graph, show the initial position and the shift. (b) Describe the effect on unemployment and inflation. (c) Explain what happens in the long run if no policy is used. (d) Explain one consequence of using expansionary policy.



5.7 Multiple-Choice Practice: Long-Run Consequences of Stabilization Policies

Choose the best answer to each question. Items cover policy combinations, the Phillips curve, deficits and debt, growth, supply-side policy and integrated stabilization cases. Read each stimulus first, then eliminate answers that move the wrong curve.

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SET A Core Concepts

Choose the best answer.

1. Which of the following best describes crowding out?
(A) The central bank's open market sales reduce the money supply
(B) Foreign firms replace domestic firms in the market
(C) Government borrowing raises the real interest rate and reduces private investment
(D) Higher taxes reduce consumption
(E) A budget surplus lowers the national debt
2. A country has a budget deficit of \$200 billion this year and a national debt of \$5 trillion at the start of the year. What is the national debt at the end of the year, all else equal?
(A) \$ 5.2 trillion (B) \$ 4.8 trillion (C) \$ 200 billion
(D) \$ 5 trillion (E) \$ 25 trillion
3. The short-run Phillips curve shows a
(A) positive relationship between unemployment and inflation
(B) vertical relationship at the natural rate
(C) negative relationship between the money supply and output
(D) positive relationship between real GDP and the price level
(E) negative relationship between unemployment and inflation
4. A rule of 70 calculation shows that GDP per capita growing at 2% per year doubles in about
(A) 7 years (B) 35 years (C) 14 years (D) 70 years (E) 140 years
5. The government wants to reduce its deficit without lowering AD much. Which policy mix is most appropriate?
(A) Expansionary fiscal policy and contractionary monetary policy
(B) Contractionary fiscal policy and contractionary monetary policy
(C) Expansionary fiscal policy and expansionary monetary policy
(D) Contractionary fiscal policy and expansionary monetary policy
(E) Raise taxes and raise the reserve requirement
6. Which of the following would shift the long-run Phillips curve?
(A) An increase in the money supply (B) A rise in expected inflation
(C) A decrease in government spending (D) A change in the natural rate of unemployment
(E) An increase in the reserve requirement
7. Which of the following is a supply-side policy?
(A) A cut in marginal tax rates intended to raise work effort and investment
(B) An increase in transfer payments
(C) An open market purchase
(D) An increase in government purchases
(E) A decrease in the discount rate

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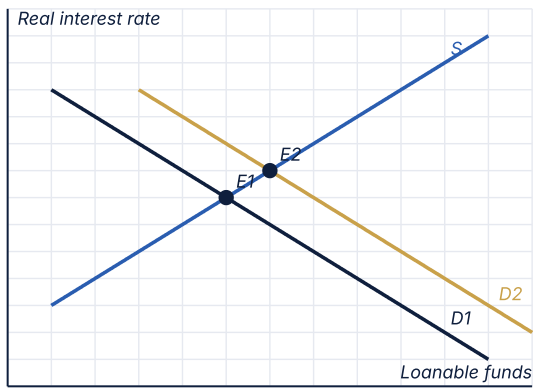
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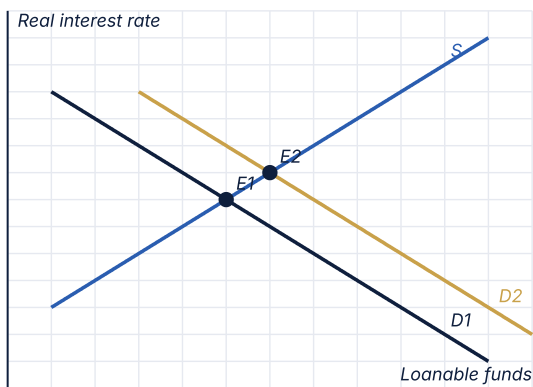
SET B Applications and Data

Use the graph or data when one is given.

8. The graph shows the loanable funds market. The shift from D1 to D2 is best explained by



- (A) an increase in household saving
 - (B) a decrease in expected profits
 - (C) an increase in the government's budget deficit
 - (D) a decrease in the money supply
 - (E) an increase in imports
9. In the loanable funds graph, the move from E1 to E2 causes private investment to



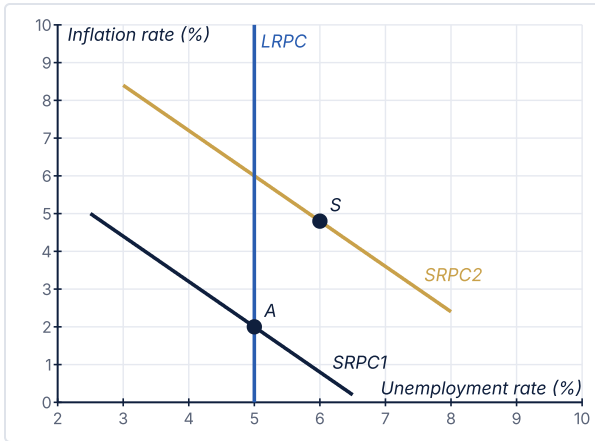
- (A) rise because the quantity of funds lent rises
- (B) remain unchanged
- (C) rise because the real interest rate rises
- (D) fall because supply shifted left
- (E) fall because the real interest rate rises

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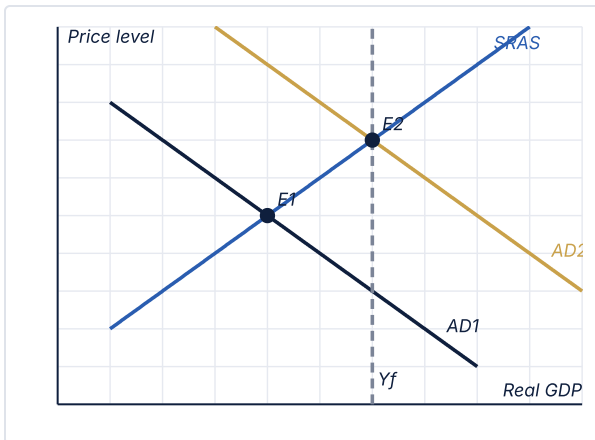
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10. The graph shows an economy moving from point A to point S on the Phillips curve diagram. The most likely cause is



- (A) an increase in aggregate demand
 (B) a negative supply shock
 (C) a decrease in aggregate demand
 (D) an increase in productivity
 (E) a decrease in expected inflation
11. In the AD-AS graph shown, the economy is initially at E1. Which of the following moves it to E2 in the short run?



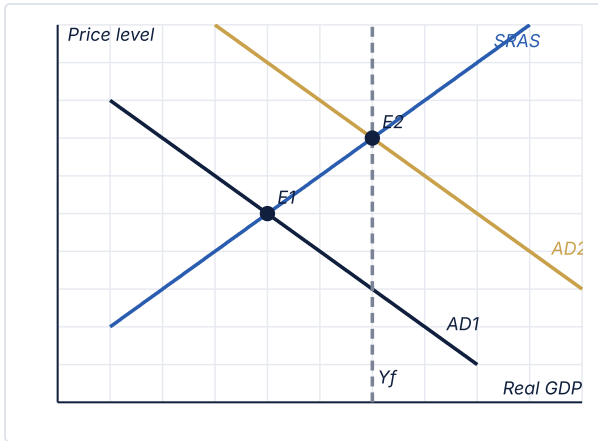
- (A) A tax increase
 (B) An open market purchase of bonds
 (C) An open market sale of bonds
 (D) A decrease in government spending
 (E) An increase in the discount rate

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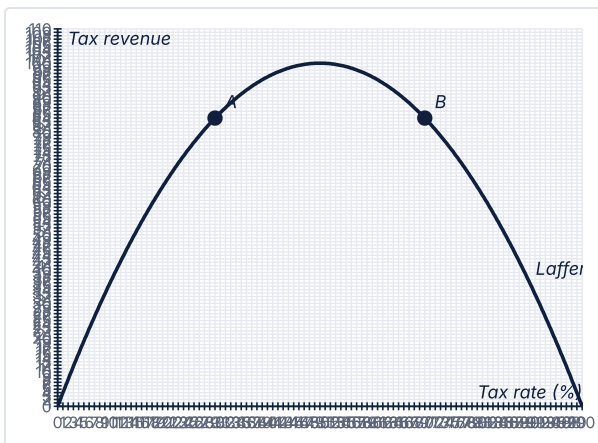
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12. Using the AD-AS graph, the output gap at E1 is closed at E2. Compared with E1, E2 has



- (A) higher output and a lower price level
 (B) lower output and a higher price level
 (C) the same output and a lower price level
 (D) lower unemployment and a lower price level
 (E) higher output and a higher price level
13. A debt of \$30 trillion and nominal GDP of \$25 trillion exist. If debt grows 3% and nominal GDP grows 5%, the debt-to-GDP ratio will
- (A) fall, because GDP grows faster than the debt
 (B) rise, because debt is greater than GDP
 (C) remain at 120%
 (D) rise, because debt is growing
 (E) fall, because the deficit is positive
14. On the Laffer curve shown, a tax cut from rate B to rate A would be expected to



- (A) increase revenue, because lower tax rates always raise revenue
 (B) decrease revenue, because lower rates never raise revenue
 (C) double revenue
 (D) leave tax revenue unchanged, because both rates yield the same revenue
 (E) reduce the tax base to zero

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SET C Exam-Level Stretch

Choose the best answer.

15. Real GDP per capita grows at 4% in Country X and 2% in Country Y, starting equal. After 35 years, X's income relative to Y's is about
- (A) the same
 - (B) 1.5 times as large
 - (C) 2 times as large (X has doubled twice, Y once, roughly)
 - (D) 4 times as large
 - (E) 8 times as large
16. The Fed lowers the discount rate while Congress raises taxes to cut the budget deficit. Which result is most certain?
- (A) Real GDP rises
 - (B) Real GDP falls
 - (C) The real interest rate falls and investment rises
 - (D) The real interest rate rises
 - (E) The price level rises
17. According to the long-run neutrality of money, a permanent increase in the money supply will, in the long run, increase
- (A) real GDP but not the price level
 - (B) the natural rate of unemployment
 - (C) long-run aggregate supply
 - (D) real interest rates permanently
 - (E) the price level but not real GDP
18. Which of the following would an adaptive-expectations view predict after the central bank unexpectedly adopts a tighter policy?
- (A) An immediate fall in inflation with no change in unemployment
 - (B) A prolonged period of high unemployment before expected inflation falls
 - (C) A permanent fall in the natural rate
 - (D) A rightward shift of LRAS
 - (E) A rise in expected inflation
19. Which statement about stagflation is correct?
- (A) It results from a leftward shift of SRAS and conflicts with a stable Phillips curve
 - (B) It results from a rightward shift of AD
 - (C) It is only possible in the long run
 - (D) It lowers both unemployment and inflation
 - (E) It shifts the LRPC
20. A recession is accompanied by a large deficit even with no policy change. Which of the following explains this?
- (A) Crowding out reduces investment
 - (B) The central bank prints money
 - (C) The Laffer curve shifts
 - (D) Automatic stabilizers reduce tax revenue and increase transfers
 - (E) Rational expectations

5.8**Free-Response Practice: Long-Run Consequences of Stabilization Policies**

Each question is scored by points listed in the model answers. Label every graph (axes, curves, equilibrium points), name the policy tool, and always state the direction of change in the interest rate, output, unemployment and the price level. Question 1 is worth 10 points, the others 5 to 7 points.

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QUESTION 1 Recession, Policy Mix and Long-Run Effects

The economy of Aria is in a recession: real GDP is below potential output and the unemployment rate is above the natural rate. The central bank and the legislature both choose to act.

1. (a) Draw a correctly labeled AD-AS graph (with SRAS, LRAS and AD) showing Aria's current short-run equilibrium.
2. (b) The central bank conducts an open market purchase of bonds. Explain the effect on the nominal interest rate using the money market, and show the effect on AD on your graph.
3. (c) The legislature instead raises government spending financed by borrowing. Explain what happens to the real interest rate and private investment in the loanable funds market.
4. (d) If neither policy were used, explain what would happen to the price level and real GDP in the long run.

QUESTION 2 The Phillips Curve and Expectations

An economy has a natural rate of unemployment of 6% and inflation of 2%. Assume the economy is initially at long-run equilibrium. Expectations of inflation are adaptive.

5. (a) Draw a graph with the short-run and long-run Phillips curves and label the initial equilibrium.
6. (b) The central bank unexpectedly adopts an expansionary policy. Show on the graph and explain the short-run effects on unemployment and inflation.
7. (c) Explain what happens to the SRPC in the long run and why, and state the resulting unemployment rate.
8. (d) Explain how a rise in the price of oil would affect the SRPC.

QUESTION 3 Deficits, Debt and Crowding Out

A country has a national debt of \$12 trillion and nominal GDP of \$16 trillion. The government runs a deficit of \$0.8 trillion. Next year nominal GDP is \$16.8 trillion.

9. (a) Calculate the debt-to-GDP ratio at the start of the year.
10. (b) Calculate the debt-to-GDP ratio at the end of the year and state whether it rose or fell.
11. (c) Using the loanable funds market, explain how deficit financing affects the real interest rate and investment.
12. (d) Explain how a Ricardian response by households would change your answer to (c).

QUESTION 4 Growth Policy and Supply-Side Effects

Country Z wants to raise its long-run growth rate. Its real GDP per capita is growing at 2% per year. The government considers cutting the corporate tax rate, increasing funding for public universities and removing regulations that restrict competition.

13. (a) Use the Rule of 70 to calculate how many years it takes for Z's real GDP per capita to double at the current growth rate. If policy raises the growth rate to 3.5%, how many years does it take?
14. (b) Identify one source of growth that each of the three policies primarily affects.
15. (c) Draw a correctly labeled AD-AS graph showing the effect of successful policies on long-run aggregate supply. State the effect on the price level and real GDP.
16. (d) Explain one possible cost of these policies in the short run.

Answers Chapter 5: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

5.1 Monetary and Fiscal Policy Combinations**SET A · CHECK YOUR UNDERSTANDING**

1. Money market: money supply shifts right and the nominal rate falls. Loanable funds (optional): supply of funds rises, lowering the real rate. AD-AS: AD shifts right because investment and net exports rise. Each graph feeds the next through the interest rate.
2. Crowding out is the fall in private investment (and interest-sensitive consumption) caused by a higher real interest rate when the government borrows to finance a deficit. It is shown in the loanable funds market, where government borrowing shifts demand for funds to the right.
3. A surplus reduces government borrowing, so demand for loanable funds shifts left (or supply rises with public saving). The real interest rate falls and private investment rises. This is the reverse of crowding out and raises future capital and LRAS.
4. Multiplier = $1/(1 - 0.75) = 4$, so AD rises by $4 \times 30 = \$120$ billion. After subtracting \$25 billion of crowding out, the net change is \$95 billion.
5. The tax cut enlarges the deficit and raises demand for loanable funds, while tight money reduces the supply of funds, so the real interest rate rises clearly. Investment falls. AD effect is ambiguous: the tax cut raises it and the higher rate lowers it, so the outcome depends on which is larger.

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6. Lower government spending or higher taxes shrink the deficit but would reduce AD. Expansionary monetary policy lowers interest rates, which raises investment and net exports, offsetting the fall in AD. The combination leaves AD roughly stable while shifting output toward investment.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. Government borrowing adds to demand for loanable funds, raising the real interest rate. A is wrong because borrowing from the public does not create money, and C would lower rates.
8. B. Cheaper borrowing from the Fed increases reserves and loans, so the money supply rises and the nominal rate falls, lifting investment and AD. E is wrong: policy shifts AD, not SRAS.
9. A. Both tools raise AD. Fiscal policy pushes interest rates up and monetary policy pushes them down, so the net change depends on relative size. Choice B ignores monetary easing.
10. B. The deficit raises real interest rates, which reduces investment and offsets part of the consumption boost. E is wrong because the money supply does not fall in this mechanism.
11. C. A surplus lowers demand for loanable funds and easy money adds to supply, so real interest rates fall and investment rises. D has opposing pushes on the rate, so it is not certain.
12. A. Less investment means less capital accumulation, so long-run aggregate supply grows more slowly. B and C involve unemployment, which is not the direct channel.

SET C · APPLY AND EXTEND

13. (a) 1 point: SRAS and AD₁ intersect at E₁ with output left of Y_f. (b) 1 point: AD shifts right (AD₂) and output and the price level rise, moving toward Y_f. (b2) 1 point: demand for loanable funds shifts right; the real interest rate rises. (c) 1 point: the higher interest rate crowds out private investment, which reduces the AD gain below multiplier times the spending change.
14. (a) 1 point: money supply shifts right (MS₁ to MS₂) and the nominal interest rate falls. (b) 1 point: lower interest rates raise investment and net exports, so AD shifts right; the balanced tax and spending change has little net effect. 1 point: output exceeds potential in the short run and the price level rises. (c) 1 point: no crowding out because the deficit does not change, so demand for loanable funds is unchanged.

5.2 The Phillips Curve

SET A · CHECK YOUR UNDERSTANDING

1. The SRPC slopes downward because with an upward-sloping SRAS, an AD increase raises the price level and output (lowering unemployment). The LRPC is vertical at the natural rate because LRAS is vertical at potential output, so AD changes affect only inflation.
2. The 1.5 points are cyclical unemployment from a recessionary gap. Inflation tends to be low and falling here. Expansionary policy would reduce cyclical unemployment while raising inflation along the SRPC.
3. Higher expected inflation leads to higher wage demands, shifting SRAS left and the SRPC up/right. The LRPC does not shift because the natural rate of unemployment is unchanged.
4. Stagflation is rising unemployment together with rising inflation. SRAS shifts left, and the SRPC shifts up/right. It contradicts a stable Phillips curve because a trade-off would have unemployment and inflation moving in opposite directions.
5. Adaptive expectations use past inflation, so expectations fall slowly and the economy needs a long spell of high unemployment before the SRPC shifts down. Rational expectations use all available information and credible announcements, so disinflation can be quick and cheap. Adaptive expectations imply the higher cost.
6. Slope = $(3.2 - 2)/(4 - 5) = -1.2$, meaning each 1-point fall in unemployment adds 1.2 points of inflation. At $u = 3\%$, inflation = $3.2 + 1.2 = 4.4\%$, assuming expectations and SRAS do not change.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Higher expected inflation raises nominal wage demands and shifts SRAS left, so the SRPC shifts up/right. B moves the economy along the SRPC; D shifts the LRPC.
8. C. Higher costs shift SRAS left and the SRPC outward (up/right), producing stagflation. A is wrong because it describes a fall in AD.
9. A. Flexible wages and prices bring output back to potential, so unemployment equals the natural rate at any steady inflation rate. B is wrong; inflation can be any rate.
10. B. AD shifts left, so output falls, unemployment rises and inflation slows. A is the expansionary case.
11. B. The LRPC sits at the natural rate; a lower natural rate (for example from better job matching) shifts it left. Expectations and AD affect inflation, not the natural rate.
12. B. Disinflation means inflation is positive but falling. A describes deflation.

SET C · APPLY AND EXTEND

13. (a) 1 point: downward SRPC and vertical LRPC at 5%, point A where they intersect at 2%. (b) 1 point: movement along SRPC₁ to a point with lower unemployment and higher inflation (B). (c) 1 point: expected inflation rises, SRPC shifts up (SRPC₂), economy moves to C at 5% unemployment and higher inflation. (d) 1 point: the Fed would need ever-faster money growth, causing accelerating inflation; there is no permanent trade-off.
14. (a) 1 point: SRAS shifts left (SRAS₁ to SRAS₂); output falls below Y_f and the price level rises. (b) 1 point: unemployment rises, inflation rises (stagflation). (c) 1 point: the SRPC shifts up/right; the LRPC stays. (d) 1 point: a dilemma – expansion worsens inflation, contraction worsens unemployment. If they do nothing, high unemployment lowers wages, SRAS shifts back right, and the economy returns to full employment.

5.3 Government Deficits, Debt, and Crowding Out

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SET A · CHECK YOUR UNDERSTANDING

1. The deficit is $3.8 - 3.0 = \$0.8$ trillion. The national debt rises by $\$0.8$ trillion because the Treasury must borrow to finance the gap. The debt is a stock that accumulates all past deficits less surpluses.
2. The ratio falls if nominal GDP grows faster (in percent) than the debt. For example, with a debt of 80% of GDP, a small deficit that raises debt by 2% while GDP grows 4% lowers the ratio. This occurred in the 1950s to 1970s.
3. Demand for loanable funds shifts right, the real interest rate rises, and the quantity of private investment falls. This is crowding out. Because investment builds capital, long-run growth of potential output can slow.
4. $\text{Debt/GDP} = 12/16 = 75\%$. Interest = $0.025 \times 12 = \$0.3$ trillion, so interest/GDP = $0.3/16 = 1.875\%$, about 1.9%.
5. Ricardian households anticipate higher future taxes and raise saving by the amount of the deficit. The supply of loanable funds shifts right, offsetting the demand increase, so the real interest rate and private investment stay the same. Crowding out is weaker or absent.
6. Interest payments require higher taxes or lower spending, and crowded-out investment leaves less capital. The burden is small if the borrowing financed productive investment that raises future GDP, or if the debt is held domestically, so interest is paid to citizens.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. A surplus uses extra revenue to retire bonds, so the debt falls. C is wrong because a smaller deficit still adds to the debt.
8. B. Higher government demand for loanable funds raises the real interest rate and crowds out investment. A and E have the wrong direction.
9. B. The ratio is debt divided by GDP, so a faster-growing denominator lowers it. A fails because deficits can coexist with a falling ratio.
10. B. Households save the tax cut to pay expected future taxes, so loanable funds supply rises with demand. C is the non-Ricardian view.
11. C. Higher interest rates raise interest payments relative to GDP. B and D reduce the burden.
12. B. Tax revenue falls and transfers rise automatically as income falls. A is wrong because no new law is passed.

SET C · APPLY AND EXTEND

13. (a) 1 point: demand for loanable funds shifts right (D1 to D2). 1 point: the real interest rate rises and private investment falls. (b) 1 point: lower investment means a smaller capital stock, slowing growth of potential output and LRAS. (c) 1 point: supply of loanable funds shifts right, so the rise in the interest rate is smaller or zero and crowding out is partly or fully offset.
14. (a) 1 point: $30/20 = 150\%$. (b) 1 point: new debt = 31.2, GDP = 20.6, ratio = $31.2/20.6 = 1.515$, about 151.5%; the ratio rose because debt grew 4%, faster than GDP at 3%. (c) 1 point: interest payments rise as debt is refinanced at higher rates. 1 point: any valid policy, for example raising growth or running a primary surplus.

5.4 Economic Growth and Productivity**SET A · CHECK YOUR UNDERSTANDING**

1. At 3.5%, doubling time = $70/3.5 = 20$ years. At 1.4%, doubling time = $70/1.4 = 50$ years. The higher rate doubles income in less than half the time.
2. Physical capital, human capital, technology, and natural resources/labor force. Policy examples: investment tax credits or higher national saving raise physical capital; education subsidies raise human capital; R&D grants raise technology.
3. Growth = $1,500/50,000 = 3\%$. Doubling time = $70/3 = \text{about } 23$ years.
4. Resources used to produce capital goods are not available for consumer goods, so consumption is lower initially (opportunity cost). The extra capital raises productivity and shifts the PPC outward, allowing more of both goods later.
5. LRAS shifts right (and SRAS shifts right). Output rises and the price level falls. Economic growth therefore raises real GDP without inflation if AD does not change.
6. They protect returns to investment and innovation, so firms and households are willing to build capital and invest in education. They reduce risk, corruption and the cost of contracts, which raises productivity and long-run growth.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. Rule of 70: $70/7 = 10$ years. A and B confuse the growth rate with the doubling time.
8. C. Better education raises human capital and potential output. A and B shift AD.
9. C. More capital raises production capacity. Choice A, moving toward the curve, uses existing resources and is not growth.
10. B. Technology explains the bulk of growth beyond added inputs. Population growth raises total, not per capita, GDP.
11. C. Productivity is real output per unit of labor input. B uses nominal GDP, which also changes with prices.
12. B. Human capital and technology increase LRAS. D reduces competition and efficiency, and E creates inflation.

SET C · APPLY AND EXTEND

13. (a) 1 point: a point further toward capital goods today; 1 point: PPC shifts outward in the future. (b) 1 point: LRAS shifts right, equilibrium output rises, price level falls (AD constant). (c) 1 point: opportunity cost is lower current consumption; benefit is higher future output and living standards.
14. (a) 1 point: A doubles in 70 years; B in 17.5 years. (b) 1 point: A doubles once to 200 and B doubles four times ($70/17.5 = 4$) to 1,600, so B is 8 times A. (c) 1 point: for any two reasons: higher investment, better education, technological catch-up, stronger institutions, open trade.

5.5 Supply-Side Policy and Policy Debates

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SET A · CHECK YOUR UNDERSTANDING

1. It is the view that economic performance is best improved by raising aggregate supply through incentives. Policies include cutting marginal income and capital gains tax rates, and deregulation of industries.
2. If the government takes all income, people have no reason to earn taxable income and will work in untaxed ways, so the tax base disappears. Revenue is 0 at both a 0% and a 100% rate.
3. Revenue falls, because the extra growth in the tax base is too small to offset the lower rate. This is the left side of the Laffer curve.
4. Changes in the money supply change the price level and other nominal variables but not real GDP or unemployment in the long run. In AD-AS, an increase in AD from money raises output in the short run, but SRAS shifts left until output returns to the vertical LRAS at a higher price level.
5. Keynesians think wages are sticky, so recovery can be slow and active policy is useful. Classical economists think wages and prices adjust quickly, so the economy self-corrects and policy mainly affects the price level.
6. A rule such as a constant money growth rate makes policy predictable and credible, anchoring expectations. A disadvantage is that it can't respond to unusual shocks such as a financial crisis, so output may fall farther.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. Incentive-based tax cuts target potential output. A, C and E shift AD, and D is a transfer.
9. C. Monetarists prefer a constant money growth rule. A is the discretionary approach they criticize.
11. A. Long and variable lags mean policy can arrive at the wrong time. C is an argument for discretion.
8. B. On the right side of the peak, lower rates raise revenue. A is the opposite. D is not a general condition.
10. B. Money is neutral: nominal variables change, not real output. A describes only the short run.
12. B. Fewer costly rules and more competition raise productive capacity. A is incomplete because deregulation affects supply.

SET C · APPLY AND EXTEND

13. (a) 1 point: AD, SRAS, vertical LRAS intersecting at Yf. (b) 1 point: LRAS and SRAS shift right; 1 point: output higher and price level lower. (c) 1 point: demand stimulus shifts AD right so output and prices rise, and the gain disappears after wages adjust. (d) 1 point: revenue falls and the deficit grows, which may raise interest rates and crowd out investment.
14. (a) 1 point: the rule anchors inflation expectations and keeps wage demands low, preventing costly disinflations. (b) 1 point: during a financial crisis demand for money jumps and the rule would not allow the central bank to inject liquidity, deepening recession. (c) 1 point: no long-run effect on real GDP; the price level rises about 10% (money neutrality).

5.6 Putting Stabilization Policy Together**SET A · CHECK YOUR UNDERSTANDING**

1. This is a recessionary gap because unemployment exceeds the natural rate. The central bank should conduct an open market purchase of bonds (or lower the discount rate or reserve requirement) to raise the money supply and lower interest rates.
2. In the long run the economy returns to the vertical LRAS at potential output. Higher AD raises wages and resource costs, shifting SRAS left, so output returns to potential while the price level stays higher.
3. The government borrows less, so demand for loanable funds shifts left (or public saving increases supply). The real interest rate falls and private investment rises. This is the opposite of crowding out.
4. The SRPC shifts up and to the right as SRAS shifts left. Expansionary policy reduces unemployment but increases inflation, while contractionary policy reduces inflation but increases unemployment.
5. The money supply shifts left, the nominal interest rate rises, investment and net exports fall, and AD shifts left. Real GDP and the price level fall, reducing inflation.
6. Higher expected inflation shifts the SRPC up. When unemployment returns to the natural rate, inflation is higher than before, with no lasting gain in employment.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. Both tools are expansionary. C has opposing effects; A is double contractionary.
9. B. Tight labor markets raise wages, SRAS shifts left, output returns to potential at a higher price level. A is the recession case.
11. B. A smaller deficit reduces government borrowing, reducing demand for funds. D reverses the effect.
8. C. Bond sales reduce reserves, shift MS left and raise the nominal rate. E is a fiscal effect.
10. C. A negative supply shock shifts SRAS left, lowering output and raising prices. A raises prices but also output.
12. B. Higher expected inflation raises wage demands and shifts the SRPC up. The LRPC depends on the natural rate.

SET C · APPLY AND EXTEND

13. (a) 1 point: correct graph with output left of Yf. (b) 1 point: e.g., open market purchase; 1 point: increase in government spending; AD shifts right. (c) 1 point: money supply shifts right, nominal rate falls. (d) 1 point: demand for loanable funds shifts right, real interest rate rises, investment crowded out, so AD increases less than the multiplier suggests.
14. (a) 1 point: SRPC shifts up/right, point S at higher unemployment and inflation. (b) 1 point: both rise. (c) 1 point: unemployment above natural rate reduces wages, SRAS shifts right, SRPC shifts back, economy returns to the natural rate. (d) 1 point: lower unemployment but higher inflation and potentially higher expected inflation, shifting the SRPC up again.

5.7 Multiple-Choice Practice: Long-Run Consequences of Stabilization Policies

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SET A · CORE CONCEPTS

1. C. Deficit finance raises demand for loanable funds, raising the real rate and lowering investment. Open market sales are a monetary effect and are not crowding out.
3. E. With an upward-sloping SRAS, lower unemployment goes with higher inflation. The vertical line describes the long-run curve, not the short-run one.
5. D. Lower interest rates from monetary easing offset the AD loss from the deficit reduction. Two contractionary tools would sharply reduce AD.
7. A. Supply-side policy targets incentives and productive capacity. Transfer payments and purchases are demand-side.
2. A. The deficit is a flow that adds to the debt stock: $5.0 + 0.2 = 5.2$ trillion. The choice of \$5 trillion treats the deficit as if it did not add to debt.
4. B. 70 divided by 2 is 35. Seventy years is the doubling time at 1% growth.
6. D. The LRPC is at the natural rate. Expected inflation shifts the SRPC, not the LRPC.

SET B · APPLICATIONS AND DATA

8. C. Demand for loanable funds shifts right when the government borrows more. A rise in saving would shift the supply curve.
10. B. Both unemployment and inflation rise, and the SRPC shifts outward. An AD increase would lower unemployment.
12. E. AD moves right along SRAS. Output and the price level both rise.
14. D. Points A and B yield the same revenue, so moving between them leaves revenue unchanged, although the revenue maximum is between them. The claim that cuts always raise revenue is false.
9. E. Total lending rises only from 5 to 6, while government takes more, and the higher rate lowers private investment. Quantity lent rising does not mean private investment rises.
11. B. Lower interest rates raise investment and shift AD right to AD2. The others shift AD left.
13. A. The ratio starts at 120% and the denominator grows faster, so the ratio declines. Debt growing does not by itself raise the ratio.

SET C · EXAM-LEVEL STRETCH

15. C. Rule of 70: X doubles every 17.5 years, so doubles twice in 35 years (4x), while Y doubles once (2x). The ratio is $4/2 = 2$.
17. E. In the long run, money changes nominal variables only. A real GDP effect would contradict neutrality.
19. A. Stagflation means higher unemployment together with higher inflation, caused by a negative supply shock. A rightward AD shift would lower unemployment.
16. C. Easy money lowers rates and tax increases reduce government borrowing (lower demand for funds), so the real rate falls. The AD net effect is ambiguous.
18. B. With adaptive expectations, expectations lag, so disinflation is costly. Immediate adjustment is the rational-expectations case.
20. D. Falling incomes lower taxes and raise transfers automatically. Crowding out is a consequence of deficits, not a cause.

5.8 Free-Response Practice: Long-Run Consequences of Stabilization Policies**QUESTION 1 · RECESSION, POLICY MIX AND LONG-RUN EFFECTS**

1. 1 point: correctly labeled axes (price level, real GDP) and curves. 1 point: short-run equilibrium output shown to the left of the vertical LRAS.
2. 1 point: bond purchase raises reserves and the money supply, shifting the money supply right. 1 point: the nominal interest rate falls. 1 point: AD shifts right on the graph because investment and net exports rise.
3. 1 point: demand for loanable funds shifts right. 1 point: the real interest rate rises and private investment falls (crowding out).
4. 1 point: high unemployment lowers nominal wages, SRAS shifts right. 1 point: output returns to potential and the price level falls (or ends lower than with policy).

QUESTION 2 · THE PHILLIPS CURVE AND EXPECTATIONS

5. 1 point: downward-sloping SRPC and vertical LRPC at 6% (axes labeled). 1 point: initial point where both intersect at 2% inflation.
7. 1 point: SRPC shifts upward as expected inflation rises. 1 point: workers demand higher wages, shifting SRAS left, unemployment returns to 6% at higher inflation.
6. 1 point: movement along the SRPC to lower unemployment and higher inflation. 1 point: explanation that AD rose, so output increased and unemployment fell below the natural rate.
8. 1 point: the SRPC shifts up (right) because SRAS shifts left, creating stagflation.

QUESTION 3 · DEFICITS, DEBT AND CROWDING OUT

9. 1 point: $12/16 = 75\%$.
11. 1 point: demand for loanable funds shifts right. 1 point: the real interest rate rises and private investment falls.
10. 1 point: debt = 12.8 trillion, GDP = 16.8 trillion, ratio = $12.8/16.8 = 76.2\%$. 1 point: it rose slightly because debt grew 6.7% while GDP grew 5%.
12. 1 point: households save more in anticipation of future taxes, so the supply of loanable funds shifts right, the interest rate rises by less (or not at all), and crowding out is reduced.

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QUESTION 4 · GROWTH POLICY AND SUPPLY-SIDE EFFECTS

13. 1 point: $70/2 = 35$ years. 1 point: $70/3.5 = 20$ years.
14. 1 point: corporate tax cut affects physical capital (investment). 1 point: university funding affects human capital. 1 point: deregulation affects technology/productivity through competition (accept efficiency).
15. 1 point: LRAS and SRAS shift right. 1 point: real GDP rises and the price level falls (AD constant).
16. 1 point: any valid cost, for example lower tax revenue raises the deficit and could crowd out investment, or resources devoted to investment reduce current consumption.

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Chapter 6: Open Economy: International Trade and Finance.

6 sections with explanations and worked examples, then 92 practice problems. Answers and full explanations are at the end of the chapter.

6.1 Balance of Payments

Learn how the balance of payments records a country's transactions with the world, why it always balances, and how trade deficits link to capital flows and national saving.

A country does not live in isolation. Every day its residents sell goods to foreigners, buy goods from them, lend to them, borrow from them, and send gifts abroad. The **balance of payments (BOP)** is the accounting record of all of these transactions between a country's residents and the rest of the world over a period, usually a year. Because it is built like a checkbook, with every transaction recorded as both a payment and a receipt, it has a surprising property: it always balances.

Structure of the balance of payments

Current account: net exports of goods and services (the trade balance), net primary income (interest, dividends and wages earned abroad minus those paid to foreigners), and net secondary income (transfers such as foreign aid and remittances).

Capital account: small transfers of non-produced assets and debt forgiveness. Usually close to zero.

Financial account: purchases and sales of assets across borders: foreign direct investment (FDI), portfolio investment (stocks, bonds, deposits), and official reserves. On the AP exam the capital and financial accounts are treated together as the flow of capital into the country.

Identity: current account balance + capital and financial account balance = 0.

Current account. The biggest piece is the **trade balance**, exports of goods and services minus imports. When this is expressed as a single number it is called **net exports** ($NX = X - M$), the same NX that appears in $GDP = C + I + G + NX$. Exports bring money in and count as positive; imports send money out and count as negative. Net primary income matters too: a U.S. pension fund that collects dividends from a Swiss company is earning income from abroad, while interest paid on Treasury bonds held by Japanese investors flows out. Net secondary income is one-way payments with nothing received in exchange, such as aid to another country or a worker sending money to family back home. Because net exports are the dominant item, a trade deficit and a current account deficit usually move together, but they are not identical.

Financial account. This records who is buying whose assets. **Foreign direct investment** means building or buying a business in which the investor holds a lasting, controlling stake (the usual cutoff is 10 percent ownership or more), such as a German automaker building an Alabama factory. **Portfolio investment** is buying stocks, bonds or deposits without control, and it can be reversed with a few clicks. A foreign purchase of a U.S. asset is a capital inflow to the United States; a U.S. purchase of a foreign asset is a capital outflow. The financial account balance is inflows minus outflows.

Why it must balance. Suppose Americans import \$100 billion more than they export. Foreigners now hold \$100 billion of dollars that Americans paid them. They have only three things to do with those dollars: buy U.S. goods (but we said exports are lower), give them away, or buy U.S. assets such as bonds, stocks and real estate. After exports and transfers are counted, the leftover dollars come back as a capital inflow. A current account deficit is therefore always matched by an equal net capital inflow, and a current account surplus is matched by a net capital outflow. In practice, measurement errors create a small statistical discrepancy, but the logic is exact.

Transaction	Account	Effect on the U.S. balance
U.S. firm sells aircraft to Brazil	Current (goods export)	Positive in current account
American tourist spends money in Italy	Current (services import)	Negative in current account
Foreign investor buys Treasury bonds	Financial (portfolio inflow)	Positive in financial account
U.S. firm builds a plant in Mexico	Financial (FDI outflow)	Negative in financial account

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Transaction	Account	Effect on the U.S. balance
Dividend paid to a U.S. owner of a foreign firm	Current (primary income)	Positive in current account
Government aid sent abroad	Current (secondary income)	Negative in current account

Deficits and surpluses. A current account deficit means the country is a **net borrower** from the rest of the world, financing extra spending with foreign funds. A surplus means it is a **net lender**. Neither is automatically good or bad. The United States ran trade deficits for most of the nineteenth century while foreign money built railroads, and the economy boomed. In the 1970s several Latin American countries borrowed heavily but did not invest the funds productively, and repayment became a crisis. In 1997 Thailand, Indonesia and South Korea suffered deep recessions when foreign portfolio investors suddenly pulled their money out. Persistent surpluses, as in Germany and Japan, do not guarantee strong growth either. The key question is whether borrowed funds are invested wisely.

National saving and investment identity

Supply of financial capital = demand for financial capital: $S + (M - X) = I + (G - T)$

S = private saving, I = private investment, $G - T$ = government budget deficit, $M - X$ = trade deficit = net capital inflow.

Rearranged: net capital inflow = $I + (G - T) - S$. A larger budget deficit, with S and I unchanged, requires a larger trade deficit (the twin deficits idea).

Business cycle link. In a recession, income falls, so households buy fewer imports and the trade balance improves. In an expansion, imports rise and the trade balance worsens. Also, do not confuse the **level of trade** (exports as a share of GDP, high for small economies with close neighbors) with the **trade balance** (exports minus imports).

EXAMPLE 1: COMPUTING THE CURRENT ACCOUNT

Country Alba reports the following data (billions of dollars): goods exports 1,200; goods imports 1,700; services exports 800; services imports 500; income received on foreign investments 600; income paid to foreigners 450; transfers received 40; transfers sent 190. The capital account is zero. Find (a) the trade balance in goods, (b) the current account balance, (c) the financial account balance, and interpret it.

SOLUTION

(a) Goods: $1,200 - 1,700 = -500$, a goods deficit of 500.

(b) Services: $800 - 500 = +300$. Net primary income: $600 - 450 = +150$. Net transfers: $40 - 190 = -150$. Current account = $-500 + 300 + 150 - 150 = -200$.

(c) Current account + financial account = 0, so the financial account balance is +200: a net capital inflow of 200 billion.

Interpretation: Alba is a net borrower. Foreigners are buying 200 billion more of Alba's assets than Alba buys of theirs, which funds its spending in excess of its income.

EXAMPLE 2: SAVING AND INVESTMENT IDENTITY

In an economy, private saving is 900, investment is 1,000 and the government budget deficit is 150. (a) What is the trade deficit ($M - X$)? (b) If the government cuts its deficit to 50 with S and I unchanged, what happens to $M - X$?

SOLUTION

(a) $S + (M - X) = I + (G - T)$, so $900 + (M - X) = 1,000 + 150$. Therefore $M - X = 250$, a trade deficit of 250 financed by a 250 capital inflow.

(b) $900 + (M - X) = 1,000 + 50$, so $M - X = 150$. The trade deficit falls by 100, equal to the deficit reduction. In reality S and I would also shift, so the full 100 is an upper bound.

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EXAMPLE 3: CLASSIFYING TRANSACTIONS

For the United States, name the account and the sign of each: (i) a German automaker builds a \$1 billion assembly plant in Alabama; (ii) a U.S. retiree buys Italian wine; (iii) a U.S. mutual fund buys Japanese government bonds; (iv) a U.S. firm receives profits from its French subsidiary.

SOLUTION

(i) Financial account, FDI inflow: a foreign purchase of a U.S. asset, so positive.

(ii) Current account, goods import: payment leaves the country, so negative.

(iii) Financial account, portfolio outflow: a U.S. purchase of a foreign asset, so negative.

(iv) Current account, primary income received: positive.

Check: (i) and (iv) bring funds in, (ii) and (iii) send funds out. Each transaction appears on both sides of the ledger once its payment is counted.

Common mistakes

(1) Saying a country with a current account deficit is 'losing money' or that the balance of payments is in deficit; the BOP as a whole always balances. (2) Confusing the trade balance with the current account, which also includes income and transfers. (3) Putting a foreign purchase of U.S. assets in the current account; asset purchases belong in the financial account. (4) Treating every deficit as harmful; judge it by how the borrowed funds are used.

Practice**SET A Check Your Understanding**

Answer each question in complete sentences or show the calculation.

1. List the three components of the current account and say which of them is included in net exports.
2. The U.S. current account balance is -300 billion dollars and the capital account is zero. What is the financial account balance, and what does it mean?
3. Explain the difference between a trade deficit and a current account deficit. Give one example of a flow that makes them differ.
4. The Chinese government buys U.S. Treasury bonds. Name the account in the U.S. balance of payments and explain the effect on the U.S. financial account.
5. Private saving is 800, investment is 900 and the budget deficit is 100. Compute net capital inflow ($M - X$) and state whether the country has a trade surplus or deficit.
6. Explain why a recession in the United States tends to shrink the U.S. trade deficit, other things equal.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following transactions is recorded in the current account of the United States?
- (A) A Japanese pension fund buys U.S. Treasury bonds
 - (B) A U.S. firm purchases 80 percent of a Mexican manufacturer
 - (C) A U.S. university receives tuition payments from students from abroad
 - (D) A Canadian investor buys shares of a U.S. company
 - (E) The U.S. central bank adds to its holdings of euros
8. A country has a current account deficit of \$80 billion and a capital account of zero. Which statement must be true?
- (A) It has a net capital inflow of \$ 80 billion
 - (B) Its exports exceed its imports
 - (C) Its government has a budget deficit of \$ 80 billion
 - (D) Its currency has depreciated
 - (E) Its private saving exceeds its investment
9. In an open economy, $S + (M - X) = I + (G - T)$. If private saving rises while I and $G - T$ do not change, what happens to the trade deficit?
- (A) It grows, because more saving means more imports
 - (B) It is unchanged, because saving is private
 - (C) It grows only if taxes rise
 - (D) It shrinks only if the budget is balanced
 - (E) It shrinks, because less foreign capital is needed

10. Use the data (billions of dollars) to find the current account balance.

Item	Receipts	Payments
Goods	500	650
Services	300	200
Net primary income		20
Net transfers		30

- (A) -150 (B) -100 (C) -50 (D) +100 (E) -20

11. Which of the following is the best example of foreign direct investment in the United States?
- (A) A French bank buys a 2 percent share of a U.S. corporation's stock
 - (B) A Swiss resident deposits money in a U.S. savings account
 - (C) A German tourist spends euros converted into dollars in Florida
 - (D) A Korean firm builds a new battery factory in Ohio
 - (E) A U.S. state government sells bonds to a Japanese insurance company
12. A country sustains a large current account deficit for 20 years. Which outcome would make the deficit most likely to benefit the country?
- (A) Foreign portfolio investors can withdraw their funds quickly
 - (B) The funds are used mainly to finance consumption
 - (C) The borrowed funds are used to build productive capital that raises future output
 - (D) The currency depreciates sharply each year
 - (E) The budget deficit rises by the same amount

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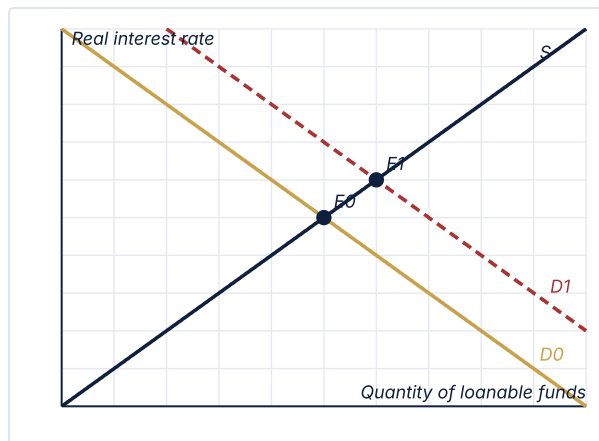
SET C Apply and Extend

Answer fully. Use the data or graph provided.

13. Country Zeeland reports (billions of dollars): goods exports 300, goods imports 420, services exports 150, services imports 90, net primary income -25, net secondary income -15, capital account 0. (a) Calculate the trade balance and the current account balance. (b) What is the financial account balance? (c) Describe what this means for Zeeland as a borrower or lender and name one condition under which this is healthy.

Item	Value
Goods exports / imports	300 / 420
Services exports / imports	150 / 90
Net primary income	-25
Net secondary income	-15

14. The graph shows the market for loanable funds in a country with an open economy. The government increases its budget deficit by borrowing more. (a) Which curve shifts and in which direction? (b) What happens to the real interest rate? (c) Explain how this change affects capital inflows and the trade balance through the national saving and investment identity.

**6.2** Exchange Rates and the Foreign Exchange Market

Learn how exchange rates are determined in the foreign exchange market, how to graph appreciation and depreciation, how to compute cross rates, and how fixed and floating regimes differ.

An **exchange rate** is the price of one currency in terms of another. If one dollar buys 0.90 euro, the exchange rate is 0.90 euro per dollar, and the euro's price in dollars is the inverse, $1/0.90$, or about \$1.11. When a currency can buy more of another currency it has **appreciated**; when it buys less it has **depreciated**. If the dollar appreciates against the euro, the euro necessarily depreciates against the dollar. Exchange rates are set in the **foreign exchange (forex) market**, where banks, firms, tourists and investors trade currencies.

Reading the forex graph

Graph the market for ONE currency. Vertical axis: the price of that currency in units of another (euros per dollar). Horizontal axis: quantity of that currency traded.

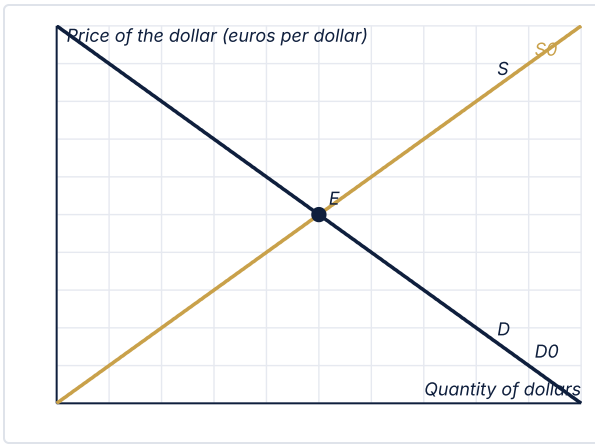
Demand for dollars comes from foreigners who want U.S. goods, services, tourism and assets. **Supply of dollars** comes from Americans who want foreign goods, services and assets, because they must sell dollars to get foreign currency.

A rightward shift of demand or a leftward shift of supply raises the price (appreciation). A leftward shift of demand or a rightward shift of supply lowers the price (depreciation).

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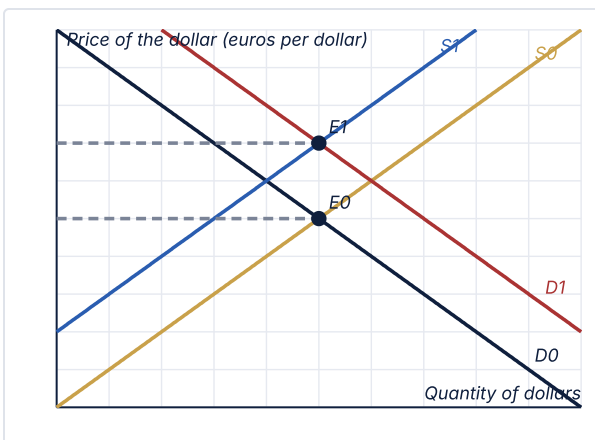


Equilibrium in the market for dollars. The equilibrium exchange rate is where quantity demanded equals quantity supplied.

Notice the logic of the sides. An American who buys a German car must pay in euros, so she sells dollars to get euros: she adds to the **supply** of dollars and the **demand** for euros. The same trade is one event seen from both currencies. Higher exports increase demand for dollars; higher imports increase the supply of dollars.

Determinant (change in the U.S. relative to abroad)	Demand for dollars	Supply of dollars	Dollar
Higher real interest rates (more attractive assets)	Increases	Decreases	Appreciates
Higher inflation / relatively higher prices	Decreases	Increases	Depreciates
Higher U.S. income (more imports)	No change	Increases	Depreciates
Higher foreign income (more U.S. exports)	Increases	No change	Appreciates
Foreign tastes shift toward U.S. goods	Increases	No change	Appreciates
U.S. tastes shift toward foreign goods	No change	Increases	Depreciates
Speculators expect the dollar to rise	Increases	Decreases	Appreciates

Why each factor works. Higher interest rates attract foreign portfolio investment, so foreigners must buy dollars first, and Americans keep savings at home. Relatively high inflation makes domestic goods more expensive, so foreigners buy less (lower demand) while locals turn to cheaper imports (greater supply). Higher domestic income raises spending on everything including imports. Speculation is self-fulfilling: if traders think the dollar will rise they buy now, and the rise confirms their belief for a time.

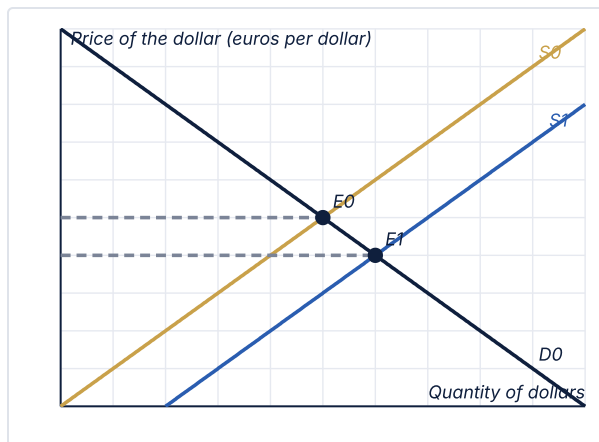


Market for dollars after U.S. interest rates rise: demand shifts right, supply shifts left, the dollar appreciates.

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Rising U.S. income raises imports, so Americans supply more dollars: the dollar depreciates.

Cross rates and purchasing power parity

Cross rate: the exchange rate between two currencies calculated from each one's rate against a third. If 1 USD = 150 yen and 1 USD = 0.90 euro, then 1 euro = $150/0.90 = 166.67$ yen.

Arbitrage is buying where an item is cheap and selling where it is dear for a risk-free profit; it forces the same good to cost the same in all places.

Purchasing power parity (PPP): the long-run exchange rate that makes a basket of traded goods cost the same in both countries:
 $\text{PPP rate} = \text{foreign price} / \text{domestic price}.$

Fixed versus floating. Under a **floating** (flexible) exchange rate the market sets the rate, as with the dollar, and the central bank does not target it. Under a **hard peg** the government commits to a fixed rate, such as 2 pesos per dollar. Under a **soft peg** (managed float) the rate mostly floats but the central bank intervenes now and then. To defend a peg when its currency is weak, the central bank must buy its own currency using foreign reserves, or raise interest rates to attract demand. The cost is that monetary policy is tied to the exchange rate instead of fighting recession or inflation, and reserves are limited. A currency union goes further and eliminates exchange rates among members, as the euro does. A floating rate lets the exchange rate absorb shocks and keeps monetary policy free, but it can swing sharply in the short run and stress exporters, importers and banks.

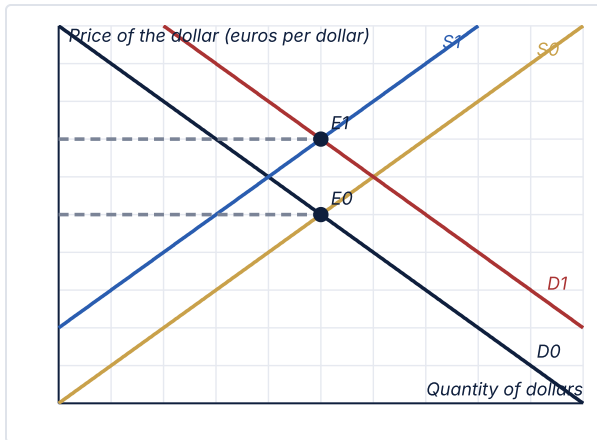
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EXAMPLE 1: INTEREST RATES AND THE DOLLAR

The Federal Reserve raises interest rates while the European central bank holds rates constant. Using a graph of the market for dollars (euros per dollar), show and explain what happens to the dollar and to the euro.



Market for dollars after U.S. interest rates rise: demand shifts right, supply shifts left, the dollar appreciates.

SOLUTION

Step 1: Draw the market for dollars with D_0 , S_0 and equilibrium E_0 .

Step 2: Higher U.S. returns mean European investors want more dollar assets, so demand shifts right (D_1). American investors keep more funds at home and buy fewer foreign assets, so they supply fewer dollars: supply shifts left (S_1).

Step 3: Both shifts raise the price of the dollar. In the graph the rate rises from 5 to 7. The dollar appreciates; the euro depreciates against the dollar. The equilibrium quantity may rise, fall or stay the same, since the shifts push quantity in opposite directions (here it is unchanged).

Exam point: always name the shift in each curve and give the reason.

EXAMPLE 2: CROSS RATE AND A TOURIST

An American plans a hotel stay costing 2,000 euros. (a) At 0.80 euro per dollar, what is the cost in dollars? (b) The dollar appreciates to 0.95 euro per dollar. What is the new dollar cost? (c) Given 1 USD = 0.92 euro and 1 USD = 150 yen, find yen per euro.

SOLUTION

(a) Dollars = euros / (euros per dollar) = $2,000 / 0.80 = \$2,500$.

(b) $2,000 / 0.95 = \$2,105$ (rounded). The dollar's appreciation made the trip about \$395 cheaper, which also encourages Americans to travel abroad and import more.

(c) Euro price in yen = $150 / 0.92 = 163.04$ yen per euro. Divide the two currencies' rates against the dollar, with the dollar canceling.

EXAMPLE 3: PPP

A basket of goods costs \$200 in the United States and 160 euros in the eurozone. The market rate is 0.90 euro per dollar. (a) Find the PPP rate. (b) Is the dollar overvalued or undervalued relative to PPP, and what would arbitrage do to it?

SOLUTION

(a) PPP rate = $160 / 200 = 0.80$ euro per dollar.

(b) At the market rate 0.90, each dollar buys more euros than PPP implies, so the dollar is overvalued. Converting \$200 gives 180 euros, which buys more than the basket at home (160 euros), so U.S. buyers would import from Europe, increasing the supply of dollars and pushing the dollar toward 0.80.

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Common mistakes

(1) Shifting the wrong curve: a U.S. interest rate rise affects both demand and supply of dollars. (2) Mixing up the axis: if the vertical axis is euros per dollar, a higher price means the dollar appreciates. (3) Saying a depreciation 'lowers quantity' automatically; quantity can move either way. (4) Forgetting that a currency's appreciation implies the other currency depreciates. (5) Using 'inflation rises' as an interest-rate effect; relative real interest rates and relative inflation have opposite effects on demand.

Practice**SET A Check Your Understanding**

Answer each question and show any calculation.

1. The exchange rate moves from 0.90 euro per dollar to 0.80 euro per dollar. Which currency appreciated and which depreciated? Give the new euro price of the dollar and the new dollar price of a euro.
2. Name two sources of demand for U.S. dollars and two sources of supply of U.S. dollars in the forex market.
3. American consumers' tastes shift toward French wine and away from California wine. Show the effect on the market for dollars (curve, direction, and result for the exchange rate).
4. Given $1 \text{ USD} = 0.80 \text{ British pound}$ and $1 \text{ USD} = 0.92 \text{ euro}$, calculate how many euros one pound buys.
5. A central bank has a hard peg that is above the market equilibrium value of its currency. What must it do to defend the peg, and what is one cost?
6. A basket costs \$250 in the United States and 200 euros in Europe. The market rate is 0.90 euro per dollar. Compute the PPP rate and say whether the dollar is overvalued or undervalued relative to PPP.

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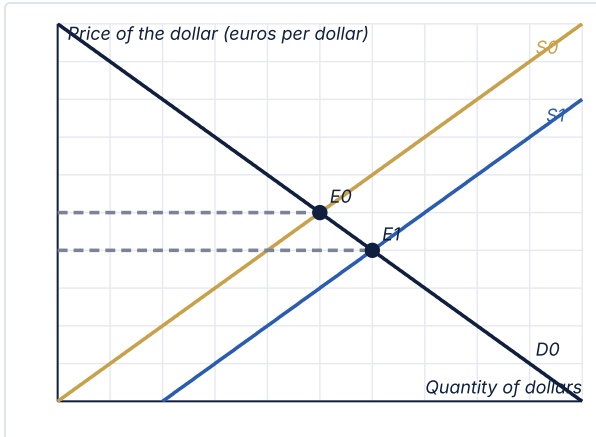
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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Which of the following would cause the U.S. dollar to appreciate against the euro?
- (A) Inflation in the United States rises relative to Europe
 - (B) U.S. real interest rates rise relative to European rates
 - (C) U.S. income rises faster than European income
 - (D) European consumers' tastes shift away from American goods
 - (E) Traders expect the dollar to fall
8. The graph shows the market for dollars. The shift from S_0 to S_1 could have been caused by



Rising U.S. income raises imports, so Americans supply more dollars: the dollar depreciates.

- (A) higher interest rates in the United States
 - (B) an increase in foreign demand for U.S. exports
 - (C) expectations that the dollar will appreciate
 - (D) a decrease in U.S. inflation relative to abroad
 - (E) rising income in the United States that raises imports
9. If 1 U.S. dollar = 150 Japanese yen and 1 U.S. dollar = 0.90 euro, then one euro is worth approximately
- (A) 135 yen
 - (B) 103.3 yen
 - (C) 1.67 yen
 - (D) 166.7 yen
 - (E) 0.006 yen
10. A country pegs its currency at a value above the equilibrium level in the forex market. To maintain the peg, its central bank must
- (A) buy its own currency using foreign exchange reserves
 - (B) sell its own currency and accumulate foreign reserves
 - (C) lower domestic interest rates
 - (D) lower the peg whenever demand falls
 - (E) reduce taxes to raise income
11. Which statement about exchange rate regimes is correct?
- (A) Under a floating rate, the central bank must hold large reserves of foreign currency
 - (B) Under a floating rate, the exchange rate never changes in the short run
 - (C) Under a hard peg, domestic monetary policy is constrained by the need to hold the exchange rate
 - (D) A hard peg lets monetary policy respond freely to recession
 - (E) A currency union keeps separate exchange rates among members
12. The dollar appreciates from 0.80 euro per dollar to 1.00 euro per dollar. A European hotel room costs 200 euros. The room's price in dollars changes from
- (A) \$ 160 to \$ 200
 - (B) \$ 250 to \$ 200
 - (C) \$ 250 to \$ 250
 - (D) \$ 200 to \$ 250
 - (E) \$ 160 to \$ 160

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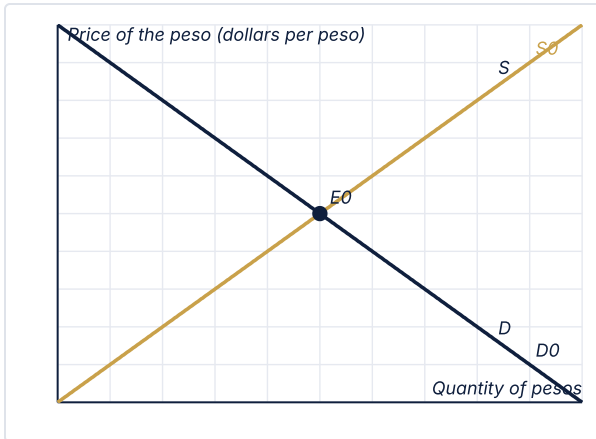
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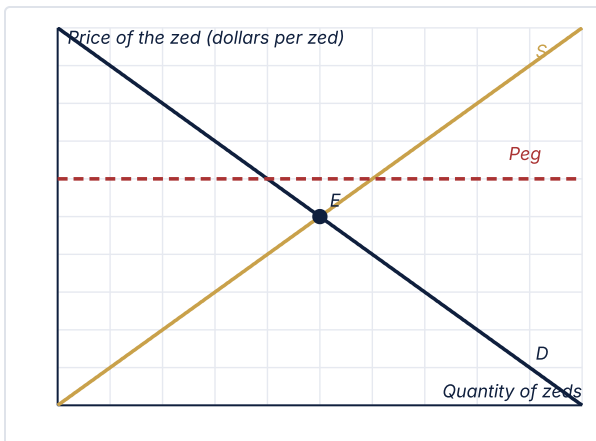
SET C Apply and Extend

Answer fully using the graph.

13. The graph shows the market for the Mexican peso (vertical axis: dollars per peso). (a) Mexican inflation rises relative to U.S. inflation. Identify the curve(s) that shift, the direction, and the effect on the peso's exchange rate. (b) Separately, a surge of U.S. tourists visits Mexico. Identify the shift and the effect on the peso. (c) Name one effect of the change in (a) on Mexican exports.



14. A small country pegs its currency, the zed. The graph shows the market for the zed (price in dollars per zed). The central bank pegs the zed at the level of the dashed line, above the equilibrium price. (a) Describe the market condition at the pegged price (surplus or shortage of zeds, and how large in the units shown). (b) Name two actions the central bank could take to defend the peg. (c) Explain one drawback of each action.



6.3 Effects of Exchange Rates and Trade Barriers

See how appreciation and depreciation change net exports and aggregate demand, and how tariffs, quotas, subsidies and trade agreements shift prices, output and welfare.

Trade links a country's output to the world. Two forces change how much a country exports and imports: the **exchange rate**, which changes the foreign-currency price of goods, and **trade policy**, which governments use to shape what crosses borders. This lesson shows how each shifts net exports and aggregate demand, and who wins and loses from protection.

Exchange rates and net exports

Appreciation of the dollar: U.S. goods cost more in foreign currency, foreign goods cost less in dollars. Exports fall, imports rise, NX falls, aggregate demand shifts left.

Depreciation of the dollar: U.S. goods become cheaper abroad, imports pricier. Exports rise, imports fall, NX rises, aggregate demand shifts right.

Because NX is a component of $AD = C + I + G + NX$, a change in NX is multiplied by the spending multiplier $1/(1 - MPC)$.

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Competitiveness. A country's goods are competitive when their price abroad is low compared with substitutes. The price a foreign buyer pays equals the dollar price converted into its currency. A U.S. machine selling for \$50,000 costs a European 40,000 euros when the rate is 0.80 euro per dollar, but 50,000 euros at 1.00 euro per dollar, a 25 percent rise, even though nothing changed in the factory. The same effect works on imports: a European tractor priced at 24,000 euros costs an American \$30,000 at 0.80 but only \$24,000 at 1.00. Depreciation also raises the price of imported inputs such as oil, which can shift short-run aggregate supply left. Price levels matter as well: if U.S. inflation is higher than abroad, American goods lose competitiveness even without a change in the nominal rate.

Trade barriers. Countries gain from trade because each can specialize in goods where it has a lower opportunity cost (comparative advantage), producing more total output and giving consumers lower prices and more variety. Governments nevertheless restrict trade with several tools.

Tool	What it does	Typical effects
Tariff	Tax on imported goods	Raises domestic price; government collects revenue; imports fall
Import quota	Legal limit on quantity imported	Raises domestic price; license holders or foreign sellers capture the extra revenue; no government revenue unless licenses are sold
Subsidy to domestic producers	Payment to firms	Lowers their costs, increases output, costs taxpayers; export subsidies undercut foreign rivals
Non-tariff barrier	Standards, licensing, paperwork	Raises costs of importing; hard to measure

Analyzing a tariff. Start with the domestic market for a good that can be imported at a world price P_w . At P_w , domestic quantity demanded exceeds domestic quantity supplied; the gap is imports. A tariff t raises the domestic price to $P_w + t$. Domestic producers increase output, consumers buy less, and imports shrink. In the graph below, free trade has $P_w = 3$, so domestic production is 3 and consumption 7 (imports 4). With a \$1 tariff the price is 4, production is 4, consumption is 6 and imports are 2.



Domestic market with a tariff. Free-trade price 3; price with a \$1 tariff 4.

Welfare effects of a tariff

Consumers lose consumer surplus: the area between the two prices to the left of the demand curve.

Domestic producers gain producer surplus: the area between the two prices above the supply curve.

The government gains revenue = tariff $\times$ quantity of imports still purchased.

The remaining two triangles are **deadweight loss**: a loss to society, so net welfare falls. A quota with the same price effect gives the same triangles, but the revenue rectangle goes to license holders or foreign exporters.

Trade agreements. In a **free trade area** (such as the agreement among the United States, Mexico and Canada) members remove tariffs on each other but keep their own tariffs on outsiders. A **customs union** adds a common external tariff, as in the European Union, which also has a common currency in the eurozone. The World Trade Organization sets rules and settles disputes among members. These agreements generally lower prices and expand exports, but some workers and industries lose when imports surge, and trade can divert purchases from the cheapest producer to a partner.

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Arguments for protection. The **infant industry argument** says a new industry needs temporary protection to grow until it can compete. Others cite national security, protecting domestic jobs, preventing **dumping** (selling abroad below cost), and enforcing health or environmental standards. Economists point out that the protected jobs cost consumers more than the wages saved, that other countries often retaliate with their own tariffs and cut exports, and that protection often goes to old, politically powerful industries rather than infants. The gains from protection are concentrated and visible; the losses are spread out over millions of consumers.

EXAMPLE 1: APPRECIATION AND AGGREGATE DEMAND

The dollar appreciates, causing U.S. exports to fall by \$40 billion and imports to rise by \$20 billion. The MPC is 0.75. Find the change in net exports and the change in aggregate demand, assuming a fixed price level.

SOLUTION

Step 1: Change in NX = change in exports - change in imports = $-40 - 20 = -\$60$ billion.

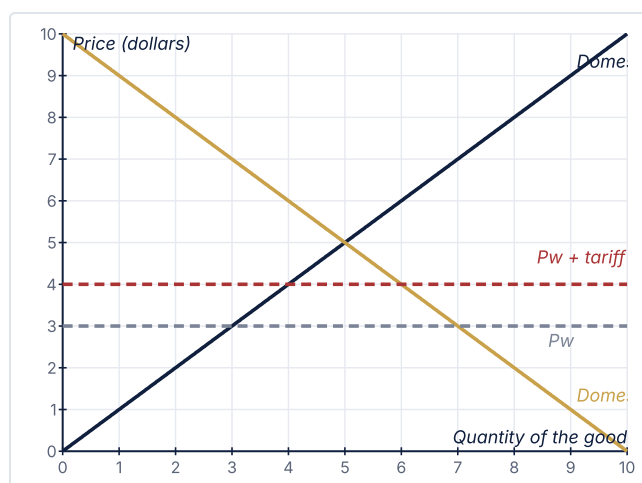
Step 2: Multiplier = $1/(1 - 0.75) = 4$.

Step 3: Change in AD (real GDP demanded) = $4 \times (-60) = -\$240$ billion. AD shifts left by \$240 billion at each price level.

Interpretation: an appreciation is contractionary, lowering real GDP and the price level in the short run.

EXAMPLE 2: TARIFF WELFARE

Using the graph ($P_w = 3$, tariff = \$1), find (a) imports before and after, (b) tariff revenue, (c) change in consumer surplus, (d) change in producer surplus, (e) deadweight loss.



SOLUTION

(a) Free trade: $Q_d = 7$, $Q_s = 3$, imports = 4. With tariff at price 4: $Q_d = 6$, $Q_s = 4$, imports = 2.

(b) Revenue = $1 \times 2 = \$2$.

(c) Consumer loss = $(1/2)(7 + 6)(1) = \$6.5$ (trapezoid between the prices).

(d) Producer gain = $(1/2)(3 + 4)(1) = \$3.5$.

(e) Deadweight loss = $6.5 - 3.5 - 2 = \$1$. Check with triangles: $(1/2)(1)(4 - 3) + (1/2)(1)(7 - 6) = 0.5 + 0.5 = \$1$.

EXAMPLE 3: COMPETITIVENESS

A U.S. firm sells a machine for \$60,000 in Europe. The exchange rate changes from 0.80 euro per dollar to 1.00 euro per dollar. What is the euro price before and after, and what happens to U.S. exports and the demand for dollars?

SOLUTION

Before: $60,000 \times 0.80 = 48,000$ euros. After: $60,000 \times 1.00 = 60,000$ euros, a 25 percent increase.

Europeans see the machine as costlier and substitute cheaper machines, so U.S. exports fall.

Fewer exports means lower demand for dollars, which pushes the dollar's value down again, an example of automatic adjustment toward balanced trade.

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Common mistakes

(1) Saying a depreciation lowers net exports because 'a weak currency is bad'; it makes exports cheaper and raises NX. (2) Forgetting that tariff revenue is a transfer to the government, not a loss, and that only the two triangles are deadweight loss. (3) Claiming a tariff lowers the domestic price; it raises it. (4) Mixing up a free trade area (no common outside tariff) with a customs union (common outside tariff).

Practice**SET A Check Your Understanding**

Answer each question and show any calculation.

1. Explain in steps why an appreciation of the dollar reduces U.S. net exports and shifts aggregate demand left.
2. A depreciation of the dollar raises the price of imported oil. Which aggregate curve could shift and in which direction, and which curve shifts because of the change in net exports?
3. A tariff is placed on imported steel. Identify one group that gains and two that lose, and state the direction of change in the domestic price and imports.
4. The world price of a good is \$8. Domestic demand is $Q_d = 100 - 5P$ and domestic supply is $Q_s = 5P$. Find imports under free trade, then with a \$1 tariff, and the tariff revenue.
5. Explain one difference between a tariff and an import quota that yields the same domestic price.
6. State the infant industry argument and give one criticism of it.

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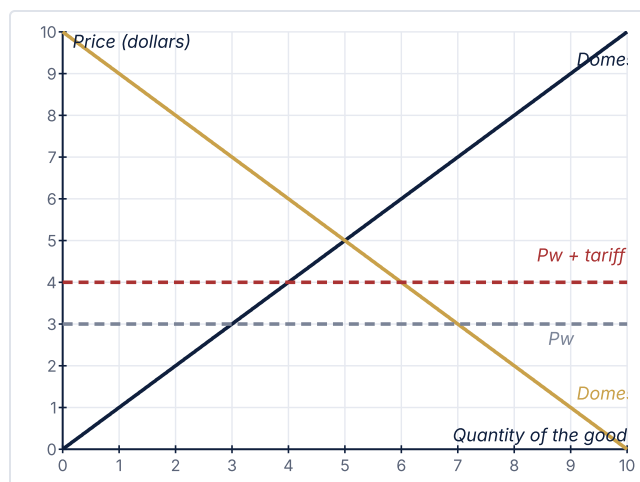
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SET B Exam-Style Multiple Choice

Choose the best answer.

7. The graph shows the domestic market for shoes with a world price P_w and a tariff. Compared with free trade, the tariff will



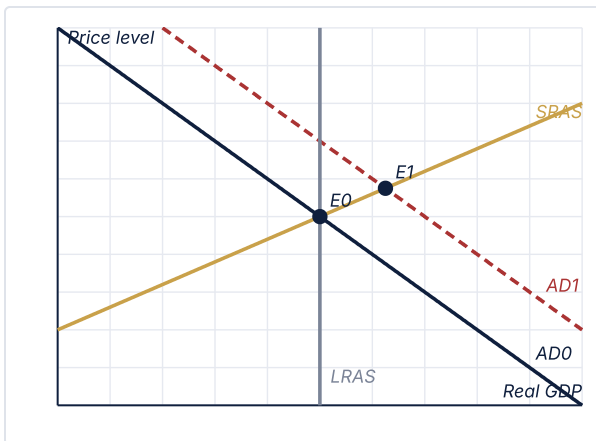
- (A) lower the domestic price and increase imports
 (B) raise the domestic price and increase domestic consumption
 (C) leave the domestic price unchanged but raise government revenue
 (D) lower domestic production and raise consumer surplus
 (E) raise the domestic price, increase domestic production and reduce imports
8. A depreciation of the U.S. dollar, other things equal, will most likely
 (A) increase net exports and shift aggregate demand right
 (B) increase imports and shift aggregate demand left
 (C) decrease net exports and shift aggregate supply right
 (D) have no effect on aggregate demand
 (E) increase export prices in foreign currency
9. Which is the most likely result of an import quota on sugar?
 (A) The domestic price falls and the government collects revenue
 (B) Domestic consumers buy more sugar at a lower price
 (C) The domestic price rises and those holding import licenses earn extra revenue
 (D) Imports rise as producers abroad are subsidized
 (E) The domestic price is unchanged but imports fall
10. Several countries agree to eliminate tariffs on one another's goods, and each keeps its own separate tariff on goods from non-members. This arrangement is a
 (A) customs union
 (B) common market with a shared currency
 (C) quota system
 (D) free trade area
 (E) tariff-rate monopoly
11. A government pays a per-unit subsidy to its farmers on wheat they export. Which is the most likely effect?
 (A) Domestic consumers of wheat see lower prices
 (B) Foreign wheat producers face lower world prices and taxpayers bear a cost
 (C) The domestic wheat price falls and imports rise
 (D) Foreign wheat producers gain from higher world prices
 (E) Government revenue rises

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12. In the graph, the economy begins at equilibrium E_0 with output at full employment (LRAS). The dollar then depreciates. In the short run, the new equilibrium E_1 shows



- (A) lower real GDP and a lower price level
- (B) higher real GDP and a lower price level
- (C) higher real GDP and a higher price level
- (D) lower real GDP and a higher price level
- (E) no change, because the economy is at full employment

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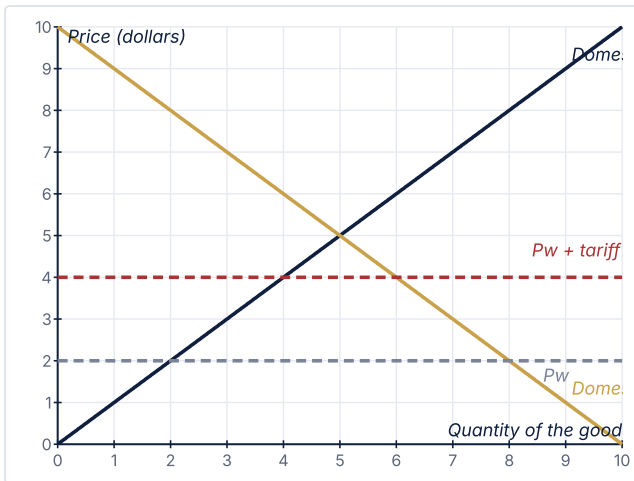
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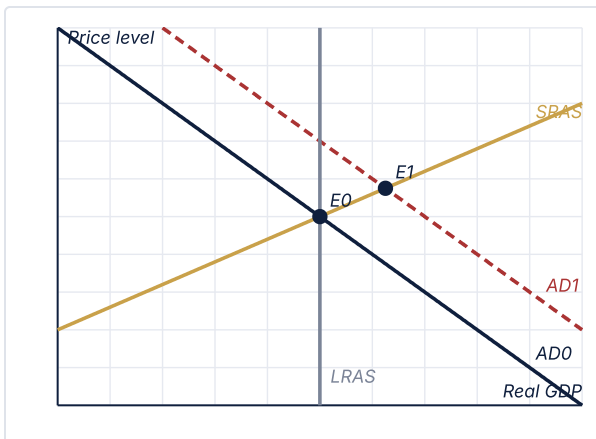
SET C Apply and Extend

Answer fully using the graph.

13. The graph shows the domestic market for a good. The world price is \$2 and the government imposes a \$2 tariff, raising the domestic price to \$4. (a) How many units are imported before and after the tariff? (b) Calculate tariff revenue. (c) Calculate the deadweight loss. (d) Explain who gains and who loses and why economists often oppose the tariff.



14. The U.S. dollar depreciates against other currencies. The economy begins at long-run equilibrium (E_0 on the graph). (a) Explain what happens to U.S. exports, imports and net exports. (b) Show the effect on the AD curve and describe the new short-run equilibrium for real GDP and the price level. (c) Explain what happens in the long run if no policy is used.

**6.4 Policy in the Open Economy**

Trace how monetary and fiscal policy move interest rates, capital flows, the exchange rate and net exports, and connect the loanable funds, money, forex and AD-AS models.

In a closed economy, monetary and fiscal policy work through interest rates, investment and spending. In an open economy, a second channel appears: changes in interest rates move **international capital flows**, which change the exchange rate, which changes **net exports**. To analyze policy you must link four graphs: the money market (or loanable funds market), the foreign exchange market, and aggregate demand and supply. A good answer follows the chain one link at a time.

Monetary policy in an open economy

Expansionary: the central bank buys bonds, money supply increases, interest rates fall, capital flows out (demand for dollars falls, supply of dollars rises), the dollar depreciates, net exports rise, aggregate demand shifts right by more than in a closed economy.

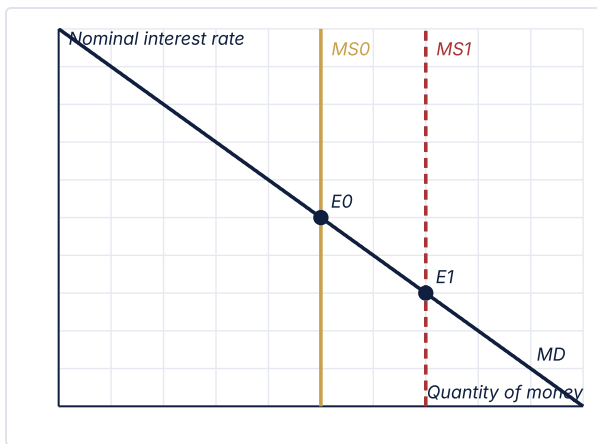
Contractionary: money supply decreases, interest rates rise, capital flows in, the dollar appreciates, net exports fall, aggregate demand shifts left.

The exchange rate channel reinforces the interest rate channel, so monetary policy is stronger in an open economy.

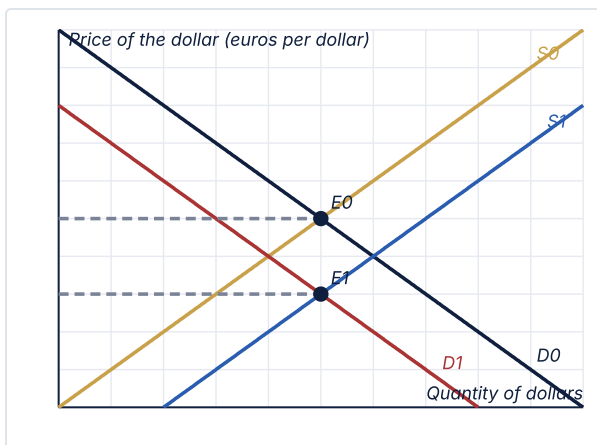
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The money market graph above shows expansionary policy: the central bank increases the money supply from MS_0 to MS_1 and the nominal interest rate falls from 5 to 3. Lower U.S. interest rates make dollar assets less attractive. Foreign investors demand fewer dollars, and Americans send more funds abroad, supplying more dollars. The forex graph shows the result: demand shifts left, supply shifts right, the dollar depreciates.



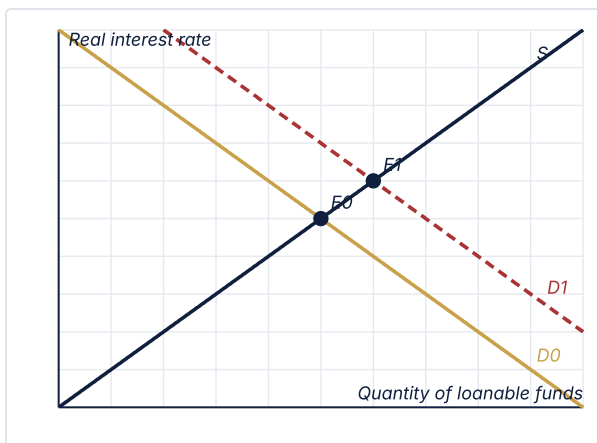
Market for dollars after U.S. interest rates fall: demand shifts left, supply shifts right, the dollar depreciates.

Fiscal policy in an open economy

Expansionary fiscal policy (more G or lower taxes) shifts AD right. If financed by borrowing, demand for loanable funds rises, the real interest rate rises, and private investment is crowded out.

Higher interest rates attract foreign capital: demand for dollars rises, the dollar appreciates, and net exports fall. This partly offsets the stimulus (some call it crowding out of net exports). Higher income also raises imports.

With S and I fixed, a larger budget deficit requires a larger trade deficit: the **twin deficits** link from $S + (M - X) = I + (G - T)$.



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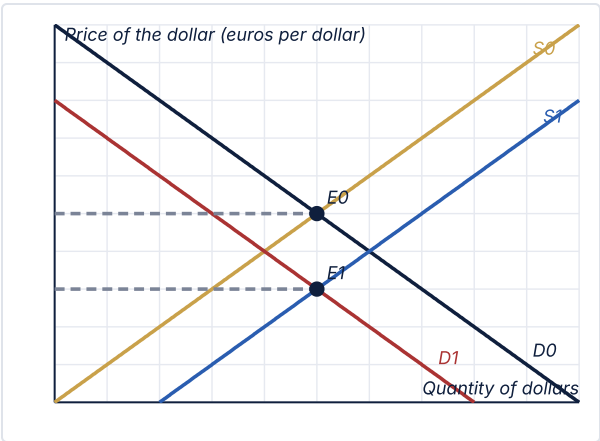
The twin deficits. The identity says the supply of loanable funds, domestic saving plus net capital inflow, equals the demand for funds, investment plus the budget deficit. If the government borrows more and private saving and investment do not change, the missing funds must come from abroad, which means the trade deficit grows. The United States saw this in the 1980s. But the link is not rigid: in the late 1990s the budget moved to surplus while the trade deficit widened, because investment boomed. Some economists note that people may save more when they anticipate higher future taxes (Ricardian equivalence), which would weaken the link, though evidence suggests this holds only partly.

Policy change	Interest rate	Capital flow	Dollar	Net exports	Effect on AD
Expansionary monetary	Falls	Outflow	Depreciates	Rise	Shifts right (reinforced)
Contractionary monetary	Rises	Inflow	Appreciates	Fall	Shifts left (reinforced)
Expansionary fiscal (deficit)	Rises	Inflow	Appreciates	Fall	Right, partly offset
Contractionary fiscal	Falls	Outflow	Depreciates	Rise	Left, partly offset
Foreign interest rates rise	Domestic unchanged	Outflow	Depreciates	Rise	Shifts right

Exchange rate regimes and policy. A country with a **hard peg** cannot run an independent monetary policy: if it lowered interest rates to fight a recession, capital would flow out and the currency would fall below the peg. To defend the peg the central bank may have to raise interest rates even in a recession. A country with a floating rate can use monetary policy freely, and the exchange rate adjusts. Countries that attract large inflows of short-term capital are vulnerable if investors suddenly leave, as happened in East Asia in 1997.

EXAMPLE 1: EXPANSIONARY MONETARY POLICY

The economy is in a recession. The central bank buys government bonds. Using the forex graph, trace the effect on the dollar and net exports and the final effect on real GDP and the price level.



Market for dollars after U.S. interest rates fall: demand shifts left, supply shifts right, the dollar depreciates.

SOLUTION

- Step 1: Bond purchases increase bank reserves and the money supply; the nominal interest rate falls (money market graph).
- Step 2: Lower U.S. rates make dollar assets less attractive, so demand for dollars shifts left and supply of dollars shifts right; the dollar depreciates from 5 to 3 on the graph.
- Step 3: Cheaper dollars make exports more competitive and imports costlier, so NX rises.
- Step 4: Lower interest rates also raise investment, and higher NX adds to spending: AD shifts right. Real GDP rises toward full employment and the price level rises somewhat.

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EXAMPLE 2: FISCAL STIMULUS AND NET EXPORTS

The government raises spending by \$100 billion financed by borrowing. The MPC is 0.8. The higher interest rate causes the dollar to appreciate and net exports to fall by \$40 billion, and investment falls by \$20 billion. Find the change in aggregate demand.

SOLUTION

Step 1: Multiplier = $1/(1 - 0.8) = 5$.

Step 2: Net initial change in spending = $+100 - 40 - 20 = +\$40$ billion.

Step 3: Change in AD = $5 \times 40 = \$200$ billion.

Compare: without the offsets the shift would be $5 \times 100 = \$500$ billion, so the offsetting effects cut the stimulus by more than half.

EXAMPLE 3: TWIN DEFICITS

An economy has private saving of 1,000 and investment of 800. The budget deficit rises from 100 to 300. Using $S + (M - X) = I + (G - T)$, find the trade balance before and after, with S and I unchanged.

SOLUTION

Before: $1,000 + (M - X) = 800 + 100$, so $M - X = -100$: a trade surplus of 100.

After: $1,000 + (M - X) = 800 + 300$, so $M - X = +100$: a trade deficit of 100.

The 200 increase in the budget deficit moves the trade balance by 200, from surplus to deficit, funded by capital inflows. In practice some of the change is absorbed by private saving or investment.

Exam tip

Write the chain in order and name the direction of every variable: money supply, interest rate, demand and supply of dollars, exchange rate, net exports, AD, real GDP, price level. Two links are commonly missed: both the demand and the supply of the currency shift when interest rates change, and net exports respond to the exchange rate, not directly to the interest rate.

Practice**SET A Check Your Understanding**

Answer each question and show any calculation.

1. The central bank sells bonds to fight inflation. Trace the effects through the interest rate, capital flows, the dollar and net exports.
2. Explain why monetary policy tends to be more powerful, and expansionary fiscal policy somewhat weaker, in an open economy with a floating exchange rate.
3. Government spending rises by \$50 billion, MPC = 0.75, and net exports fall by \$20 billion because of dollar appreciation. Find the change in aggregate demand (ignore investment).
4. With private saving and investment unchanged, the budget deficit rises by \$60 billion. What happens to the trade deficit? Explain with the identity.
5. Interest rates abroad rise while U.S. rates stay the same. What happens to the demand and supply of dollars, the value of the dollar, and U.S. net exports?
6. Why can a country with a hard peg not freely use expansionary monetary policy to fight a recession?

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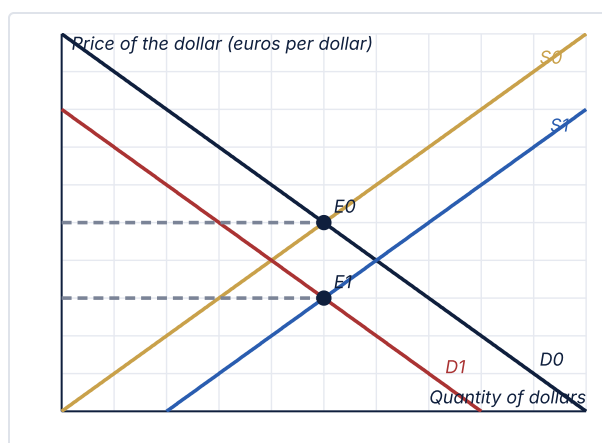
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SET B Exam-Style Multiple Choice

Choose the best answer.

7. Suppose the central bank lowers its target interest rate. In the foreign exchange market, the dollar will most likely
 - (A) appreciate, and net exports will fall
 - (B) appreciate, and net exports will rise
 - (C) depreciate, and net exports will fall
 - (D) depreciate, and net exports will rise
 - (E) remain unchanged, because only domestic investment responds
8. The U.S. government runs a larger budget deficit financed by borrowing from the public. Other things equal, in an open economy this is most likely to
 - (A) lower the real interest rate and raise net exports
 - (B) raise the real interest rate, appreciate the dollar and reduce net exports
 - (C) raise the real interest rate, depreciate the dollar and raise net exports
 - (D) leave the real interest rate unchanged but reduce saving
 - (E) lower the real interest rate and appreciate the dollar
9. The graph shows the market for dollars. Which of the following could explain the shift from D_0 , S_0 to D_1 , S_1 ?



Market for dollars after U.S. interest rates fall: demand shifts left, supply shifts right, the dollar depreciates.

- (A) The Federal Reserve raises interest rates
 - (B) U.S. consumers switch to buying imports
 - (C) Foreign income rises
 - (D) Traders expect the dollar to appreciate
 - (E) The Federal Reserve lowers interest rates
10. With private saving and investment constant, an increase in the government budget deficit will lead to
 - (A) a larger trade deficit financed by foreign capital
 - (B) a smaller trade deficit
 - (C) a trade surplus
 - (D) higher exports because the dollar appreciates
 - (E) a smaller current account deficit
11. A country with a floating exchange rate has high unemployment and expands its money supply. Compared with a country with a hard peg, it
 - (A) must raise interest rates to maintain the exchange rate
 - (B) will see its exports fall as a result
 - (C) can lower domestic interest rates freely and let its currency depreciate
 - (D) must also raise taxes
 - (E) cannot use monetary policy at all

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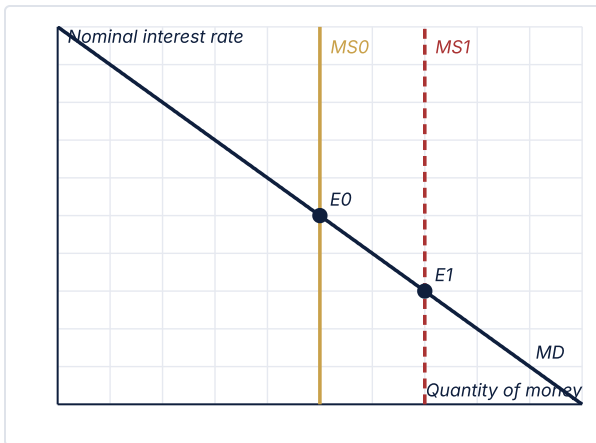
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12. To defend its fixed exchange rate against a sudden outflow of capital during a recession, a central bank would most likely
- (A) lower interest rates to stimulate investment
 - (B) reduce reserves of foreign currency to zero
 - (C) increase the money supply
 - (D) raise domestic interest rates, which deepens the recession
 - (E) lower the peg to zero

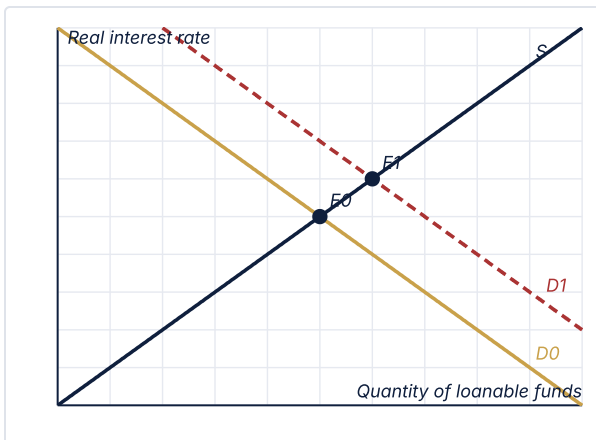
SET C Apply and Extend

Answer fully using the graph.

13. The graph shows the money market. (a) What action by the central bank moves the money supply from MS_0 to MS_1 ? (b) What happens to the nominal interest rate? (c) Explain the effects on demand and supply of dollars, the value of the dollar, and net exports. (d) What is the final effect on aggregate demand, real GDP and the price level in the short run?



14. The graph shows the loanable funds market. The government increases its deficit spending, shifting D_0 to D_1 . (a) What happens to the real interest rate? (b) Explain the effect on the dollar and net exports. (c) If the MPC is 0.75, government spending rises by \$50 billion and net exports fall by \$10 billion, what is the change in aggregate demand (ignore investment)? (d) With $S = 700$ and $I = 600$, and the budget deficit rising from 100 to 150, find the change in $M - X$.



6.5

Multiple-Choice Practice: Open Economy: International Trade and Finance

Twenty AP-style questions on the balance of payments, exchange rates, trade policy and open-economy policy.

Choose the best answer for each question. Use the graphs and data given. Each explanation says why the correct choice works and why the best distractor fails.

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SET A Core Concepts

Choose the best answer.

1. Which of the following is recorded in the financial account of the United States?
(A) A Japanese insurance company buys bonds issued by a U.S. corporation
(B) A U.S. firm sells software to a customer in India
(C) An American tourist pays for a hotel in Spain
(D) A U.S. resident sends money to relatives in Mexico
(E) A U.S. firm receives interest from a foreign borrower
2. A country has a net capital inflow (capital and financial account surplus) of \$50 billion. Assuming no statistical discrepancy, its current account balance is
(A) a surplus of \$ 50 billion
(B) a surplus of \$ 100 billion
(C) zero
(D) a deficit of \$ 50 billion
(E) a deficit of \$ 100 billion
3. The exchange rate changes from 0.80 euro per dollar to 0.90 euro per dollar. This means the
(A) dollar has depreciated against the euro
(B) dollar has appreciated against the euro
(C) euro has appreciated against the dollar
(D) dollar has appreciated and the euro has appreciated
(E) price of the euro in dollars has risen
4. In the market for dollars, a higher U.S. inflation rate relative to inflation abroad will most likely cause
(A) demand for dollars to increase and the dollar to appreciate
(B) supply of dollars to decrease and the dollar to appreciate
(C) demand for dollars to decrease and the dollar to appreciate
(D) only supply to increase, with no change in demand
(E) demand for dollars to decrease, supply of dollars to increase, and the dollar to depreciate
5. A tariff on imported bicycles will
(A) lower the price of bicycles for consumers
(B) increase imports and reduce domestic production
(C) raise the domestic price, benefit domestic producers, and generate government revenue
(D) reduce domestic consumption and also reduce the domestic price
(E) benefit consumers and foreign producers at the expense of domestic producers
6. If 1 U.S. dollar = 7 Chinese yuan and 1 U.S. dollar = 0.8 British pounds, then one British pound is worth
(A) 5.6 yuan
(B) 8.75 yuan
(C) 0.114 yuan
(D) 7.8 yuan
(E) 1.14 yuan
7. A country that adopts a hard peg for its currency
(A) can lower interest rates freely during recessions
(B) lets the market determine its exchange rate
(C) has no need for foreign exchange reserves
(D) gives up independent monetary policy aimed at domestic inflation or unemployment
(E) sees its exports rise when its currency appreciates

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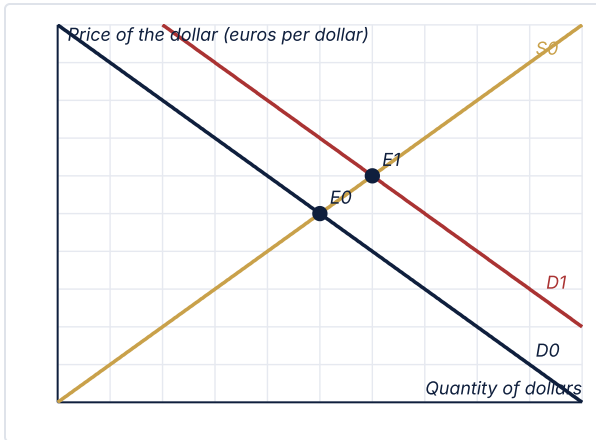
SET B Applications and Data

Use the data or graph where provided.

8. The table shows a country's transactions for one year (billions of dollars). The current account balance is

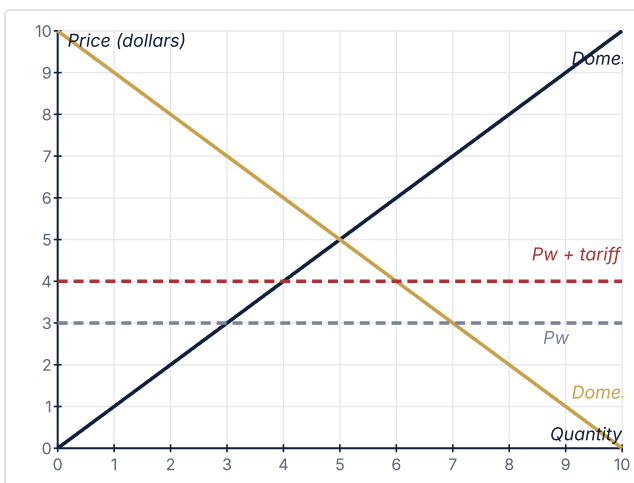
Item	Exports/Receipts	Imports/Payments
Goods	800	950
Services	400	250
Net primary income	60	
Net secondary income		40

- (A) a deficit of \$ 20 (B) a deficit of \$ 150 (C) a surplus of \$ 20
 (D) a surplus of \$ 150 (E) a surplus of \$ 210
9. The graph shows the market for the U.S. dollar. The shift from D0 to D1 could be caused by



Market for dollars

- (A) an increase in U.S. income that raises purchases of imports
 (B) a decrease in U.S. interest rates
 (C) higher U.S. inflation compared with abroad
 (D) a shift in U.S. tastes toward foreign goods
 (E) an increase in foreign incomes that raises purchases of U.S. goods
10. The graph shows the domestic market for a good with a world price of \$3 and a tariff of \$1. How much tariff revenue does the government collect?



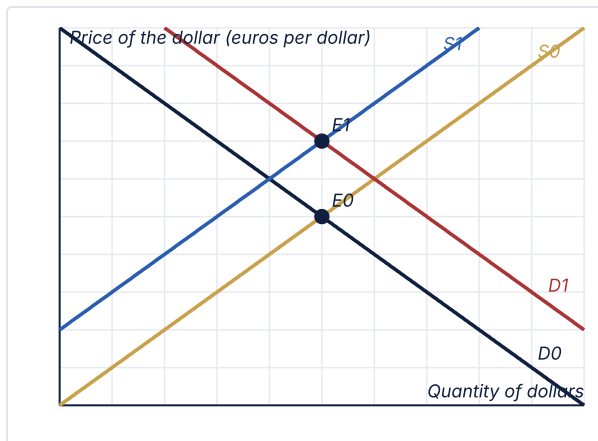
- (A) \$ 2 (B) \$ 1 (C) \$ 4 (D) \$ 6 (E) \$ 7

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11. In an economy, private saving is 500, investment is 450, and the government budget deficit is 80. The trade balance is
 (A) a surplus of 30 (B) a deficit of 30 (C) a deficit of 130
 (D) a surplus of 130 (E) a deficit of 80
12. The U.S. dollar depreciates. Net exports rise by \$25 billion and the MPC is 0.8. Other things equal, aggregate demand will shift
 (A) right by \$25 billion (B) left by \$125 billion (C) right by \$31.25 billion
 (D) right by \$125 billion (E) left by \$25 billion
13. The graph shows the market for dollars after a change. Which policy action would most likely cause the shift?



Market for dollars

- (A) The Federal Reserve buys bonds
 (B) Congress cuts government spending to reduce the budget deficit
 (C) The Federal Reserve sells bonds
 (D) U.S. consumers prefer foreign goods
 (E) Foreign interest rates rise
14. Many East Asian economies suffered deep recessions in 1997-1998 largely because
 (A) their current account surpluses were too large
 (B) trade deficits are always harmful
 (C) they were net lenders to the rest of the world
 (D) they had imposed high tariffs
 (E) capital inflows were short-term and could leave suddenly, causing a financial crisis

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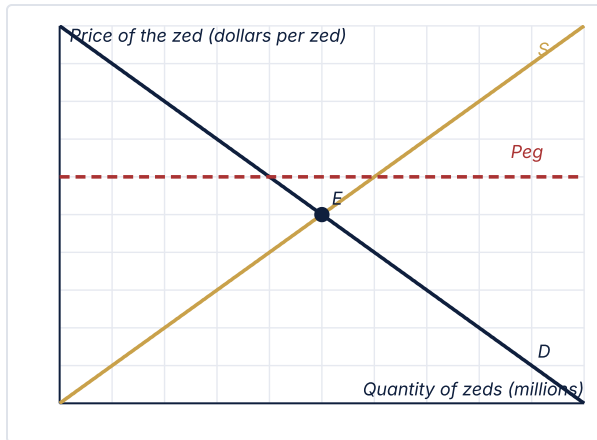
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SET C Exam-Level Stretch

Choose the best answer.

15. Private investment rises by 50 and private saving rises by 20; the government budget deficit is unchanged. By the saving and investment identity, net capital inflow
 (A) rises by 30 (B) falls by 30 (C) rises by 70
 (D) falls by 70 (E) does not change
16. Why does expansionary monetary policy increase aggregate demand by more in an open economy than in a closed economy?
 (A) Lower interest rates raise the exchange rate and exports
 (B) Higher output increases the tax base
 (C) Lower interest rates depreciate the currency, which raises net exports
 (D) A depreciation raises imports and lowers net exports
 (E) Domestic saving rises, which raises investment
17. Which of the following is true of a quota and a tariff that yield the same domestic price?
 (A) A tariff creates deadweight loss but a quota does not
 (B) A quota always raises government revenue more than a tariff
 (C) A quota lowers the domestic price
 (D) A tariff increases imports
 (E) With a quota the price gap may go to import license holders or foreign sellers instead of the government
18. The graph shows the market for the zed, the currency of a country that has pegged its exchange rate at the dashed line. To maintain the peg, the central bank must



- (A) sell 2 million zeds for foreign reserves (B) buy 2 million zeds using foreign reserves
 (C) buy 6 million zeds (D) sell 4 million zeds
 (E) do nothing, since the peg is at equilibrium
19. Which combination of events would definitely cause the dollar to depreciate?
 (A) U.S. real interest rates rise and U.S. income rises
 (B) U.S. inflation falls and foreign income rises
 (C) U.S. real interest rates rise and foreign tastes favor U.S. goods
 (D) U.S. real interest rates fall and U.S. income rises
 (E) U.S. inflation falls and speculators expect the dollar to rise
20. A basket of goods costs \$100 in the United States and 90 euros in the eurozone. The market exchange rate is 0.80 euro per dollar. Relative to purchasing power parity, the dollar is
 (A) undervalued, and would tend to appreciate (B) overvalued, and would tend to appreciate
 (C) undervalued, and would tend to depreciate (D) overvalued, and would tend to depreciate
 (E) correctly valued

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6.6 Free-Response Practice: Open Economy: International Trade and Finance

Four free-response questions on foreign exchange graphs, balance of payments, trade policy and an integrated open-economy problem.

Each question is scored by points. Draw and label graphs fully (axes, curves, equilibrium, shifts with arrows), state the direction of every change, and give a brief reason. Model answers list the scoring points.

QUESTION 1 The Foreign Exchange Market

Assume the United States and the eurozone have flexible exchange rates and trade freely. Answer the following about the market for U.S. dollars, with euros per dollar on the vertical axis.

- (a) Draw a correctly labeled graph of the foreign exchange market for the dollar showing the equilibrium exchange rate and quantity.
- (b) Assume real interest rates in the eurozone fall while U.S. rates are unchanged. On your graph show the effect on the demand for and supply of dollars.
- (c) State whether the dollar appreciates or depreciates and explain the effect on U.S. net exports.
- (d) What happens to U.S. aggregate demand in the short run? Explain.

QUESTION 2 Balance of Payments

The table gives data for the country of Norland for one year, in billions of dollars. The capital account is zero.

- (a) Calculate Norland's merchandise (goods) trade balance and its current account balance.

Item	Receipts	Payments
Goods	600	760
Services	250	180
Primary income	90	140
Secondary income (transfers)	20	60

- (b) Calculate the financial account balance and explain what it means for Norland as a borrower or lender.
- (c) A German firm builds a plant in Norland. Identify the account and the effect on that account's balance.
- (d) Using the national saving and investment identity, explain how an increase in Norland's budget deficit affects its trade balance, other things equal.

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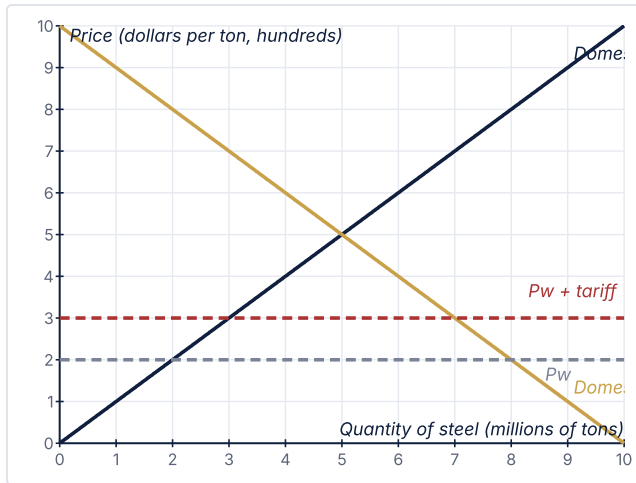
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QUESTION 3 Trade Policy

The graph shows the domestic market for steel in a country. The world price is 2 (hundreds of dollars per ton). The government imposes a tariff of 1 per ton, raising the domestic price to 3. Quantities are in millions of tons.

9. (a) How many tons are imported before the tariff and after the tariff?

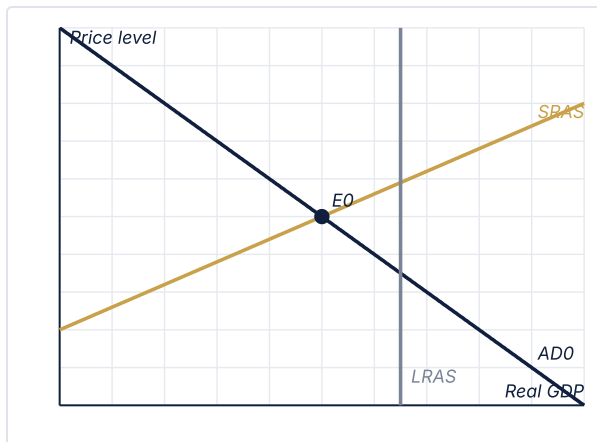


10. (b) Calculate the tariff revenue and the deadweight loss.
 11. (c) Identify who gains and who loses from the tariff.
 12. (d) Suppose the trading partner retaliates with its own tariff on this country's exports. Explain the effect on this country's net exports and aggregate demand.

QUESTION 4 Integrated Open-Economy Analysis

The graph shows an open economy with a flexible exchange rate in a recession (output is below the LRAS level). The central bank decides to conduct expansionary monetary policy.

13. (a) Identify an open market operation the central bank would use and its effect on the nominal interest rate.



14. (b) Explain the effect on the demand for and supply of the country's currency and on the exchange rate.
 15. (c) Explain the effect on net exports.
 16. (d) Describe the final effect on aggregate demand, real GDP and the price level, and compare the strength of the policy with a closed economy.

Answers Chapter 6: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

6.1 Balance of Payments

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SET A · CHECK YOUR UNDERSTANDING

1. The three components are the trade balance in goods and services, net primary income, and net secondary income (transfers). Only the trade balance, exports minus imports, is net exports. Income and transfers are in the current account but not in NX.
2. The financial account is +300 billion. Since the current account and capital and financial account sum to zero, a 300 billion current account deficit is financed by a 300 billion net capital inflow: foreigners acquired 300 billion more U.S. assets than Americans acquired abroad.
3. A trade deficit means imports of goods and services exceed exports. A current account deficit also includes net primary and secondary income. Example: a country with a small trade deficit that pays large interest to foreign bondholders or sends big aid payments can have a larger current account deficit than trade deficit.
4. This is a financial account transaction (portfolio investment). It is a foreign purchase of a U.S. asset, so it counts as a capital inflow and raises the financial account balance. It also helps finance a U.S. current account deficit.
5. Using $S + (M - X) = I + (G - T)$: $800 + (M - X) = 900 + 100$, so $M - X = 200$. Imports exceed exports by 200, a trade deficit, financed by a 200 capital inflow.
6. A recession lowers income and spending, so households and firms buy fewer imports. Exports depend on foreign income, which is unchanged. Imports fall while exports hold, so $X - M$ rises and the trade deficit shrinks. A boom does the reverse.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. C. C. Tuition paid by foreign students is a service export, part of the current account. The others are purchases of assets, which belong in the financial account; the Treasury bond purchase is the tempting one but it is portfolio investment, not trade.
8. A. A. The balance of payments identity requires the financial account to be +80 when the current account is -80. Choice C confuses the budget with the trade sector; the identity links them but does not make them equal. Choice E is backward because a capital inflow means domestic saving is below domestic investment plus the budget deficit.
9. E. E. With I and $G - T$ fixed, a higher S must be offset by a lower $M - X$, since the right side is unchanged. Domestic saving replaces foreign funds. Choice A treats saving as spending on imports, which it is not.
10. B. B. Goods: $500 - 650 = -150$. Services: $300 - 200 = +100$. Net primary income -20, net transfers -30. Total = $-150 + 100 - 20 - 30 = -100$. Choice A is the goods balance alone, the typical error of ignoring services and income.
11. D. D. FDI means a lasting controlling stake, such as building a factory or buying a large share of a firm. The small stock purchase is portfolio investment, and the tourist's spending is a service export in the current account. The deposit and bond are portfolio flows.
12. C. C. A deficit is a way to import capital; it pays for itself if the capital raises productivity, as with nineteenth-century railroads. Quickly withdrawable funds (A) are a risk, as in East Asia in 1997, and funds spent on consumption (B) leave only the debt.

SET C · APPLY AND EXTEND

13. (a) Trade balance = $(300 + 150) - (420 + 90) = 450 - 510 = -60$ (a goods deficit of 120 partly offset by a services surplus of 60). Current account = $-60 - 25 - 15 = -100$. (b) The financial account balance is +100 (net capital inflow). (c) Zeeland is a net borrower: foreigners are acquiring 100 billion more of its assets than it acquires abroad. The pattern is healthy if the funds finance productive investment, such as factories or infrastructure, that raises future income enough to repay. Scoring: 1 point trade balance -60; 1 point current account -100; 1 point financial account +100; 1 point borrower with a valid condition.
14. (a) The demand for loanable funds shifts right (D0 to D1) because the government is a larger borrower. (b) The real interest rate rises from the E0 level to the E1 level. (c) In $S + (M - X) = I + (G - T)$, a larger $G - T$ raises the right side. Higher interest rates attract foreign funds, so net capital inflow ($M - X$) rises, meaning net exports fall and the trade deficit widens. Higher rates also crowd out some private investment, so part of the adjustment shows up in lower I . Scoring: 1 point right shift of demand; 1 point higher real interest rate; 1 point capital inflow rises; 1 point trade deficit widens / NX falls.

6.2 Exchange Rates and the Foreign Exchange Market**SET A · CHECK YOUR UNDERSTANDING**

1. The dollar depreciated, because it now buys fewer euros; the euro appreciated. The euro price of the dollar is 0.80 euro. The dollar price of a euro rose from $1/0.90 = \$1.11$ to $1/0.80 = \$1.25$.
2. Demand: foreigners buying U.S. exports; foreign tourists visiting the United States; foreigners buying U.S. stocks and bonds. Supply: Americans buying imports; American tourists abroad; Americans buying foreign assets. Any two from each side are correct.
3. Americans need euros to buy wine, so they supply more dollars: supply of dollars shifts right. The dollar depreciates (a lower euro price of the dollar). Demand for dollars is unchanged, so the equilibrium quantity of dollars rises.
4. Pound-to-euro = euros per dollar / pounds per dollar = $0.92 / 0.80 = 1.15$ euros per pound. The dollar cancels out, leaving the cross rate.
5. At a pegged price above equilibrium there is an excess supply of the currency, so the bank must buy its own currency with foreign reserves (or raise interest rates to boost demand). Costs: reserves can run out, or monetary policy cannot be used to fight recession or inflation.
6. PPP rate = $200 / 250 = 0.80$ euro per dollar. The market rate 0.90 is higher, so the dollar buys more euros than PPP implies; it is overvalued relative to PPP, and arbitrage pressure would tend to lower the dollar over time.

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SET B · EXAM-STYLE MULTIPLE CHOICE

7. B. B. Higher relative returns increase demand for dollar assets and reduce the supply of dollars. Choice A is the tempting one because inflation sounds like higher prices, but higher relative prices reduce demand for U.S. goods and depreciate the dollar.
8. E. E. A rightward shift of supply means Americans sell more dollars, as when higher income raises imports. Choice B would shift demand, not supply, and would appreciate the dollar.
9. D. D. Euro in yen = $150 / 0.90 = 166.7$. Multiplying instead (135 yen) is the common trap; the dollar must cancel by dividing.
10. A. A. At a price above equilibrium, quantity supplied of the currency exceeds quantity demanded; the central bank closes the gap by purchasing the surplus. Selling its currency (B) would add to the excess supply.
11. C. C. To hold a peg, the central bank must target the rate rather than inflation or unemployment. Choice D is the reverse of the truth, and a floating rate (B) is the one that fluctuates.
12. B. B. Dollars = $200 / \text{rate}$: $200/0.80 = \$250$ and $200/1.00 = \$200$. An appreciating dollar makes foreign goods cheaper for Americans. Choice A multiplies instead of dividing.

SET C · APPLY AND EXTEND

13. (a) Higher Mexican inflation makes Mexican goods less attractive: demand for pesos shifts left and supply of pesos shifts right, so the peso depreciates (dollars per peso falls). (b) U.S. tourists must buy pesos, so demand for pesos shifts right and the peso appreciates. (c) A depreciated peso makes Mexican goods cheaper to foreigners, which raises exports. Scoring: 1 point left demand/right supply; 1 point depreciation; 1 point right demand for tourists; 1 point appreciation; 1 point exports rise.
14. (a) At the peg (6), quantity supplied is 6 and quantity demanded is 4, a surplus of 2 zeds. (b) The central bank can buy the surplus zeds using foreign reserves, or raise interest rates to increase demand for and reduce supply of zeds. (c) Buying zeds depletes the bank's limited foreign reserves. Raising interest rates may cause or deepen a recession and divert monetary policy from domestic goals. Scoring: 1 point surplus of 2; 1 point for each valid action (2 points); 1 point for each correct drawback (2 points).

6.3 Effects of Exchange Rates and Trade Barriers**SET A · CHECK YOUR UNDERSTANDING**

1. Appreciation raises the foreign-currency price of U.S. goods, so foreigners buy fewer U.S. exports. It lowers the dollar price of imports, so Americans buy more imports. Exports fall and imports rise, so NX falls. Since NX is a part of AD, aggregate demand shifts left (more so with the multiplier).
2. Higher import costs for inputs shift short-run aggregate supply left. The depreciation also raises NX (cheaper exports, dearer imports), which shifts aggregate demand right. The result is a higher price level, and real GDP may rise or fall depending on which shift is larger.
3. Gain: domestic steel producers (and their workers) and the government through revenue. Lose: steel-using firms and consumers paying higher prices; foreign steel exporters also lose. The domestic price rises and imports fall.
4. Free trade at $P = 8$: $Q_d = 100 - 40 = 60$, $Q_s = 40$, imports = 20. With the tariff $P = 9$: $Q_d = 55$, $Q_s = 45$, imports = 10. Revenue = $1 \times 10 = \$10$.
5. With a tariff the government collects the revenue from the price gap. With a quota the same price gap goes to whoever holds the import licenses, often foreign exporters or importers, unless the government auctions the licenses. Both create the same deadweight loss.
6. The argument says a new industry cannot compete at first because it lacks scale and experience, so temporary protection lets it grow. A criticism: governments are poor at picking winners, and protection tends to become permanent and benefit established, politically influential industries instead.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. E. E. The price rises to P_w plus the tariff, so quantity supplied by domestic firms rises, quantity demanded falls and the gap (imports) shrinks. Choice B is wrong because higher prices reduce, not increase, consumption.
8. A. A. Cheaper dollars make U.S. goods less expensive abroad, so exports rise and imports fall. Choice A describes appreciation.
9. C. C. A quota restricts supply, so the domestic price rises above the world price; the price gap becomes a gain for license holders. Choice A confuses a quota with a tariff, which produces revenue for the government, and also has the price direction wrong.
10. D. D. Removing internal tariffs while keeping separate external tariffs defines a free trade area. In a customs union (A) members adopt a common external tariff, which is the tempting wrong answer.
11. B. B. Export subsidies increase exports, lower the price paid by foreigners, and cost taxpayers; domestic prices tend to rise because supply is diverted abroad. Choice A has the domestic price direction wrong.
12. C. C. Depreciation raises NX, shifting AD right; along the upward-sloping SRAS both output and the price level rise, putting output above full employment. Choice D is the stagflation pattern and requires an SRAS shift instead.

SET C · APPLY AND EXTEND

13. (a) Before: $Q_d = 8$, $Q_s = 2$, imports = 6. After at price 4: $Q_d = 6$, $Q_s = 4$, imports = 2. (b) Revenue = $\$2 \times 2 = \$4$. (c) Deadweight loss = $(1/2)(2)(4 - 2) + (1/2)(2)(8 - 6) = 2 + 2 = \$4$ (consumer loss 14 - producer gain 6 - revenue 4 = 4). (d) Domestic producers gain and the government collects revenue; consumers lose through higher prices and less consumption; society suffers a net loss, and retaliation can hurt exporters. Scoring: 1 point each for imports before and after, revenue 4, DWL 4, and 1 point for correct winners and losers.
14. (a) Depreciation makes U.S. goods cheaper for foreigners and imports more expensive for Americans, so exports rise, imports fall, and NX rises. (b) NX is part of AD, so AD shifts right (AD0 to AD1). In the short run real GDP rises above full employment and the price level rises (E1). (c) With output above the full-employment level, nominal wages and input prices rise, SRAS shifts left, and the economy returns to LRAS at a higher price level. Scoring: 1 point each for X up and M down, AD right, higher output and price level, SRAS shifts left in the long run, return to potential output at higher prices.

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6.4 Policy in the Open Economy

SET A · CHECK YOUR UNDERSTANDING

1. Selling bonds decreases the money supply, so the interest rate rises. Higher U.S. returns attract foreign capital: demand for dollars rises and supply falls, so the dollar appreciates. A dearer dollar makes exports costlier and imports cheaper, so net exports fall and AD shifts left.
2. Monetary policy changes interest rates, which shifts capital flows and the exchange rate, so net exports move in the same direction as other spending. In contrast, fiscal stimulus raises interest rates, which causes an appreciation and lowers net exports, offsetting part of the stimulus.
3. Net initial change in spending = $50 - 20 = 30$. Multiplier = $1/(1 - 0.75) = 4$. Change in AD = $4 \times 30 = \$120$ billion rightward.
4. From $S + (M - X) = I + (G - T)$ with S and I constant, a \$60 billion rise in $G - T$ requires $M - X$ to rise by \$60 billion. The trade deficit grows by \$60 billion, financed by foreign borrowing: the twin deficits.
5. Higher foreign returns lead Americans to invest abroad (supply of dollars rises) and foreigners to hold fewer dollars (demand for dollars falls). The dollar depreciates, so exports rise, imports fall and U.S. net exports rise.
6. Expansionary policy lowers interest rates, causing capital to leave and putting downward pressure on the currency. To keep the fixed rate, the central bank must reverse the policy or spend reserves, so it cannot freely cut rates.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. D. D. Lower rates cause a capital outflow, a fall in demand and a rise in supply of dollars. A depreciation makes exports cheaper and raises net exports. Choice C pairs a depreciation with the wrong direction for net exports.
8. B. B. Borrowing raises demand for loanable funds, attracting capital inflows that appreciate the dollar and cut net exports. Choice C pairs a higher interest rate with a depreciation, which contradicts the capital inflow logic.
9. E. E. Lower U.S. interest rates reduce demand for dollar assets (demand left) and make foreign assets more attractive (supply right). Choice B would shift only supply and does not lower demand.
10. A. A. From $S + (M - X) = I + (G - T)$, a higher $G - T$ requires $M - X$ to rise. Choice D is a trap: dollar appreciation lowers exports.
11. C. C. A floating rate allows monetary policy to target the domestic economy; the currency adjusts. Choice A describes the burden of the hard peg.
12. D. D. Higher rates attract capital and support the currency but reduce spending. Lowering rates (A) would intensify the outflow.

SET C · APPLY AND EXTEND

13. (a) The central bank buys government bonds (open market purchase), lowers the discount or reserve requirement, or otherwise expands reserves. (b) The nominal interest rate falls from 5 to 3. (c) Lower U.S. interest rates reduce demand for dollars and raise supply of dollars, so the dollar depreciates; exports rise and imports fall, so net exports rise. (d) Lower rates raise investment and higher NX adds to demand, so AD shifts right; real GDP rises and the price level rises. Scoring: 1 point open market purchase; 1 point interest rate falls; 1 point demand left and supply right; 1 point depreciation and NX rise; 1 point AD right with higher real GDP and prices.
14. (a) The real interest rate rises from 5 to 6. (b) Higher rates attract foreign capital; demand for dollars rises and the dollar appreciates, so exports fall, imports rise and net exports fall. (c) Net initial change = $50 - 10 = 40$; multiplier = 4; change in AD = \$160 billion. (d) Initially $M - X = 600 + 100 - 700 = 0$. After the deficit rises, $M - X = 600 + 150 - 700 = 50$, so the trade deficit rises by 50. Scoring: 1 point higher interest rate; 1 point appreciation; 1 point NX falls; 1 point AD = 160; 1 point $M - X$ rises by 50.

6.5 Multiple-Choice Practice: Open Economy: International Trade and Finance

SET A · CORE CONCEPTS

1. A. A. A foreign purchase of a U.S. asset is a capital inflow in the financial account. The tempting choice about interest received is primary income, which belongs in the current account.
2. D. D. The two accounts must sum to zero, so +50 implies -50. The surplus of 50 is the reverse of the identity.
3. B. B. Each dollar buys more euros, so the dollar appreciated and the euro depreciated. Choice A reverses the direction; choice D is impossible because one currency's appreciation is the other's depreciation.
4. E. E. U.S. goods become relatively expensive, so foreigners buy fewer (demand falls) while Americans buy more imports (supply rises). Choice D says only supply shifts, ignoring the fall in demand for U.S. goods.
5. C. C. A tariff raises price, encourages domestic output, and creates revenue on remaining imports. The tempting choice that benefits consumers confuses a tariff with a subsidy.
6. B. B. Yuan per pound = $7 / 0.8 = 8.75$. Multiplying (5.6) fails to cancel the dollar.
7. D. D. To hold the fixed rate, monetary policy must be geared to the exchange rate. Choice A is exactly what a peg prevents.

SET B · APPLICATIONS AND DATA

8. C. C. Goods: $800 - 950 = -150$; services: $400 - 250 = +150$; primary income +60; secondary income -40; total = +20. Choice B is the goods deficit alone, which ignores services and income.
9. E. E. Higher foreign income raises demand for U.S. exports and so demand for dollars. The tempting rise in U.S. income would shift supply, not demand.
10. A. A. With the tariff the price is 4, domestic quantity demanded is 6 and quantity supplied is 4, so imports are 2 and revenue = $1 \times 2 = \$2$. The tempting \$4 uses the post-tariff price instead of the tariff rate.
11. B. B. $S + (M - X) = I + (G - T)$: $500 + (M - X) = 530$, so $M - X = 30$, an import surplus (deficit). The surplus choice has the sign reversed.
12. D. D. Multiplier = $1/(1 - 0.8) = 5$, so $5 \times 25 = 125$ to the right. The shift of 25 ignores the multiplier.

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13. C. C. Higher U.S. interest rates shift demand right and supply left, appreciating the dollar. A bond purchase and rising foreign rates do the opposite.
14. E. E. Foreign portfolio investors withdrew funds quickly, hurting banks and currencies. A trade deficit alone is not harmful; the problem was the reversible nature of the financing.

SET C · EXAM-LEVEL STRETCH

15. A. A. $M - X = I + (G - T) - S$, so the change is $+50 - 20 = +30$. Choice B has the wrong sign.
16. C. C. The exchange rate channel adds NX growth to the investment effect. The option saying lower rates raise exports through a stronger currency has the exchange rate direction backward.
17. E. E. Both create the same triangles of deadweight loss; the rectangle goes to the government only under a tariff. The claim that only a tariff has deadweight loss is wrong.
18. B. B. At the peg quantity supplied is 6 and quantity demanded is 4, a surplus of 2 million zeds, which the central bank must buy. Selling zeds would add to the surplus.
19. D. D. Lower interest rates reduce demand and raise supply of dollars, and higher income increases imports and supply; both depreciate the dollar. The first option mixes an appreciating factor (higher rates) with a depreciating factor.
20. A. A. The PPP rate is $90/100 = 0.90$ euro per dollar; the market rate 0.80 is lower, so the dollar buys fewer euros than PPP implies. U.S. goods look cheap to foreigners, raising demand for dollars. The overvalued choice reverses the comparison.

6.6 Free-Response Practice: Open Economy: International Trade and Finance**QUESTION 1 · THE FOREIGN EXCHANGE MARKET**

1. (a) 1 point: axes labeled (euros per dollar vertical, quantity of dollars horizontal). 1 point: downward-sloping demand and upward-sloping supply curves labeled. 1 point: equilibrium exchange rate and quantity marked where they intersect.
2. (b) 1 point: demand for dollars shifts right, because European investors prefer dollar assets now that euro returns are lower. 1 point: supply of dollars shifts left, because Americans keep funds at home instead of buying euro assets.
3. (c) 1 point: the dollar appreciates (the euro price of the dollar rises). 1 point: U.S. exports become more expensive for Europeans and imports cheaper for Americans, so net exports fall.
4. (d) 1 point: aggregate demand shifts left (NX is a component of $AD = C + I + G + NX$, and the multiplier amplifies the change), lowering real GDP and the price level in the short run.

QUESTION 2 · BALANCE OF PAYMENTS

5. (a) 1 point: goods balance = $600 - 760 = -160$. 1 point: current account = $-160 + (250 - 180) + (90 - 140) + (20 - 60) = -160 + 70 - 50 - 40 = -180$.
6. (b) 1 point: financial account = $+180$ (current plus financial must sum to zero). 1 point: Norland is a net borrower, since foreigners acquire 180 more of its assets than it acquires abroad.
7. (c) 1 point: financial account (foreign direct investment). 1 point: it is a capital inflow, so the financial account balance rises.
8. (d) 1 point: $S + (M - X) = I + (G - T)$. 1 point: a larger $G - T$ with S and I unchanged requires a larger $M - X$, so the trade deficit increases (funded by foreign capital).

QUESTION 3 · TRADE POLICY

9. (a) 1 point: before, $Q_d = 8$ and $Q_s = 2$, so imports = 6 million tons. 1 point: after at price 3, $Q_d = 7$ and $Q_s = 3$, so imports = 4 million tons.
10. (b) 1 point: revenue = $1 \times 4 = 4$ (in hundreds of millions of dollars). 1 point: deadweight loss = $(1/2)(1)(3 - 2) + (1/2)(1)(8 - 7) = 0.5 + 0.5 = 1$.
11. (c) 1 point: domestic steel producers gain (higher price and output) and the government gains revenue. 1 point: domestic consumers and steel-using industries lose through higher prices (consumer surplus falls by 7.5 versus producer gain of 2.5), and foreign exporters lose sales.
12. (d) 1 point: the partner's tariff raises the price of this country's exports abroad, so exports fall and NX falls. 1 point: lower NX shifts aggregate demand left, reducing real GDP and the price level.

QUESTION 4 · INTEGRATED OPEN-ECONOMY ANALYSIS

13. (a) 1 point: the central bank buys government bonds. 1 point: this raises reserves and the money supply, so the nominal interest rate falls.
14. (b) 1 point: lower domestic interest rates reduce demand for the currency (foreign investors buy fewer domestic assets). 1 point: supply of the currency rises as residents buy foreign assets. 1 point: the currency depreciates.
15. (c) 1 point: depreciation makes exports cheaper abroad and imports costlier at home, so exports rise, imports fall, and net exports rise.
16. (d) 1 point: aggregate demand shifts right (investment and net exports rise); real GDP rises toward full employment and the price level rises. 1 point: the policy is stronger than in a closed economy because the exchange rate channel adds to the interest rate channel.

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Chapter 7: Deep Dives and Extra Practice.

2 sections with explanations and worked examples, then 28 practice problems. Answers and full explanations are at the end of the chapter.

7.1 Monetary Policy at the Zero Lower Bound

Learn what the Fed can do when the federal funds rate cannot fall any further, how quantitative easing and forward guidance work, and how the modern ample-reserves system sets interest rates.

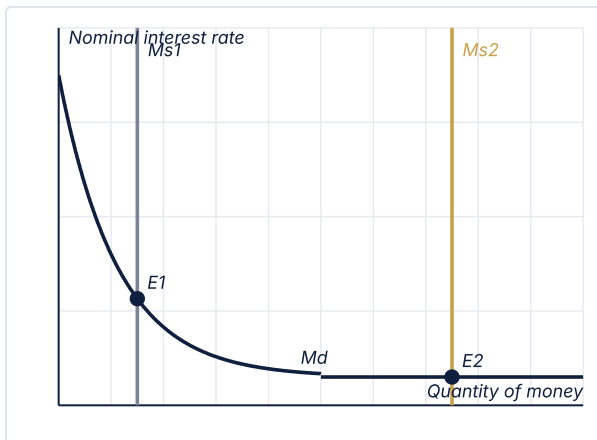
The standard monetary tool is an open market purchase that lowers the federal funds rate. But a nominal interest rate cannot fall far below **zero**: if a bank or saver faced a negative return on deposits, it could hold physical cash, which earns exactly 0%. This floor is called the **zero lower bound** (ZLB). When the policy rate is already near zero and the economy is still in a deep recession, ordinary open market operations lose their power, because adding reserves does not push the rate any lower. The Fed's rate was held near zero from December 2008 to December 2015 and again from March 2020 to March 2022.

Zero lower bound and liquidity trap

Zero lower bound (ZLB): the nominal policy rate cannot be cut meaningfully below 0%, because people can hold cash instead.

Liquidity trap: a situation where the money demand curve is nearly flat at a very low interest rate, so a larger money supply does not lower the rate or raise spending.

Real interest rate = nominal rate - expected inflation. At the ZLB the central bank can still push the real rate down by raising expected inflation.



Money demand flattens near 0%. A large increase in the money supply ($Ms1$ to $Ms2$) lowers the rate only slightly.

What the Fed does instead. After 2008 the Fed, like other central banks, turned to tools that work through longer-term rates and expectations.

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- ◆ **Quantitative easing (QE):** large-scale purchases of long-term Treasury securities and mortgage-backed securities. QE expands bank reserves and the Fed's balance sheet, and it pushes down long-term interest rates (mortgage rates, corporate bond rates) even when the short-term rate is already at zero. The Fed ran QE programs from 2008 to 2014 and again in 2020.
- ◆ **Forward guidance:** public statements about the likely future path of the policy rate, such as promising to keep it near zero until unemployment falls below a threshold. Long-term rates reflect expected future short-term rates, so a credible promise lowers long-term rates today and supports expectations of inflation.
- ◆ **Quantitative tightening (QT):** the reverse of QE, in which the Fed lets securities mature without replacing them, shrinking its balance sheet and reserves.

QE is still a form of expansionary monetary policy and uses the same chain you already know: more reserves and lower long-term rates raise investment, housing, and durable goods purchases, the dollar tends to depreciate, net exports rise, and AD shifts right. The difference is the target of the purchases (long-term securities rather than short-term bills) and the fact that the short-term rate cannot fall further.

The ample-reserves framework. Before 2008, banks held few excess reserves and the Fed moved the federal funds rate by changing the quantity of reserves through open market operations. Since 2008 the banking system holds trillions of dollars of reserves, so changing the quantity by a little has almost no effect on the federal funds rate. The Fed now steers the rate mainly with **administered rates**:

- ◆ **Interest on reserve balances (IORB):** the rate paid to banks on reserves held at the Fed. A bank will not lend reserves to another bank for less than it earns risk-free from the Fed, so IORB acts as a floor under the federal funds rate. Raising IORB raises market rates.
- ◆ **Overnight reverse repo rate:** the rate the Fed pays other financial institutions that lend it cash overnight, which supports a firm floor.
- ◆ **Discount rate:** the rate banks pay to borrow from the Fed; it is set above the target range and acts as a ceiling.
- ◆ **Reserve requirement:** set to 0% in March 2020, so it is no longer a working tool, although AP problems still use positive ratios when practicing the money multiplier.

Tool	Normal times	At or near the ZLB
Open market operations (short-term bills)	Main tool; moves federal funds rate	Little extra effect, rate already near 0%
IORB and overnight reverse repo	Fine tuning of the rate range	Set the floor; keep rate at the bottom of the range
Quantitative easing	Rarely used	Lowers long-term rates, expands the balance sheet
Forward guidance	Supports credibility	Lowers long rates by promising low future short rates
Discount rate / reserve requirement	Minor today	Minor today

Targets and rules. The Fed's dual mandate is maximum employment and stable prices, and since 2012 it has defined stable prices as 2% inflation, measured by the price index for personal consumption expenditures (PCE). Setting a numerical target for inflation is called **inflation targeting**; its advantage is that it anchors the public's expectations, which makes it easier to keep both inflation and unemployment stable. Many economists describe policy with the **Taylor rule**, a guide for setting the rate: the policy rate is the neutral real rate plus current inflation, adjusted upward when inflation exceeds its target and when output exceeds potential, and downward in the opposite cases. The rule is not an AP calculation requirement, but it explains the logic: the Fed raises rates more than one-for-one with inflation.

A simple Taylor rule

$$i = r^* + \pi + 0.5(\pi - \pi^*) + 0.5(\text{output gap})$$

r^* = neutral real rate (about 2% in the textbook version), π = current inflation, π^* = target (2%), output gap = percent difference of real GDP from potential.

If the formula gives a negative rate, the ZLB binds and the Fed uses QE and forward guidance instead.

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EXAMPLE 1: TAYLOR RULE

The neutral real rate is 2%, the inflation target is 2%, inflation is 3%, and real GDP is 2% below potential. Use the simple rule above to find the recommended policy rate.

SOLUTION

Step 1: Inflation gap = $3 - 2 = 1$ point, so $0.5 \times 1 = 0.5$.

Step 2: Output gap = -2 , so $0.5 \times (-2) = -1$.

Step 3: $i = 2 + 3 + 0.5 - 1 = 4.5\%$.

Step 4: Inflation above target pushes the rate up, the recessionary gap pushes it down, and the net recommendation is 4.5%.

EXAMPLE 2: CHOOSING A TOOL AT THE ZLB

The federal funds rate is 0.1%, unemployment is 10%, and inflation is 0.5%. Name two actions the Fed can take and trace one to its effect on AD.

SOLUTION

Step 1: Lowering the federal funds rate further is not possible, so conventional tools are exhausted.

Step 2: The Fed can buy long-term Treasuries and mortgage-backed securities (QE) and announce that it will keep rates low for an extended time (forward guidance).

Step 3: QE raises reserves and bond prices, so long-term interest rates fall.

Step 4: Lower mortgage and corporate borrowing rates raise investment and housing purchases, AD shifts right, real GDP rises, unemployment falls, and the price level rises.

EXAMPLE 3: RAISING RATES UNDER AMPLE RESERVES

The Fed wants to raise the federal funds rate by 0.25 percentage point while bank reserves are very large. Why would selling a small amount of bonds be ineffective, and what does the Fed do?

SOLUTION

Step 1: With reserves abundant, banks have far more than they need, so removing a small quantity leaves them with plenty and the overnight rate barely changes.

Step 2: The Fed instead raises the IORB rate (and the overnight reverse repo rate) by 0.25 point.

Step 3: Banks will not lend reserves for less than they can earn from the Fed, so the federal funds rate rises with IORB.

Step 4: Higher borrowing costs reduce investment and interest-sensitive consumption, and AD shifts left.

Common mistakes

(1) Saying QE lowers the federal funds rate when it is at zero: QE works through long-term rates. (2) Describing QE as printing money for government spending: the Fed buys existing securities, and the Treasury, not the Fed, decides on spending. (3) Claiming a negative nominal rate is impossible; it is only hard to push far below zero, and a few countries tried slightly negative rates. (4) Saying the Fed still controls the funds rate mainly through reserve requirements; the main tools are IORB and the other administered rates.

Practice**SET A Check Your Understanding**

Answer each question in one to three sentences.

1. Define the zero lower bound and explain why nominal interest rates are unlikely to fall far below zero.
2. What is quantitative easing, and which interest rates is it designed to lower?
3. Explain how forward guidance can lower long-term interest rates.
4. Under the ample-reserves framework, explain why raising IORB raises the federal funds rate.
5. Using the simple Taylor rule with $r^* = 2$, target 2%, inflation 4%, and an output gap of 0, find the recommended policy rate.
6. Explain how a central bank at the ZLB can still reduce the real interest rate.

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SET B Exam-Style Multiple Choice

Choose the best answer.

7. The federal funds rate is near zero during a severe recession. Which action is an example of quantitative easing?
(A) Lowering the discount rate to 0%
(B) Raising the reserve requirement
(C) Buying long-term Treasury and mortgage-backed securities in large amounts
(D) Selling short-term Treasury bills
(E) Announcing a higher inflation target for the next decade only
8. Which statement about the zero lower bound is correct?
(A) Nominal interest rates cannot fall meaningfully below zero because cash earns 0%
(B) The central bank cannot undertake expansionary policy of any kind
(C) The real interest rate cannot fall below zero
(D) The ZLB only applies to the discount rate
(E) The ZLB means the money demand curve is vertical
9. In the ample-reserves framework, the Fed raises the federal funds rate primarily by
(A) selling large quantities of securities until reserves are scarce
(B) raising the reserve requirement to 20%
(C) lowering the discount rate
(D) buying mortgage-backed securities
(E) raising IORB and the overnight reverse repo rate
10. Forward guidance affects the economy mainly by changing
(A) the required reserve ratio
(B) the expectations of future short-term interest rates
(C) the marginal propensity to consume
(D) the exchange rate regime
(E) the size of the automatic stabilizers
11. A central bank following the simple Taylor rule would be most likely to raise its policy rate when
(A) inflation is below target and output is below potential
(B) inflation is below target and output is above potential
(C) there is falling inflation and rising unemployment
(D) inflation is above target and output is above potential
(E) prices are falling and there is a recessionary gap
12. Quantitative easing is most likely to cause which combination of effects?
(A) Lower bank reserves, higher long-term rates, AD shifts left
(B) Higher bank reserves, higher long-term rates, SRAS shifts right
(C) Higher bank reserves, lower long-term rates, AD shifts right
(D) No change in reserves, lower long-term rates, LRAS shifts right
(E) Lower bank reserves, lower long-term rates, AD shifts right

SET C Apply and Extend

Answer fully. Draw the graphs where asked.

13. The economy is in a deep recession, the federal funds rate is 0.1%, and the Fed has concluded that further cuts are impossible. (a) Name the problem that prevents further cuts. (b) Identify one unconventional tool and explain how it lowers long-term rates. (c) Draw a correctly labeled AD-AS graph showing the effect of the policy on a recessionary gap.
14. Explain the difference between how the Fed moved the federal funds rate in 2005 and how it moves the rate today. In your answer, use the terms reserves, IORB, and the discount rate.

7.2 The Quantity Theory of Money and Velocity

Learn the equation of exchange, how to calculate velocity, what the quantity theory predicts about money growth and inflation, and why money is neutral in the long run but not in the short run.

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Every purchase has two sides: a buyer hands over money and a seller hands over goods. Adding up all purchases in a year, the money spent must equal the value of the output sold. This accounting statement, the **equation of exchange**, links the money supply to the price level and is the starting point for the classical view that too much money growth causes inflation.

Equation of exchange

$$M \times V = P \times Q$$

M = money supply, V = **velocity of money** (the average number of times a dollar is spent on final goods per year), P = price level, Q = real output.

$P \times Q$ = nominal GDP, so velocity = nominal GDP / money supply: $V = \frac{P \times Q}{M}$.

In growth rates: $\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Q$ (approximately).

The equation is an identity: because velocity is defined as nominal GDP divided by the money supply, it is true by construction. It becomes a theory only when we assume something about how V and Q behave. The **quantity theory of money** assumes that velocity is stable (it depends on payment habits and technology, which change slowly) and that real output Q is determined in the long run by resources, technology and institutions, not by the money supply. Then, any change in M must show up as a proportional change in P .

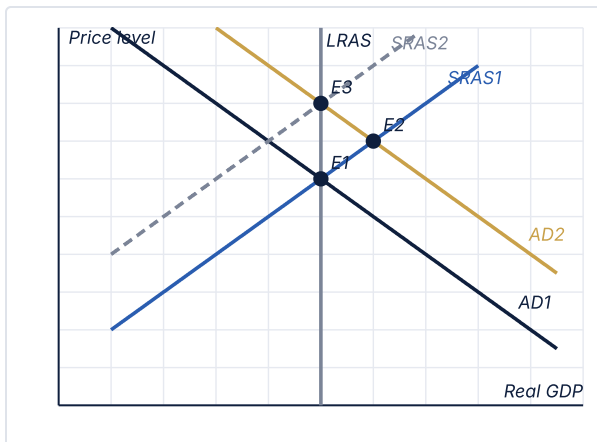
Quantity theory and monetary neutrality

If V and Q are constant, a given percent increase in M causes the same percent increase in P .

Inflation rate = money growth rate - real output growth rate (with V constant).

Monetary neutrality: in the long run, changes in the money supply change nominal variables (the price level, nominal wages, nominal GDP) but not real variables (real GDP, real wages, unemployment).

Connecting to AD-AS. In the short run, nominal wages and other input prices are sticky. An increase in the money supply lowers interest rates, raises AD, and moves the economy along SRAS to a higher price level and higher real GDP. So money is not neutral in the short run. Over time, workers and firms see the higher prices, nominal wages rise, SRAS shifts left, and the economy returns to the long-run aggregate supply (LRAS) at potential output, with only a higher price level to show for the increase. This is exactly the long-run neutrality that the quantity theory predicts.



A money supply increase shifts AD right (E1 to E2: output and prices rise). Wages catch up, SRAS shifts left, and the economy ends at E3 with the same real GDP and a higher price level.

How reliable is the theory? The long-run link between money growth and inflation is strong. Across countries and decades, the highest inflation rates are almost always found where money grows fastest. But velocity is not constant in the short run. It rises when interest rates are high, since people economize on idle cash, and falls when rates are very low or when banks pile up reserves instead of lending. After 2008, the Fed's reserves multiplied, yet inflation stayed low for years because velocity of the broad money measures fell sharply. For this reason central banks watch inflation and interest rates rather than targeting a particular money growth rate.

Hyperinflation. Economists usually define **hyperinflation** as inflation above 50 percent per month. It occurs when a government pays for large deficits by creating money, often after a war or a collapse of tax collection. Germany in 1923, Hungary in 1946, Zimbabwe in the late 2000s, and Venezuela in the late 2010s are well-known cases. As prices soar, people spend money immediately, so velocity rises, which pushes prices up faster, and the currency stops functioning as a store of value. The cure is to restore fiscal discipline and credible, independent control of the money supply.

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Question	Short run	Long run (quantity theory)
Effect of higher M on real GDP	Rises (sticky wages and prices)	No change (money neutral)
Effect of higher M on price level	Rises somewhat	Rises in proportion to M , if V and Q constant
Is velocity stable?	No; it changes with interest rates and financial innovation	Treated as roughly constant or slowly changing
Main policy lesson	Monetary policy can stabilize output	Sustained inflation is a monetary phenomenon

EXAMPLE 1: SOLVING THE EQUATION OF EXCHANGE

An economy has a money supply of \$600 billion, velocity of 5, and real output of 1,500 billion units. (a) Find the price level. (b) The money supply rises 10% with V and Q constant. Find the new price level.

SOLUTION

Step 1: $MV = 600 \times 5 = 3,000$, so nominal GDP is \$3,000 billion.

Step 2: $P = 3,000/1,500 = 2.00$.

Step 3: New $M = 660$, so $MV = 3,300$ and $P = 3,300/1,500 = 2.20$.

Step 4: P rose 10%, the same percent as M , as the quantity theory predicts.

EXAMPLE 2: CALCULATING VELOCITY

Nominal GDP is \$18,000 billion and the money supply is \$4,500 billion in Year 1. In Year 2, nominal GDP is \$19,800 billion and the money supply is \$6,600 billion. Find velocity in each year and explain the change.

SOLUTION

Step 1: Year 1: $V = 18,000/4,500 = 4$.

Step 2: Year 2: $V = 19,800/6,600 = 3$.

Step 3: The money supply grew 46.7% but nominal GDP grew only 10%, so each dollar was spent less often.

Step 4: Falling velocity offset most of the money growth, which is why large increases in the money supply do not always produce inflation.

EXAMPLE 3: PREDICTING INFLATION

A central bank allows the money supply to grow 9% per year. Velocity is constant and real GDP grows 3% per year. Predict inflation. What happens if money growth rises to 20% with the same real growth?

SOLUTION

Step 1: With V constant, $\% \Delta M = \% \Delta P + \% \Delta Q$.

Step 2: Inflation = $9\% - 3\% = 6\%$.

Step 3: With 20% money growth, inflation = $20\% - 3\% = 17\%$.

Step 4: Faster real growth lowers inflation; faster money growth raises it.

Common mistakes

(1) Treating $MV = PQ$ as a theory rather than an identity: the quantity theory needs the extra assumptions of constant V and fixed Q . (2) Using P for the inflation rate: P is the level, and the inflation rate is its percent change. (3) Forgetting that money is neutral only in the long run; in the short run it affects real GDP. (4) Reading hyperinflation as just high inflation: the cause is rapid money creation to finance deficits. (5) Mixing up V (spending per dollar) with the money multiplier, which concerns deposit creation.

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Practice

SET A Check Your Understanding

Answer each question briefly. Show any calculation.

1. State the equation of exchange and define each variable.
2. Nominal GDP is \$12,000 billion and the money supply is \$2,400 billion. Find velocity.
3. With velocity constant and real output fixed, the money supply doubles. What happens to the price level?
4. Define monetary neutrality and say whether it holds in the short run.
5. Money grows 7% per year, velocity is constant, and real GDP grows 2%. Estimate inflation.
6. Explain why large increases in bank reserves after 2008 did not cause high inflation.

SET B Exam-Style Multiple Choice

Choose the best answer.

7. An economy has $M = 400$, $V = 6$, and $Q = 800$. The price level is
(A) 3 (B) 0.33 (C) 2 (D) 4.8 (E) 12
8. Which situation is most consistent with the quantity theory of money?
(A) A country doubles its money supply and its real GDP permanently doubles
(B) A country has stable money but 30% inflation each year
(C) A country sees prices fall as its money supply grows rapidly
(D) A country's velocity rises every time the interest rate falls
(E) A country has 40% annual money growth and about 38% annual inflation
9. An increase in the money supply, starting from long-run equilibrium, will in the long run
(A) raise real GDP and leave the price level unchanged
(B) raise both real GDP and the price level permanently
(C) raise the price level and leave real GDP unchanged
(D) lower the price level and raise real GDP
(E) leave both unchanged
10. Nominal GDP rises from \$10 trillion to \$11 trillion while the money supply rises from \$2 trillion to \$2.75 trillion. Velocity
(A) rose from 4 to 5 (B) stayed at 5 (C) fell from 5 to 3
(D) fell from 5 to 4 (E) rose from 4.5 to 5.5
11. Hyperinflation is most often caused by
(A) a sudden rise in worker productivity
(B) a government financing large deficits by rapidly creating money
(C) a decline in the money supply
(D) a large increase in net exports
(E) an increase in the reserve requirement
12. In the short run, a central bank's open market purchase has which effect, assuming sticky wages?
(A) Real GDP rises and the price level rises
(B) Real GDP is unchanged and the price level rises
(C) Real GDP falls and the price level rises
(D) Real GDP rises and the price level falls
(E) Both fall

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SET C Apply and Extend

Answer fully.

- Real GDP grows 4% per year and velocity is constant. (a) What money growth rate is consistent with zero inflation? (b) What money growth rate would produce 3% inflation? (c) Explain what the quantity theory predicts if the central bank raises money growth to 12%.
- Starting at long-run equilibrium, the central bank increases the money supply. (a) Draw an AD-AS graph with LRAS showing the short-run effect. (b) Explain what happens to nominal wages and SRAS in the long run. (c) State what has changed in the long-run equilibrium and what has not.

Answers Chapter 7: Answers and Explanations

Answers for every practice problem, numbered to match. Read the explanation even when your answer is correct.

7.1 Monetary Policy at the Zero Lower Bound**SET A · CHECK YOUR UNDERSTANDING**

- The zero lower bound is the floor near 0% on the nominal policy rate. Holding cash earns 0%, so lenders and depositors would convert deposits to cash rather than accept a meaningfully negative return.
- QE is the large-scale purchase of long-term government securities and mortgage-backed securities by the central bank. It aims to lower long-term rates such as mortgage and corporate bond rates when the short-term rate is already near zero.
- Long-term rates reflect the expected path of short-term rates. A credible promise to keep the policy rate low for a long time lowers expected future short rates, so today's long-term rates fall and investment and housing demand rise.
- Banks will not lend reserves to other banks at a rate below what the Fed pays them risk-free, so IORB acts as a floor. When IORB rises, the interbank lending rate rises with it, and other market rates follow.
- $i = 2 + 4 + 0.5(4 - 2) + 0.5(0) = 7\%$. Inflation 2 points above target raises the rate recommendation by 1 point beyond the 6% base.
- Real rate = nominal rate - expected inflation. If the nominal rate is stuck near 0%, a credible commitment that raises expected inflation lowers the real rate, which encourages borrowing and spending.

SET B · EXAM-STYLE MULTIPLE CHOICE

- C. QE is the large-scale purchase of long-term securities with new reserves. Lowering the discount rate is a minor tool, raising reserve requirements and selling bills are contractionary, and an announcement alone is not a purchase program.
- A. Cash earns 0%, so deposits cannot pay much less than zero. The real rate can be negative when expected inflation exceeds the nominal rate, QE and forward guidance remain available, and a liquidity trap is a flat, not vertical, money demand curve.
- E. With very large reserves the Fed sets the rates it pays, so IORB and the reverse repo rate steer the federal funds rate. Draining reserves until they are scarce is impractical, the reserve requirement is 0%, and the last two options lower rates.
- B. Forward guidance lowers expected future short-term rates and so lowers long-term rates today. The reserve ratio, MPC, exchange rate regime and stabilizers are not what an announcement changes.
- D. The rule raises the rate when both gaps are positive. The other options describe below-target inflation or slack, which call for a lower rate or a mixed, smaller change.
- C. QE pays for securities with new reserves, which lowers long-term rates and raises investment, so AD shifts right. The other options reverse a sign or confuse AD effects with supply shifts.

SET C · APPLY AND EXTEND

- (a) 1 point: the zero lower bound (liquidity trap), because the nominal rate cannot fall meaningfully below 0%. (b) 1 point: QE or forward guidance. 1 point: QE buys long-term securities, raising their prices and lowering their yields (or forward guidance lowers expected future short rates). (c) 1 point: graph with axes labeled (price level, real GDP), AD₁, SRAS, LRAS, and equilibrium to the left of LRAS. 1 point: AD shifts right toward LRAS, real GDP rises, the price level rises, and the recessionary gap closes.
- 1 point: In 2005 reserves were scarce, so the Fed changed the quantity of reserves through open market operations and the federal funds rate moved with the reserve supply. 1 point: Today reserves are abundant, so changing their quantity has little effect on the rate. 1 point: The Fed sets IORB (the floor) and related administered rates, and banks will not lend below IORB, so the funds rate moves with it. 1 point: The discount rate, set above the target range, serves as a ceiling because banks would not borrow elsewhere at a higher rate.

7.2 The Quantity Theory of Money and Velocity**SET A · CHECK YOUR UNDERSTANDING**

- $MV = PQ$. M is the money supply, V is velocity (times a dollar is spent per year), P is the price level, and Q is real output, so PQ is nominal GDP.
- $V = 12,000/2,400 = 5$. Each dollar is spent on final goods and services five times per year.
- The price level also doubles. With V and Q constant, P must rise by the same proportion as M.
- Monetary neutrality means changes in the money supply alter only nominal variables such as the price level and nominal wages, not real GDP or unemployment. It holds in the long run, not the short run, when sticky wages and prices let money change real output.
- Inflation is about $7\% - 2\% = 5\%$, from $\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Q$ with $\%\Delta V = 0$.

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6. Banks held much of the new reserves as excess reserves rather than lending, and broad measures of velocity fell. So spending and nominal GDP did not rise in proportion to reserves, and inflation stayed low.

SET B · EXAM-STYLE MULTIPLE CHOICE

7. A. $MV = 2,400$ and $P = 2,400/800 = 3$. The value 2 would come from using $V = 4$, and 0.33 inverts the ratio.
8. E. Sustained high money growth with similar inflation is the quantity theory's prediction. Doubling M cannot permanently double real GDP, and high inflation with stable money or falling prices with rapid money growth contradict it.
9. C. Money is neutral in the long run. The short-run gain in output disappears as nominal wages rise and SRAS shifts left, leaving only the higher price level.
10. D. $V = 10/2 = 5$ in the first year and $11/2.75 = 4$ in the second. Money grew faster (37.5%) than nominal GDP (10%), so velocity fell.
11. B. Rapid money creation to pay for spending is the common source. Higher productivity and falling money lower prices, and net exports and reserve requirements do not generate prolonged runaway price increases.
12. A. AD shifts right along an upward-sloping SRAS, raising both. Unchanged real GDP is the long-run result, and the other combinations do not follow from a rightward AD shift.

SET C · APPLY AND EXTEND

13. (a) 1 point: 4%, because inflation = money growth - real growth = 0. (b) 1 point: 7%, since $7 - 4 = 3$. (c) 1 point: inflation would be $12 - 4 = 8\%$ per year, with real growth unaffected. 1 point: this follows from money neutrality, since sustained faster money growth raises only the price level.
14. (a) 1 point: correctly labeled graph (price level, real GDP, AD1, AD2, SRAS, LRAS). 1 point: AD shifts right, real GDP rises above potential and the price level rises. (b) 1 point: with output above potential, labor markets tighten and nominal wages rise, shifting SRAS left. 1 point: the economy returns to LRAS at a higher price level. (c) 1 point: the price level and nominal wages are higher; real GDP, unemployment, and real wages are back at their original levels.

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E1 Practice Exam 1

A full-length AP Macroeconomics practice exam: 60 multiple-choice questions followed by three free-response questions.

Take this exam in one sitting if you can. Section I has 60 multiple-choice questions to finish in 70 minutes with no penalty for guessing. Section II has three free-response questions to finish in 60 minutes: one long question worth 10 points and two short questions worth 4 points each. Show all work, label every graph fully (axes, curves, equilibrium points, and shifts), and write in complete sentences when asked to explain. A calculator is allowed.

Section	Questions	Time	Raw points	Weight in composite (150)
I: Multiple choice	60	70 min	60 (1 each)	100 (multiply correct by 1.667)
II: Question 1 (long)	1	about 25 min	10	25 (multiply by 2.5)
II: Questions 2 and 3 (short)	2	about 17 min each	4 each	12.5 each (multiply by 3.125)

To estimate your level, add the three weighted parts. As a rough guide, a composite near 110 or above is in the top band, 90 to 109 is strong, 70 to 89 is passing, and below 50 needs substantial review. Official cut points change from year to year. Check each missed multiple-choice item against its explanation, and grade each free-response answer point by point using the model answers.

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Choose the best answer for each question. Graphs use the standard axes; a vertical gold line marks long-run aggregate supply or the natural rate.

1. The graph shows a production possibilities curve for an economy that produces capital goods and consumer goods. Which of the following statements is correct?



- (A) Point Y is attainable if the economy trades with other countries, but not otherwise.
 - (B) Both X and Y are attainable, but only X is efficient.
 - (C) Point X is unattainable, and point Y shows an efficient use of resources.
 - (D) Point X shows that the opportunity cost of capital goods is zero.
 - (E) Point Y cannot be reached with current resources and technology, and point X indicates that some resources are unemployed or used inefficiently.
2. Alpha can produce 30 units of wheat or 60 units of cloth in a day. Beta can produce 20 units of wheat or 20 units of cloth in a day. Which of the following exchange rates would make both countries better off if they specialize according to comparative advantage and trade?

Country	Wheat per day	Cloth per day
Alpha	30	60
Beta	20	20

- (A) 1 unit of wheat for 1.5 units of cloth
 - (B) 1 unit of wheat for 2 units of cloth
 - (C) 1 unit of wheat for 0.5 units of cloth
 - (D) 1 unit of wheat for 1 unit of cloth when Alpha exports wheat
 - (E) 1 unit of wheat for 2.5 units of cloth
3. Which of the following would most likely cause a country's production possibilities curve to shift outward along both axes?
- (A) An improvement in the general level of worker education and skills
 - (B) A reduction in the capital stock because of a hurricane
 - (C) An increase in the production of consumer goods at the expense of capital goods
 - (D) A temporary fall in the unemployment rate
 - (E) A rise in the price level
4. A country produces 10 units of good A or 5 units of good B per hour of labor. If this country is operating on its production possibilities curve and increases production of good A by 4 units, the opportunity cost is
- | | | |
|-----------------------|-------------------------|-----------------------|
| (A) 1 unit of good B | (B) 8 units of good B | (C) 2 units of good B |
| (D) 4 units of good B | (E) 0.5 units of good B | |

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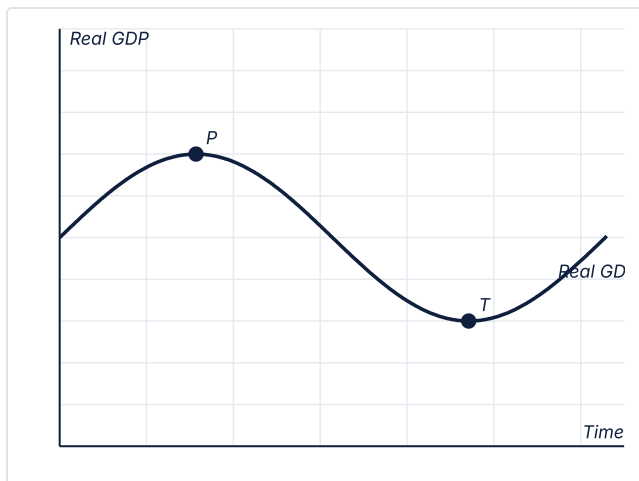
5. The price of crude oil used to produce plastic toys rises. What is the most likely effect in the market for plastic toys?
- (A) Supply decreases, the equilibrium price rises, and the equilibrium quantity rises.
 - (B) Demand increases, the equilibrium price rises, and the equilibrium quantity rises.
 - (C) Demand decreases, the equilibrium price falls, and the equilibrium quantity falls.
 - (D) Supply decreases, the equilibrium price rises, and the equilibrium quantity falls.
 - (E) Supply increases, the equilibrium price falls, and the equilibrium quantity rises.
6. Which of the following is included in this year's gross domestic product?
- (A) An investor buys shares of stock on an exchange.
 - (B) A family buys a house built five years ago.
 - (C) A bakery buys flour that it will bake into bread it sells this year.
 - (D) A retiree receives a Social Security payment.
 - (E) A family buys a newly built house from a developer.
7. In a simple accounting of an economy, consumption is \$700 billion, gross private investment is \$200 billion, government purchases are \$300 billion, exports are \$150 billion, and imports are \$180 billion. GDP equals
- (A) \$1,020 billion
 - (B) \$1,170 billion
 - (C) \$1,200 billion
 - (D) \$1,350 billion
 - (E) \$1,530 billion
8. Nominal GDP rises from \$2,100 billion to \$2,310 billion while the GDP deflator rises from 105 to 110. Real GDP grew by approximately
- (A) 2.0%
 - (B) 4.8%
 - (C) 5.0%
 - (D) 10.0%
 - (E) 15.0%
9. A worker's nominal wage rises by 3 percent in a year in which the price level rises by 5 percent. The worker's real wage
- (A) rises by about 8 percent
 - (B) rises by about 2 percent
 - (C) is unchanged
 - (D) falls by about 2 percent
 - (E) falls by about 8 percent
10. The adult civilian noninstitutional population is 250 million. Of these, 150 million are employed, 10 million are unemployed and looking for work, and 90 million are not in the labor force. The unemployment rate is
- (A) 4.0%
 - (B) 6.25%
 - (C) 6.67%
 - (D) 10.0%
 - (E) 36.0%
11. In a certain year, actual unemployment is 7 percent and the natural rate of unemployment is 5 percent. Which statement is correct?
- (A) Cyclical unemployment is 7 percentage points, and the economy is operating above potential output.
 - (B) Structural unemployment is 2 percentage points, and the economy is at full employment.
 - (C) Cyclical unemployment is 2 percentage points, and the economy is operating below potential output.
 - (D) Cyclical unemployment is negative 2 percentage points, and there is an inflationary gap.
 - (E) Frictional unemployment is 2 percentage points, and output equals potential.

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12. The graph shows real GDP over time. Between points P and T, the economy is most likely experiencing



- (A) a recovery that begins at point P
 - (B) a contraction in which real GDP is falling and cyclical unemployment is rising
 - (C) a permanent decline in potential output
 - (D) an expansion in which real GDP is rising and unemployment is falling
 - (E) stagflation, because both real GDP and the price level are falling
13. Which group is most likely to be harmed by unexpected inflation?
- (A) Firms holding inventories of goods whose prices rise
 - (B) People who own real estate
 - (C) Borrowers who took out fixed-rate loans before the inflation began
 - (D) Lenders who made fixed-rate loans before the inflation began
 - (E) Workers whose contracts index wages fully to inflation
14. If the nominal interest rate on a one-year loan is 7 percent and expected inflation is 3 percent, the expected real interest rate is approximately
- (A) -4 percent
 - (B) 3 percent
 - (C) 4 percent
 - (D) 7 percent
 - (E) 10 percent
15. Which of the following would shift the aggregate demand curve to the right?
- (A) A decrease in expected future income
 - (B) A rise in the real interest rate that reduces investment
 - (C) An increase in nominal wages that raises production cost
 - (D) An increase in the price level
 - (E) A decrease in personal income taxes

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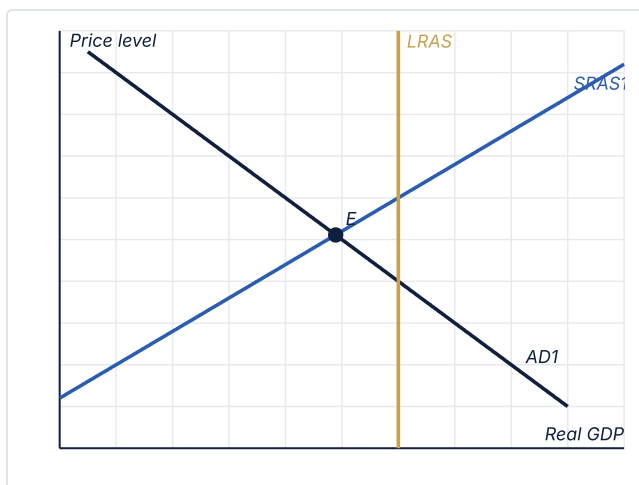
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16. In the graph, the economy moves from E1 to E2. Which of the following is the most likely cause?



- (A) An increase in government purchases
 (B) A decrease in consumer confidence
 (C) A decrease in the money supply
 (D) A technological advance that raises labor productivity
 (E) A drought that reduces harvests and raises the price of agricultural inputs
17. An increase in the economy's capital stock and a better educated labor force would most likely
- (A) shift LRAS to the left because wages rise
 (B) shift only SRAS to the right, leaving potential output unchanged
 (C) shift LRAS and SRAS to the right, raising potential output
 (D) move the economy along a fixed LRAS curve
 (E) shift AD to the left because saving rises
18. The economy in the graph is at E. If no stabilization policy is used, what is most likely to happen in the long run?



Recessionary gap

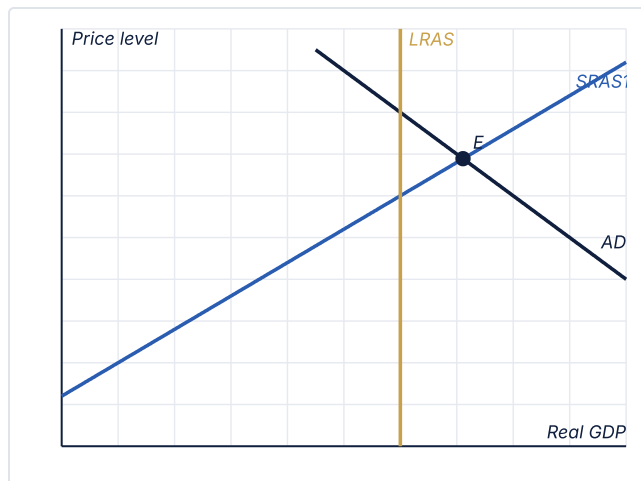
- (A) The price level stays constant while real GDP rises to potential.
 (B) Nominal wages rise, SRAS shifts left, and the price level rises.
 (C) LRAS shifts left to meet the current level of output.
 (D) AD shifts right automatically until output reaches potential.
 (E) Nominal wages fall, SRAS shifts right, the price level falls, and real GDP returns to potential.

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19. In the graph, the economy is at E, to the right of LRAS. In the long run, with no policy response,



Inflationary gap

- (A) SRAS shifts left, the price level rises, and real GDP falls back to potential output
 (B) SRAS shifts right, the price level falls, and real GDP rises further
 (C) the unemployment rate stays below the natural rate indefinitely
 (D) LRAS shifts right to the level of output at E
 (E) AD shifts left, and the price level is unchanged
20. The marginal propensity to consume is 0.8. If the government increases purchases by \$20 billion, the maximum change in real GDP, holding the price level constant, is
- (A) \$ 20 billion (B) \$ 25 billion (C) \$ 80 billion
 (D) \$ 100 billion (E) \$ 125 billion

SECTION I, PART 2 Multiple Choice, Questions 21-40

Choose the best answer for each question. Graphs use the standard axes; a vertical gold line marks long-run aggregate supply or the natural rate.

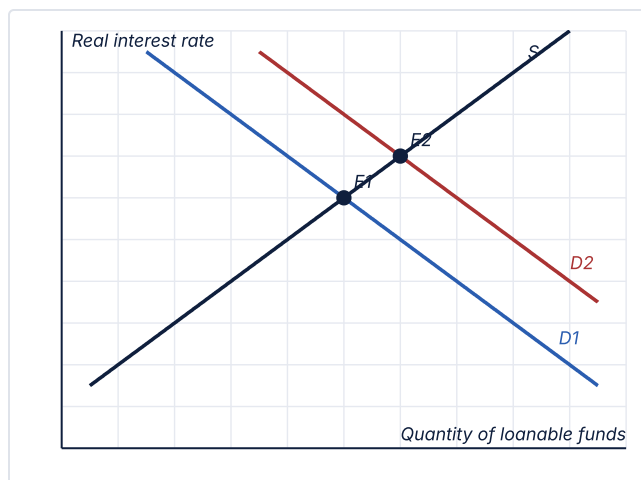
21. The marginal propensity to consume is 0.75. A tax cut of \$20 billion, with the price level held constant, will increase real GDP by up to
- (A) \$ 15 billion (B) \$ 20 billion (C) \$ 60 billion
 (D) \$ 80 billion (E) \$ 100 billion
22. An economy has a recessionary gap of \$120 billion and an MPC of 0.6. To close the gap, government purchases should increase by
- (A) \$ 48 billion (B) \$ 72 billion (C) \$ 120 billion
 (D) \$ 200 billion (E) \$ 300 billion
23. Which of the following is an example of an automatic stabilizer?
- (A) A change in the reserve requirement
 (B) A new infrastructure program approved by Congress
 (C) A tax cut passed by Congress during a recession
 (D) An increase in the discount rate
 (E) Unemployment insurance payments that rise when the economy enters a recession

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24. The graph shows the market for loanable funds. A larger government budget deficit financed by borrowing would most likely



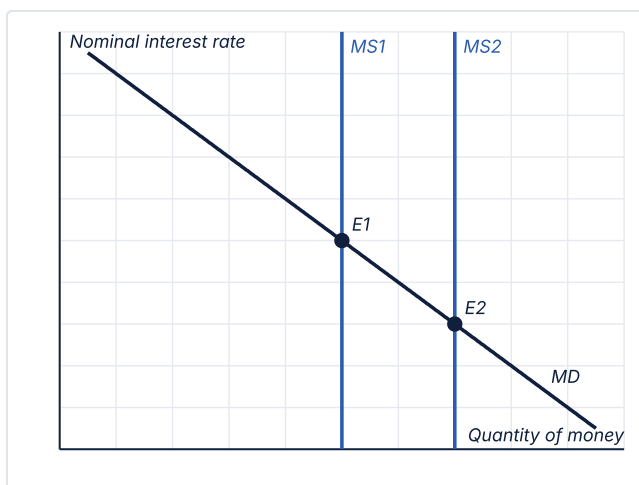
- (A) shift demand from D1 to D2, raising the real interest rate and crowding out private investment
 (B) shift supply right, lowering the real interest rate
 (C) shift supply left, raising the quantity of private investment
 (D) shift demand from D2 to D1, lowering the real interest rate
 (E) have no effect on the real interest rate
25. Stagflation presents a dilemma for policymakers because
 (A) the price level and real GDP both rise
 (B) monetary policy cannot affect the interest rate
 (C) aggregate supply is vertical in the short run
 (D) policies that raise aggregate demand to restore output also worsen inflation
 (E) policies that lower the price level raise inflation
26. An increase in consumer confidence leads to a short-run increase in autonomous consumption. Why does real GDP increase by more than the initial change in spending?
 (A) SRAS shifts to the right as wages rise.
 (B) Imports fall in each round of spending.
 (C) The price level falls, increasing real wealth.
 (D) The central bank automatically buys bonds.
 (E) Income received from the initial spending is partly spent again, creating further rounds of spending.
27. The government runs a budget deficit this year. Which statement is correct?
 (A) The national debt increases by the amount of the deficit.
 (B) Government purchases are less than tax revenue.
 (C) The national debt decreases.
 (D) The deficit has no effect on the debt.
 (E) The deficit and the debt are the same measure.
28. Starting from long-run equilibrium, a permanent increase in government purchases that raises aggregate demand will, in the long run, most likely
 (A) shift LRAS to the right
 (B) raise real GDP and lower the price level
 (C) raise the price level with real GDP unchanged from potential output
 (D) lower the price level
 (E) raise real GDP above potential permanently

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29. Which characteristic best explains why fiat money is accepted as a medium of exchange?
- (A) Its supply is fixed by law.
 - (B) It is backed by the government's gold reserves.
 - (C) It has high intrinsic value as a commodity.
 - (D) It earns interest for the holder.
 - (E) People believe it will be accepted by others, and it is legal tender backed by government authority.
30. A household moves \$5,000 from its checking account to a savings account at the same bank. Which of the following correctly describes the effect on the money supply measures?
- (A) M1 increases by \$ 5,000 and M2 is unchanged.
 - (B) M1 is unchanged and M2 increases by \$ 5,000.
 - (C) M1 and M2 both decrease by \$ 5,000.
 - (D) M1 decreases by \$ 5,000 and M2 is unchanged.
 - (E) M1 and M2 are both unchanged.
31. The required reserve ratio is 20 percent. If the central bank buys \$100 million of government bonds from banks and banks lend out all excess reserves, the maximum increase in the money supply is
- (A) \$ 20 million
 - (B) \$ 100 million
 - (C) \$ 400 million
 - (D) \$ 500 million
 - (E) \$ 2,000 million
32. In the graph, the money market moves from E1 to E2. Which central bank action best explains this change?



- (A) An increase in the discount rate
 - (B) An open market purchase of government bonds
 - (C) An increase in the price level
 - (D) An open market sale of government bonds
 - (E) An increase in the reserve requirement
33. Which of the following would shift the demand for money to the right?
- (A) An increase in the price level
 - (B) A decrease in the price level
 - (C) A decrease in the nominal interest rate
 - (D) A decrease in real GDP
 - (E) An increase in the money supply
34. In the market for loanable funds, an increase in household saving, all else equal, will
- (A) raise the real interest rate and decrease investment
 - (B) lower the real interest rate and decrease investment
 - (C) raise the real interest rate and increase investment
 - (D) shift the demand for loanable funds to the left
 - (E) lower the real interest rate and increase investment
35. When the central bank sells government bonds in the open market, which of the following is most likely?
- (A) Bond prices and interest rates both fall.
 - (B) Bond prices fall and interest rates rise.
 - (C) The money supply increases.
 - (D) Bond prices and interest rates both rise.
 - (E) Bond prices rise and interest rates fall.

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36. Which combination of central bank actions is most clearly contractionary?
- (A) Raise the reserve requirement, raise the discount rate, and sell government securities
 - (B) Raise the discount rate, buy government securities, and lower the reserve requirement
 - (C) Lower the reserve requirement, lower the discount rate, and buy government securities
 - (D) Raise the reserve requirement, lower the discount rate, and buy government securities
 - (E) Lower the reserve requirement, raise the discount rate, and sell government securities
37. To raise the federal funds rate when banks hold ample reserves, the central bank can most directly
- (A) increase the interest rate it pays on reserve balances
 - (B) purchase long-term government bonds
 - (C) decrease the interest rate it pays on reserve balances
 - (D) decrease the discount rate
 - (E) lower the reserve requirement to zero
38. An investor expects to receive \$1,100 one year from now. If the market interest rate is 10 percent, the present value of this payment is
- (A) \$ 900 (B) \$ 990 (C) \$ 1,000 (D) \$ 1,010 (E) \$ 1,210
39. A bank has the balance sheet shown. The required reserve ratio is 10 percent. The bank's excess reserves are
- | Assets | Amount | Liabilities | Amount |
|----------|--------|--------------------|--------|
| Reserves | @500 | Checkable deposits | @2,000 |
| Loans | @1,500 | | |
- (A) \$ 0 (B) \$ 200 (C) \$ 300 (D) \$ 500 (E) \$ 1,500
40. Which of the following is the most direct reason that the money demand curve slopes downward?
- (A) A higher interest rate raises the price level.
 - (B) A higher nominal interest rate raises the opportunity cost of holding money.
 - (C) The central bank fixes the quantity of money.
 - (D) People hold more money when interest rates rise because bonds are less safe.
 - (E) A higher interest rate raises real GDP.

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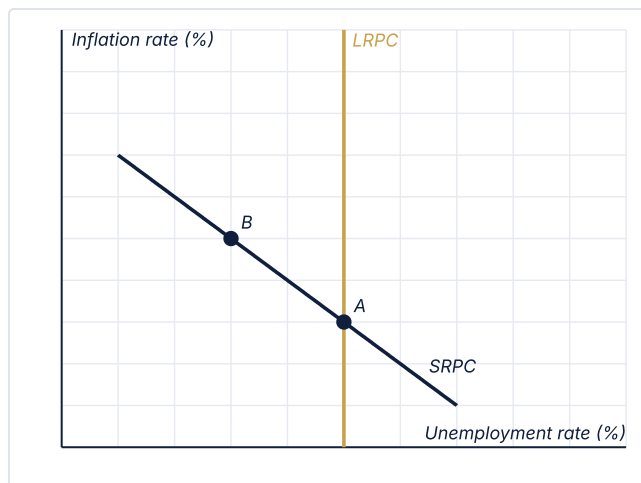
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SECTION I, PART 3 Multiple Choice, Questions 41-60

Choose the best answer for each question. Graphs use the standard axes; a vertical gold line marks long-run aggregate supply or the natural rate.

41. The graph shows a short-run Phillips curve and a long-run Phillips curve. The movement from A to B is most likely the result of



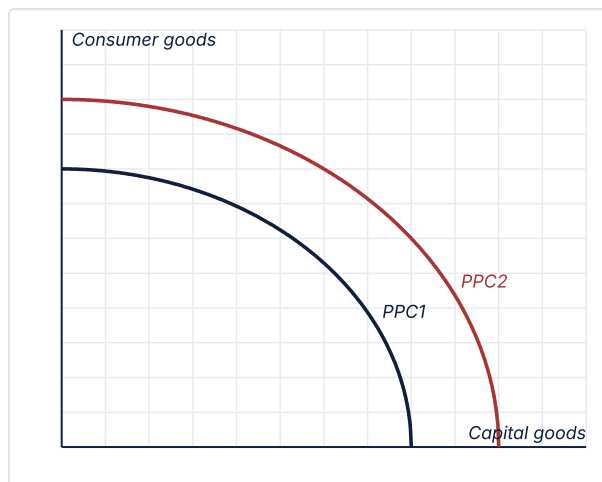
- (A) an increase in expected inflation
 (B) an increase in the natural rate of unemployment
 (C) expansionary monetary policy that increases aggregate demand
 (D) a negative supply shock
 (E) a decrease in the money supply
42. An increase in expected inflation will most likely
 (A) shift the short-run Phillips curve downward
 (B) decrease the natural rate of unemployment
 (C) move the economy down along the short-run Phillips curve
 (D) shift the long-run Phillips curve to the right
 (E) shift the short-run Phillips curve upward, with no change in the natural rate
43. Suppose the central bank keeps unemployment below the natural rate year after year through expansionary policy. In the long run the result will be
 (A) higher inflation with unemployment returning to the natural rate
 (B) lower inflation and higher unemployment
 (C) a rightward shift of the long-run Phillips curve
 (D) a permanent increase in real GDP above potential
 (E) permanently lower unemployment with stable inflation
44. During a recession the central bank lowers its target interest rate. Which sequence best describes the transmission of this policy?
 (A) Money supply increases, the nominal interest rate falls, investment and interest-sensitive spending rise, AD shifts right
 (B) The exchange rate appreciates, net exports rise, AD shifts right
 (C) Money supply increases, the nominal interest rate rises, investment rises, AD shifts right
 (D) Government purchases rise, AD shifts right, the interest rate falls
 (E) Money supply decreases, the nominal interest rate rises, investment falls, AD shifts left
45. Fiscal policy is expansionary while monetary policy is contractionary. Compared with the initial situation, the most likely effect is
 (A) a rise in interest rates and a certain rise in aggregate demand
 (B) no change in interest rates
 (C) a fall in interest rates and a fall in aggregate demand
 (D) a fall in interest rates and a rise in aggregate demand
 (E) a rise in interest rates and an uncertain change in aggregate demand

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46. Which policy is most likely to increase long-run economic growth?
- (A) Lowering the discount rate for a year
 - (B) Subsidizing education and job training
 - (C) Increasing government purchases during a recession
 - (D) Imposing price controls
 - (E) Increasing the unemployment benefit
47. If real GDP per capita grows at a constant 3.5 percent per year, approximately how many years will it take to double, according to the rule of 70?
- (A) 7 (B) 14 (C) 20 (D) 35 (E) 70
48. Which of the following would shift the production possibilities curve shown outward from PPC1 to PPC2?



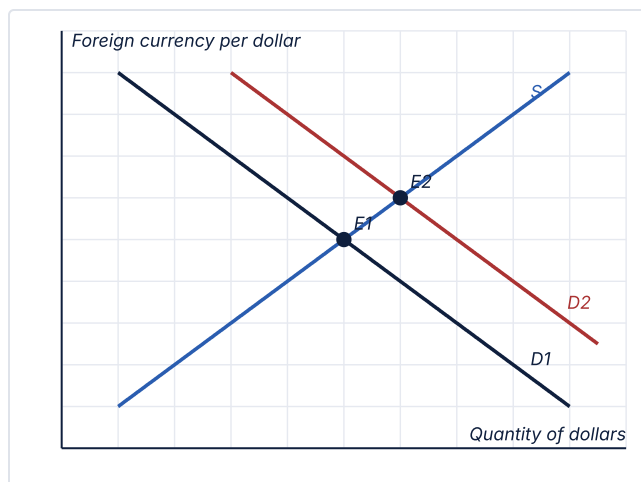
- (A) A technological advance that raises productivity in both goods
 - (B) A decrease in the price level
 - (C) A decrease in the unemployment rate
 - (D) An increase in the government budget deficit
 - (E) A shift in preferences toward consumer goods
49. Large and persistent government deficits financed by borrowing from the public are most likely to
- (A) lower real interest rates and increase private investment
 - (B) have no effect on the capital stock
 - (C) raise real interest rates and reduce private investment, slowing long-run growth
 - (D) lower the national debt
 - (E) increase the supply of loanable funds
50. A negative supply shock occurs. Which of the following describes the effect on the Phillips curve diagram?
- (A) The long-run Phillips curve shifts left.
 - (B) The short-run Phillips curve shifts up and to the right.
 - (C) The short-run Phillips curve shifts down and to the left.
 - (D) The long-run Phillips curve becomes horizontal.
 - (E) The economy moves down along an unchanged short-run Phillips curve.
51. Inflation exceeds the central bank's target while real GDP is above potential output. Which action is most appropriate?
- (A) Reduce taxes
 - (B) Buy government securities
 - (C) Lower the target interest rate
 - (D) Lower the reserve requirement
 - (E) Raise the target interest rate

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52. Which of the following is a true statement about discretionary fiscal policy?
- (A) It operates automatically without legislation.
 - (B) It has no effect on the budget deficit.
 - (C) It always lowers interest rates.
 - (D) Implementation lags can cause it to take effect after the economy has already begun to recover.
 - (E) It affects the economy immediately.
53. A central bank tightens policy to bring down inflation. In the short run, which of the following is the most likely cost?
- (A) Higher inflation
 - (B) Higher unemployment as the economy moves along the short-run Phillips curve
 - (C) A leftward shift of the long-run Phillips curve
 - (D) A fall in the interest rate
 - (E) A permanent increase in the natural rate of unemployment
54. In a given year a country imports more goods and services than it exports. All else equal, which statement is correct?
- (A) The current account is in surplus, and the financial account must be in deficit.
 - (B) The current account is in deficit, and the financial account must be in surplus.
 - (C) Both accounts must be in deficit.
 - (D) The capital account and financial account are unrelated to trade.
 - (E) The balance of payments is in deficit overall.
55. The graph shows the foreign exchange market for the U.S. dollar. Which of the following could cause the shift from D1 to D2?



- (A) A decrease in foreign demand for U.S. exports
 - (B) A rise in U.S. imports of foreign goods
 - (C) A fall in U.S. interest rates
 - (D) A rise in U.S. real interest rates relative to rates abroad
 - (E) A decrease in U.S. inflation that makes foreign goods relatively cheaper
56. The U.S. dollar depreciates relative to other currencies. All else equal, this will most likely cause U.S. net exports and aggregate demand to
- (A) increase, because U.S. goods become more expensive abroad
 - (B) increase, because U.S. goods become cheaper to foreigners
 - (C) decrease, because imports become cheaper
 - (D) remain unchanged
 - (E) decrease, because exports become more expensive
57. The exchange rate is 0.90 euros per U.S. dollar. A watch priced at 54 euros in Europe costs how many dollars?
- (A) \$ 48.60
 - (B) \$ 54.00
 - (C) \$ 60.00
 - (D) \$ 66.00
 - (E) \$ 90.00

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58. The United States imposes a tariff on imported steel. Which of the following is most likely?
- (A) Consumer surplus rises.
 - (B) The tariff has no effect on the quantity imported.
 - (C) Domestic production falls, and imports fall.
 - (D) The domestic price of steel rises, domestic production rises, and imports fall.
 - (E) The domestic price of steel falls, and imports rise.
59. The central bank of Country X lowers its interest rate while rates abroad stay the same. In the foreign exchange market, X's currency will most likely
- (A) depreciate, because imports fall
 - (B) be unchanged
 - (C) appreciate, because exports fall
 - (D) appreciate, because capital flows in
 - (E) depreciate, because capital flows out in search of higher returns
60. Which of the following would increase the demand for a country's currency in the foreign exchange market?
- (A) Foreign consumers increase their purchases of the country's goods.
 - (B) Domestic investors buy foreign stocks.
 - (C) Domestic residents increase purchases of foreign goods.
 - (D) Domestic interest rates fall relative to foreign rates.
 - (E) The country's inflation rate rises sharply.

QUESTION 1 **Recession and Policy Options (10 points)**

Country Z is in a recession. Real GDP is below potential output, the unemployment rate exceeds the natural rate, and the output gap is \$100 billion. The marginal propensity to consume is 0.8. Assume the price level is constant when you calculate multiplier effects.

61. (a) Draw a correctly labeled graph of aggregate demand, short-run aggregate supply, and long-run aggregate supply that shows Country Z in the recession. Label the equilibrium price level PL1, equilibrium real GDP Y1, and potential output Yf.
62. (b) Identify one open market operation the central bank should conduct to address the recession.
63. (c) Draw a correctly labeled graph of the money market. Show the effect of the operation you identified in part (b) on the nominal interest rate. Label the initial and new interest rates i_1 and i_2 .
64. (d) Explain how the change in the interest rate affects aggregate demand.
65. (e) Explain what the change in the interest rate does to the value of Country Z's currency, and state the resulting effect on net exports.
66. (f) Calculate the change in government purchases that would close the output gap. Show your work.
67. (g) Calculate the tax cut that would close the output gap instead. Show your work.

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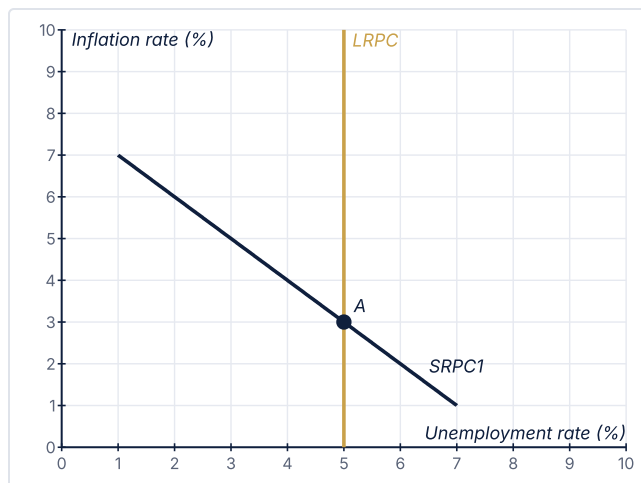
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QUESTION 2 Phillips Curves (4 points)

The graph shows the short-run and long-run Phillips curves for the economy of Valdia, which is initially at point A. The central bank then lowers its target interest rate.

68. (a) What is Valdia's natural rate of unemployment according to the graph?



Economy of Valdia at point A

69. (b) Using the graph, state the unemployment rate and the inflation rate the economy reaches in the short run if expansionary policy moves it down the short-run Phillips curve to an unemployment rate of 3 percent.
70. (c) Explain why the economy cannot stay at an unemployment rate of 3 percent in the long run.
71. (d) Show or describe the long-run adjustment on the graph: which curve shifts, and in which direction?

QUESTION 3 Comparative Advantage (4 points)

In one week, Aria can produce 40 tons of coffee or 20 tons of tea, and Boria can produce 30 tons of coffee or 30 tons of tea. Each country has constant opportunity costs.

72. (a) Calculate the opportunity cost of producing one ton of coffee in Aria and in Boria.
73. (b) Which country has the comparative advantage in coffee? Justify your answer using opportunity cost.
74. (c) Give one terms of trade (tons of tea per ton of coffee) that would benefit both countries, and explain why it is acceptable to both.
75. (d) Suppose Aria produces only coffee and trades 20 tons of coffee to Boria at the terms of trade you gave in part (c). How many tons of tea does Aria receive, and how does its consumption compare with producing 20 tons of coffee on its own?

Key Practice Exam 1: Answers and Explanations

Complete solutions. Free-response keys show the scoring breakdown.

E1 Practice Exam 1**SECTION I, PART 1 · MULTIPLE CHOICE, QUESTIONS 1-20**

- E. Points inside the curve are attainable but inefficient (idle or misused resources), while points outside the curve are beyond current capacity. The tempting wrong choice reverses X and Y.
- A. Alpha's opportunity cost of a unit of wheat is 2 cloth and Beta's is 1 cloth, so Beta exports wheat and Alpha exports cloth. A price strictly between 1 and 2 cloth per wheat benefits both; at 2 cloth Alpha gains nothing.
- A. Better human capital raises potential output of every good, shifting the whole curve outward. Reducing unemployment only moves the economy toward the existing curve, and reallocating production is movement along it.
- C. Producing 10 A means giving up 5 B, so each A costs 0.5 B. Four more A cost $4 \times 0.5 = 2$ B. Inverting the ratio gives the wrong choice of 8.
- D. A higher input price raises production cost and shifts supply left. With demand unchanged, price rises and quantity falls. Saying demand increases confuses a supply shift with a demand shift.
- E. GDP counts the final value of newly produced goods and services, and new residential construction is investment. Used goods, transfer payments, and financial asset purchases are not production; flour is an intermediate good whose value is counted in the bread.
- B. $GDP = C + I + G + (X - M) = 700 + 200 + 300 + (150 - 180) = 1,170$. Adding imports instead of subtracting gives 1,530, and ignoring net exports gives 1,200.

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8. C. Real GDP = nominal GDP / deflator $\times$ 100, which is 2,000 in the first year and 2,100 in the second, a 5.0% increase. Nominal growth is 10%, and 4.8% is the rate of increase in the deflator.
9. D. The real wage changes by roughly the nominal change minus inflation: $3 - 5 = -2$ percent. Adding the two percentages is a common error.
10. B. The labor force is $150 + 10 = 160$ million, and the rate is $10/160 = 6.25\%$. Dividing by employment gives 6.67%, and dividing by the whole population gives 4.0%.
11. C. Cyclical unemployment equals actual minus natural, here 2 points, which signals a recessionary gap. The natural rate (frictional plus structural) is already 5 percent.
12. B. Moving from a peak (P) to a trough (T) is a contraction, so output falls and cyclical unemployment rises. The graph shows nothing about the price level or potential output.
13. D. A fixed nominal interest rate repays the lender in dollars that buy less, so the real return falls. Borrowers gain, and indexed or real-asset holders are protected.
14. C. Real rate = nominal rate - expected inflation = $7 - 3 = 4$ percent. Adding gives 10, a common slip.
15. E. Lower income taxes raise disposable income and consumption at every price level. A price-level change moves along AD, and a nominal wage increase is a supply-side event.
16. E. E2 has a higher price level and lower output, which signals a leftward shift of SRAS caused by a negative supply shock. The demand-side events listed would move price and output in the same direction.
17. C. More resources and productivity raise full-employment output, so LRAS shifts right, and lower costs shift SRAS right as well. LRAS depends on resources and technology, not the price level.
18. E. At E real GDP is below potential, so unemployment is above the natural rate and wages eventually fall. SRAS shifts right until it intersects AD at potential output at a lower price level.
19. A. Output above potential means unemployment is below the natural rate, which pushes wages and input prices up. SRAS shifts left until output returns to potential at a higher price level.
20. D. The spending multiplier is $1/(1 - 0.8) = 5$, so the change is $5 \times 20 = 100$. Using $MPC/(1 - MPC) = 4$ gives 80, which is the tax multiplier magnitude.

SECTION I, PART 2 · MULTIPLE CHOICE, QUESTIONS 21-40

21. C. The tax multiplier is $-MPC/(1 - MPC) = -3$, so a 20 billion tax cut raises GDP by 60 billion. The 80 billion choice wrongly applies the spending multiplier of 4.
22. A. The multiplier is $1/(1 - 0.6) = 2.5$, so required spending is $120/2.5 = 48$ billion. Multiplying by 2.5 gives the 300 billion distractor.
23. E. Automatic stabilizers change spending or taxes without new legislation. The tax cut and infrastructure program are discretionary fiscal policy, and the other two are monetary tools.
24. A. Government borrowing adds to the demand for loanable funds, raising the real interest rate and reducing interest-sensitive private investment. That is the crowding-out effect.
25. D. Stagflation combines falling output and a rising price level, so expansionary policy fights unemployment but raises prices, and contractionary policy does the reverse. Only the correct choice states the trade-off.
26. E. The multiplier arises because one person's spending is another's income, and a fraction (the MPC) is spent in each round. Falling imports or central bank action are not part of the basic multiplier.
27. A. A deficit means spending exceeds revenue, and the shortfall is borrowed, adding to the debt, which is the accumulated total of past borrowing. The deficit is a flow and the debt is a stock.
28. C. In the long run, wages adjust and SRAS shifts left until output returns to potential, leaving only a higher price level. LRAS depends on resources and technology, not on demand.
29. E. Fiat money has little intrinsic value; its worth comes from general acceptance and legal status. Modern currencies are not tied to a gold stock.
30. D. M1 includes currency and checkable deposits, and M2 includes M1 plus savings and small time deposits. The transfer leaves M2 the same but lowers M1.
31. D. The money multiplier is $1/0.20 = 5$, so $100 \times 5 = 500$ million. The 400 million choice is a common slip that subtracts the initial 100 million.
32. B. The money supply increased from MS1 to MS2, which lowers the nominal interest rate. Only a purchase of bonds adds reserves and expands the supply; a higher price level would shift money demand instead.
33. A. Higher prices mean people need more money to make the same purchases, shifting money demand right. A change in the interest rate moves along the demand curve.
34. E. More saving shifts the supply of loanable funds right, lowering the real interest rate along the demand curve, which raises the quantity demanded for investment.
35. B. Selling bonds adds supply to the bond market, lowering prices; because bond prices and yields move inversely, interest rates rise. The sale also drains reserves, so the money supply shrinks.
36. A. Each listed action in the correct choice reduces reserves or makes borrowing them costlier, shrinking the money supply. The others mix expansionary and contractionary moves.
37. A. A higher rate paid on reserves raises the opportunity cost of lending reserves at lower rates, pushing market rates up. The other actions are expansionary.
38. C. $PV = 1,100 / (1 + 0.10) = 1,000$. Subtracting 10 percent of 1,100 gives 990, which does not reverse the compounding correctly.
39. C. Required reserves are 10% of 2,000 deposits = 200, so excess reserves = $500 - 200 = 300$. The 200 figure is the requirement, not the excess.
40. B. Money earns little or no interest, so people hold less of it when other assets pay more. The quantity demanded of money falls as the nominal rate rises.

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SECTION I, PART 3 · MULTIPLE CHOICE, QUESTIONS 41-60

41. C. A movement along the SRPC to lower unemployment and higher inflation reflects stronger aggregate demand. A change in expected inflation or a supply shock would shift the SRPC itself.
42. E. Higher expected inflation raises wage and price setting at each unemployment rate, shifting the SRPC up. The LRPC stays at the natural rate.
43. A. Workers adjust expectations, the SRPC shifts up, and unemployment returns to its natural rate while inflation stays high. There is no long-run trade-off.
44. A. Expansionary monetary policy works through lower interest rates stimulating investment and consumption. The exchange-rate sequence is not the main channel here, and it starts from the wrong sign because lower rates depreciate the currency.
45. E. Both expansionary fiscal and contractionary monetary policy push interest rates up, but their effects on AD pull in opposite directions, so the net change is ambiguous.
46. B. Investment in human capital raises productivity and potential output, shifting LRAS and the PPC outward. The other policies are mostly short-run or distortive.
47. C. $70 / 3.5 = 20$ years. Using the rate itself, 35, ignores the division.
48. A. Only a change in resources or technology shifts the PPC; employment, prices, and preferences change where the economy operates, not what it can produce.
49. C. Borrowing raises demand in the loanable funds market and crowds out private investment, reducing capital accumulation. Deficits add to the debt.
50. B. Stagflation means both higher inflation and higher unemployment at once, which requires an outward shift of the SRPC rather than movement along it.
51. E. Contractionary policy reduces AD and closes an inflationary gap. The other options would raise AD.
52. D. Recognition, legislative, and implementation lags can delay effects. Automatic stabilizers, not discretionary policy, work without new laws.
53. B. Disinflation typically moves the economy to higher unemployment and lower inflation along its SRPC. The natural rate does not change.
54. B. The balance of payments must sum to zero, so a current account deficit is offset by net capital inflows. Foreign lenders and investors finance the deficit.
55. D. Higher U.S. interest rates attract foreign financial investment, increasing demand for dollars and appreciating the dollar. More imports would increase the supply of dollars.
56. B. A weaker dollar lowers the foreign price of U.S. goods and raises the dollar price of imports, increasing exports and lowering imports, so net exports and AD rise.
57. C. $\text{Dollars} = 54 / 0.90 = 60$. Multiplying 54 by 0.90 gives 48.60, which applies the rate in the wrong direction.
58. D. A tariff raises the price of the imported good, encouraging domestic producers to supply more and reducing the quantity imported. Domestic consumers lose surplus.
59. E. Lower relative rates reduce foreign demand for the currency and raise the supply of it as investors move funds abroad, depreciating the currency.
60. A. Foreigners must buy the currency to pay for exports, increasing its demand. The other events increase supply or reduce demand.

QUESTION 1 · RECESSION AND POLICY OPTIONS (10 POINTS)

61. 2 points. 1 point: axes labeled price level and real GDP, with a downward-sloping AD, an upward-sloping SRAS, and a vertical LRAS at Y_f . 1 point: AD and SRAS intersect at Y_1 to the LEFT of Y_f , with PL_1 and Y_1 marked on the axes. (Model: $AD\ y = 10 - x$ and $SRAS\ y = 1.2 + 0.8x$ cross at about $x = 4.9$, left of an LRAS drawn at $x = 6$.)
62. 1 point: The central bank should BUY government securities (bonds) in the open market. Selling securities or raising a rate would be contractionary and earns no credit.
63. 2 points. 1 point: money market axes labeled nominal interest rate and quantity of money, with a downward-sloping MD and a vertical MS_1 crossing at i_1 . 1 point: MS shifts RIGHT to MS_2 , and the new equilibrium interest rate i_2 is below i_1 .
64. 1 point: A lower interest rate lowers the cost of borrowing, so investment (and interest-sensitive consumption such as autos and housing) increases, which shifts aggregate demand to the right.
65. 2 points. 1 point: The lower interest rate reduces demand for the country's financial assets and currency and raises its supply, so the currency depreciates. 1 point: Exports become cheaper for foreigners and imports costlier, so net exports increase.
66. 1 point: The spending multiplier is $1/(1 - 0.8) = 5$, so the change in government purchases is $100/5 = \$20$ billion increase.
67. 1 point: The tax multiplier is $-0.8/(1 - 0.8) = -4$, so the required tax cut is $100/4 = \$25$ billion. (A cut larger than the spending increase is needed because part of each tax cut is saved.)

QUESTION 2 · PHILLIPS CURVES (4 POINTS)

68. 1 point: The natural rate is 5 percent, the unemployment rate at which the vertical long-run Phillips curve crosses the axis.
69. 1 point: Unemployment of 3 percent and inflation of 5 percent, read from the SRPC ($\text{inflation} = 8 - 3$).
70. 1 point: With unemployment below the natural rate, wages and prices rise faster than expected; workers and firms raise their expected inflation and negotiate higher wages, which pushes unemployment back up to the natural rate.
71. 1 point: The short-run Phillips curve shifts UP (to the right) as expected inflation rises, so the new SRPC intersects the LRPC at 5 percent unemployment and a higher inflation rate than at A.

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QUESTION 3 · COMPARATIVE ADVANTAGE (4 POINTS)

- 72.** 1 point: Aria gives up $20/40 = 0.5$ ton of tea per ton of coffee; Boria gives up $30/30 = 1$ ton of tea per ton of coffee.
- 73.** 1 point: Aria has the comparative advantage in coffee because its opportunity cost (0.5 tea) is lower than Boria's (1 tea). (Boria has the comparative advantage in tea.)
- 74.** 1 point: Any price strictly between 0.5 and 1 ton of tea per ton of coffee, for example 0.75. Aria receives more than it gives up at home and Boria pays less than its own opportunity cost.
- 75.** 1 point: Aria receives $20 \times 0.75 = 15$ tons of tea and keeps 20 tons of coffee. Without trade, producing 20 tons of coffee would leave resources for only 10 tons of tea, so trade gives Aria 5 more tons of tea.

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Appendix: Reference.

Formulas, graph gallery, glossary, and a skills checklist for last-minute review.

R.1 Formula Sheet and Graph Gallery

A quick lookup for every formula in the course, with notes on when to use it, and a table of every standard graph and what shifts each curve.

Use this sheet as a quick lookup. Formulas are grouped by unit, and each row says when the formula applies and what traps to avoid. The graph gallery then summarizes every standard graph, what is on each axis, and what shifts each curve.

Rules that apply to every calculation

Percent change = $(\text{new} - \text{old}) / \text{old} \times 100$. Always divide by the old (starting) value.

Use real values to compare output across years, and nominal values only for the year they are measured in.

Write the formula, substitute, and include the unit or percent sign in the answer.

Topic	Formula	When to use / trap
Opportunity cost	Amount of other good given up / amount of good gained	PPC and trade; the slope of a straight PPC
Comparative advantage	Lower opportunity cost for a good	Not the one who makes more; compare costs, not quantities
GDP, expenditure approach	$GDP = C + I + G + (X - M)$	Counts final goods only; transfer payments, used goods, and financial asset trades are excluded
GDP per capita	$GDP / \text{population}$	Compare living standards across countries or years
Real GDP	$\text{Nominal GDP} / \text{GDP deflator} \times 100$	Deflator in index form (base year = 100)
GDP deflator	$\text{Nominal GDP} / \text{Real GDP} \times 100$	Covers all domestic output, not just a fixed basket
Growth rate	$(Y_2 - Y_1) / Y_1 \times 100$	Use real GDP for economic growth
Rule of 70	Years to double = $70 / \text{growth rate (in percent)}$	Approximation; the rate is the percent, not the decimal
Unemployment rate	$\text{Unemployed} / \text{labor force} \times 100$	Labor force = employed + unemployed
Labor force participation	$\text{Labor force} / \text{adult population} \times 100$	Discouraged workers are outside the labor force
Natural rate of unemployment	Frictional + structural unemployment	Cyclical unemployment = actual rate - natural rate
CPI	$\text{Cost of market basket in current year} / \text{cost in base year} \times 100$	Fixed basket; overstates inflation because of substitution bias
Inflation rate	$(CPI_2 - CPI_1) / CPI_1 \times 100$	Also works with the GDP deflator
Real value	$\text{Nominal value} / \text{price index} \times 100$	Deflating wages, income, or GDP
Real interest rate	Nominal rate - inflation rate	Use expected inflation for lenders' and borrowers' decisions
MPC and MPS	$MPC = \text{change in } C / \text{change in disposable income}$; $MPC + MPS = 1$	MPC and MPS are between 0 and 1

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Topic	Formula	When to use / trap
Spending multiplier	$1 / (1 - MPC) = 1 / MPS$	Change in GDP = multiplier x change in spending; simple model has no crowding out
Tax multiplier	$-MPC / MPS = -MPC \times \text{spending multiplier}$	Magnitude is one less than the spending multiplier
Balanced-budget multiplier	Equal changes in G and taxes: multiplier = 1	Spending multiplier + tax multiplier = 1
Required reserves	Required reserve ratio x deposits	Excess reserves = total reserves - required reserves
Money multiplier	$1 / \text{required reserve ratio}$	Maximum change in money supply = excess reserves x multiplier
Budget balance	Taxes - government spending	Negative = deficit; positive = surplus
Exchange rate conversion	Foreign price / exchange rate = domestic price	Check which currency the rate is quoted in
Percent change in currency value	$(\text{new rate} - \text{old rate}) / \text{old rate} \times 100$	Rate in units of foreign currency per unit of home currency
Balance of payments	Current account + capital and financial account = 0	A current account deficit means a capital inflow surplus

Using the multiplier correctly. The simple multiplier assumes that prices are fixed and the central bank does not respond. In AD-AS terms, the multiplier measures the horizontal shift of AD. The actual change in real GDP is smaller if the price level rises, and a government that borrows may crowd out private investment.

Graph	Vertical axis	Horizontal axis	Curves and slopes	Equilibrium
AD-AS	Price level	Real GDP	AD down; SRAS up; LRAS vertical at full employment output	AD = SRAS (short run); long-run equilibrium also on LRAS
Production possibilities	Good Y (e.g., capital)	Good X (e.g., consumer)	Bowed out for increasing opportunity cost	Any point on the curve is efficient
Money market	Nominal interest rate	Quantity of money	Md down; Ms vertical	Md = Ms
Loanable funds	Real interest rate	Quantity of loanable funds	D down; S up	D = S
Foreign exchange	Exchange rate (foreign currency per unit)	Quantity of the currency	D down; S up	D = S
Phillips curve	Inflation rate	Unemployment rate	SRPC down; LRPC vertical at the natural rate	Economy sits on the SRPC at current expectations
Single product market	Price	Quantity	D down; S up	Qd = Qs

Curve	Shifts right (increase) when	Shifts left (decrease) when
AD	Consumer confidence or wealth rises; investment rises; government spending rises; taxes fall; net exports rise; money supply rises	Opposite of each: lower confidence, higher taxes, less G, net exports fall, tighter money
SRAS	Input or oil prices fall; productivity rises; expected inflation falls; business taxes fall	Input prices, wages, or oil rise; productivity falls; expected inflation rises; regulation increases costs
LRAS	Labor, capital, or technology increases; institutions improve	Resources are lost; war or disaster; worse institutions
Ms	Central bank buys bonds, lowers reserve requirement or discount rate	Central bank sells bonds, raises reserve requirement or discount rate
Md	Price level rises, real income rises	Price level falls, real income falls

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Curve	Shifts right (increase) when	Shifts left (decrease) when
Loanable funds supply (S)	Saving rises; private saving incentives; foreign capital inflow rises; government surplus	Saving falls; government deficit shrinks public saving
Loanable funds demand (D)	Business investment optimism; government borrowing increases	Investment opportunity falls; business taxes rise
Demand for a currency	Foreign demand for exports; higher relative interest rates; foreign investment; lower relative inflation	Opposite changes
Supply of a currency	Domestic demand for foreign goods and assets rises	Domestic demand for imports and foreign assets falls
SRPC	Expected inflation rises or negative supply shock (shifts up and right)	Expected inflation falls or positive supply shock (shifts down and left)

Policy or event	Immediate effect	Result on AD-AS or other graph
Expansionary fiscal policy (more G, lower taxes)	Larger deficit	AD right; real GDP and price level rise; loanable funds D shifts right and the real rate rises (crowding out)
Contractionary fiscal policy	Smaller deficit	AD left; real GDP and price level fall; real rate falls
Open market purchase	Bank reserves rise	Ms right, nominal rate falls, investment rises, AD right
Open market sale, higher reserve requirement, higher discount rate	Reserves or lending fall	Ms left, nominal rate rises, investment falls, AD left
Higher domestic interest rate	Capital inflow	Demand for currency right, currency appreciates, net exports fall, AD left
Negative supply shock	Costs rise	SRAS left: price level up, real GDP down (stagflation)
Long-run adjustment from a recessionary gap	Wages and input prices fall	SRAS right back to LRAS, price level falls
Long-run adjustment from an inflationary gap	Wages and input prices rise	SRAS left back to LRAS, price level rises

Exam tip

Before you draw any graph, ask three questions: Which market is this (goods and services, money, loanable funds, or foreign exchange)? Which curve does the event shift? What happens to the price on the vertical axis? Then draw, label, and write the result in words with the direction of change.

R.2 Glossary and Skills Checklist

Definitions of the key terms in each unit and a skills checklist to confirm you are ready for the exam.

The glossary is organized by unit. After it, a skills checklist lists what you should be able to do before the exam. Check off each skill only if you can do it without notes.

Term (Unit 1: Basic Concepts)	Definition
Scarcity	The condition of limited resources and unlimited wants, which forces choices.
Opportunity cost	The value of the next best alternative given up when a choice is made.
Production possibilities curve	A graph showing the maximum combinations of two goods an economy can produce with its resources and technology.
Factors of production	Land, labor, capital, and entrepreneurship, the resources used to produce goods and services.
Absolute advantage	The ability to produce more of a good with the same resources.
Comparative advantage	The ability to produce a good at a lower opportunity cost than another producer.

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Term (Unit 1: Basic Concepts)	Definition
Terms of trade	The rate at which two parties exchange goods; mutually beneficial trade lies between the two opportunity costs.
Specialization	Focusing production on goods in which a producer has a comparative advantage.
Marginal analysis	Comparing the extra benefit and extra cost of an additional unit to decide how much to do.
Circular flow	A model of how households and firms exchange goods, services, resources, and money through markets.
Demand	The quantity buyers are willing and able to purchase at each price, other things equal.
Supply	The quantity sellers are willing to offer at each price, other things equal.
Equilibrium	The price and quantity where quantity demanded equals quantity supplied.

Term (Unit 2: Indicators and Business Cycle)	Definition
Gross domestic product (GDP)	The market value of all final goods and services produced within a country in a year.
Nominal GDP	GDP measured at current-year prices.
Real GDP	GDP adjusted for changes in the price level, measured in base-year prices.
GDP deflator	A price index for all domestic output, equal to nominal GDP divided by real GDP times 100.
Economic growth	An increase in real GDP, or in real GDP per capita, over time.
Business cycle	The recurring fluctuations of real GDP through expansion, peak, contraction, and trough.
Recession	A significant fall in economic activity, usually shown by falling real GDP and rising unemployment.
Labor force	People 16 and older who are employed or actively seeking work.
Unemployment rate	The percentage of the labor force that is unemployed.
Frictional unemployment	Short-term unemployment from the time it takes to match workers and jobs.
Structural unemployment	Unemployment from a mismatch between workers' skills and available jobs.
Cyclical unemployment	Unemployment caused by a downturn in the business cycle.
Natural rate of unemployment	The sum of frictional and structural unemployment; the rate at full employment.
Consumer price index (CPI)	A measure of the cost of a fixed basket of goods and services relative to a base year.
Inflation	A sustained rise in the general price level.
Deflation	A sustained fall in the general price level.
Real interest rate	The nominal interest rate minus the inflation rate.
Nominal interest rate	The stated rate of interest, not adjusted for inflation.

Term (Unit 3: National Income and Price Determination)	Definition
Aggregate demand (AD)	The total quantity of real GDP demanded at each price level.
Aggregate supply (AS)	The total quantity of real GDP producers will supply at each price level.
Short-run aggregate supply (SRAS)	An upward-sloping curve that holds nominal wages and input prices fixed.
Long-run aggregate supply (LRAS)	A vertical curve at full employment output, determined by resources and technology.
Full employment output	The level of real GDP produced when the economy is at the natural rate of unemployment.
Recessionary gap	A situation in which real GDP is below full employment output.

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Term (Unit 3: National Income and Price Determination)	Definition
Inflationary gap	A situation in which real GDP is above full employment output.
Stagflation	Falling real GDP together with rising prices, usually from a negative supply shock.
Marginal propensity to consume (MPC)	The fraction of an extra dollar of disposable income that is spent.
Marginal propensity to save (MPS)	The fraction of an extra dollar of disposable income that is saved.
Multiplier	The ratio of the change in real GDP to the initial change in spending.
Fiscal policy	Changes in government spending and taxes to influence the economy.
Automatic stabilizers	Tax and transfer programs that change automatically with the business cycle.
Budget deficit	The amount by which government spending exceeds tax revenue in a year.
National debt	The total accumulated amount the government owes from past deficits.
Crowding out	The fall in private investment caused by government borrowing that raises interest rates.

Term (Unit 4: The Financial Sector)	Definition
Money	Anything generally accepted as a medium of exchange, unit of account, and store of value.
M1 and M2	Measures of the money supply; M1 is the most liquid (currency, checkable deposits), and M2 adds savings and small time deposits.
Fractional reserve banking	A system in which banks keep only a fraction of deposits in reserve and lend the rest.
Required reserve ratio	The fraction of deposits that banks must hold in reserve.
Excess reserves	Reserves held above the required amount.
Money multiplier	1 divided by the required reserve ratio, the maximum expansion of money per dollar of excess reserves.
Federal funds rate	The interest rate banks charge each other for overnight loans of reserves.
Open market operations	The central bank's purchase or sale of government bonds to change reserves.
Discount rate	The interest rate the central bank charges banks for loans.
Monetary policy	Central bank actions to change the money supply and interest rates to influence the economy.
Expansionary monetary policy	Policy that increases the money supply and lowers interest rates to raise output.
Contractionary monetary policy	Policy that decreases the money supply and raises interest rates to reduce inflation.
Loanable funds market	The market where savers supply funds and borrowers demand funds, with the real interest rate as the price.
Money market	The market for money where money demand and the money supply determine the nominal interest rate.
Liquidity	How easily and cheaply an asset can be converted to cash.

Term (Unit 5: Long-Run Consequences of Stabilization Policies)	Definition
Short-run Phillips curve (SRPC)	A downward-sloping curve showing the short-run tradeoff between inflation and unemployment.
Long-run Phillips curve (LRPC)	A vertical line at the natural rate of unemployment.
Expected inflation	The inflation rate people anticipate, which shifts the SRPC.

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Term (Unit 5: Long-Run Consequences of Stabilization Policies)	Definition
Supply-side policy	Policy aimed at increasing LRAS, such as education, investment in capital, or tax incentives.
Productivity	Output per unit of input, usually per worker-hour.
Physical capital	Manufactured goods such as machinery and buildings used to produce other goods.
Human capital	The knowledge and skills of workers gained through education and experience.
Public debt burden	The cost of interest and the effects of crowding out associated with government borrowing.
Discretionary policy	Policy actions deliberately taken by policymakers, as opposed to automatic changes.
Policy lag	The delay between a problem and the effect of policy, including recognition, decision, and impact.

Term (Unit 6: Open Economy)	Definition
Exchange rate	The price of one currency in terms of another.
Appreciation	A rise in the value of a currency relative to another.
Depreciation	A fall in the value of a currency relative to another.
Current account	The part of the balance of payments covering trade in goods and services, income, and transfers.
Capital and financial account	The part of the balance of payments covering purchases and sales of assets across borders.
Net exports	Exports minus imports of goods and services.
Tariff	A tax on imported goods.
Quota	A legal limit on the quantity of an imported good.
Trade deficit	A situation in which imports exceed exports.
Net capital outflow	Domestic purchases of foreign assets minus foreign purchases of domestic assets.
Flexible exchange rate	An exchange rate determined by the supply and demand for currency in the market.
Fixed exchange rate	An exchange rate set and maintained by the government or central bank.

Unit	Skills checklist: I can...
1	Draw and interpret a PPC, calculate opportunity cost, and identify comparative advantage; shift supply and demand.
2	Calculate GDP, real GDP, growth rates, unemployment, CPI, and inflation; classify types of unemployment; identify business cycle phases.
3	Draw AD-AS, explain the three reasons AD slopes down, identify shifters, show short-run and long-run effects; calculate multipliers and fiscal policy changes.
4	Explain money functions, calculate reserves and the money multiplier, draw money market and loanable funds graphs, and trace monetary policy to AD.
5	Draw the Phillips curve and its shifts, explain the long-run effects of policy, and discuss growth, productivity, and crowding out.
6	Draw foreign exchange graphs, explain appreciation and depreciation effects on net exports, and apply the balance of payments identity.
All	Write cause-and-effect explanations, label graphs completely, and manage time on both sections.

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