

ECO2021: BASIC MACROECONOMICS

Lecture 11: Aggregate Demand and Aggregate Supply

Wontae Han

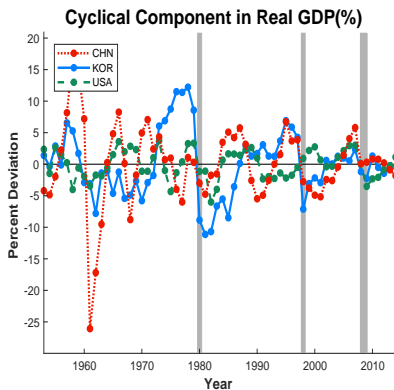
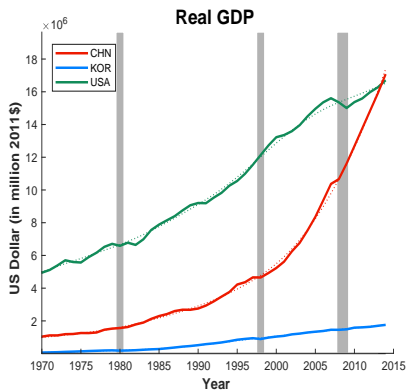
The Chinese University of Hong Kong, Shenzhen

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The takeaway

- 1 How does the aggregate demand curve illustrate the relationship between the aggregate price level and the quantity of aggregate output demanded?
- 2 How does the aggregate supply curve illustrate the relationship between the aggregate price level and the quantity of aggregate output supplied?
- 3 Why is the aggregate supply curve different in the short run than in the long run?
- 4 How is the AD-AS model used to analyze economic fluctuations?
- 5 How can monetary policy and fiscal policy stabilize the economy?

Stabilize Short-Run Economic Fluctuations

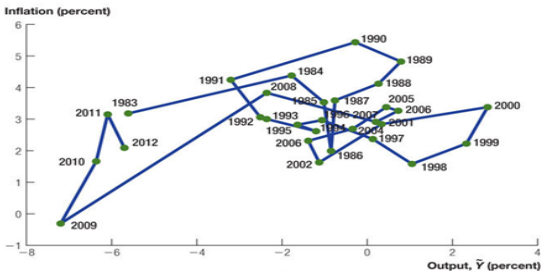
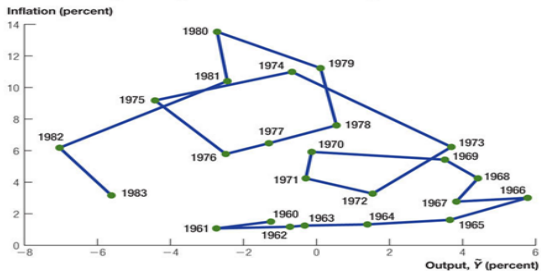


Sources: Penn World Table 9.0

Stabilize Short-Run Economic Fluctuations

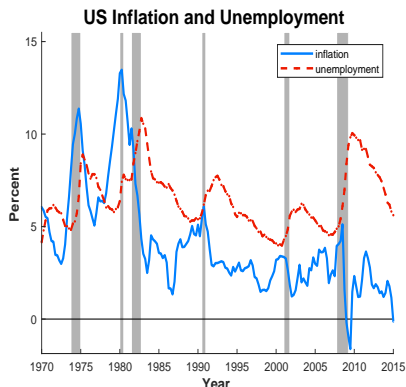
FIGURE 13.17

Inflation-Output Loops in the U.S. Economy



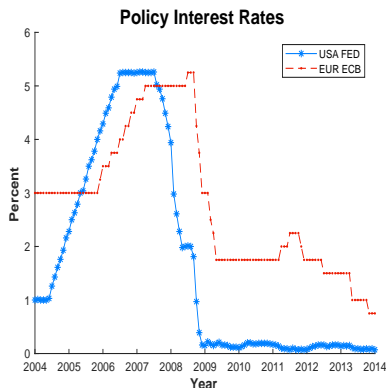
Stabilize Short-Run Economic Fluctuations

- In 2011, the US unemployment rate was at around 9% which was very high by historical standards.
- But inflation had spiked to almost 4%, twice the widely accepted policy target of 2%, putting policy makers in a quandary.
- Should policy be **expansionary** to fight unemployment?
- Or should it be **contractionary** to reduce inflation?



Stabilize Short-Run Economic Fluctuations

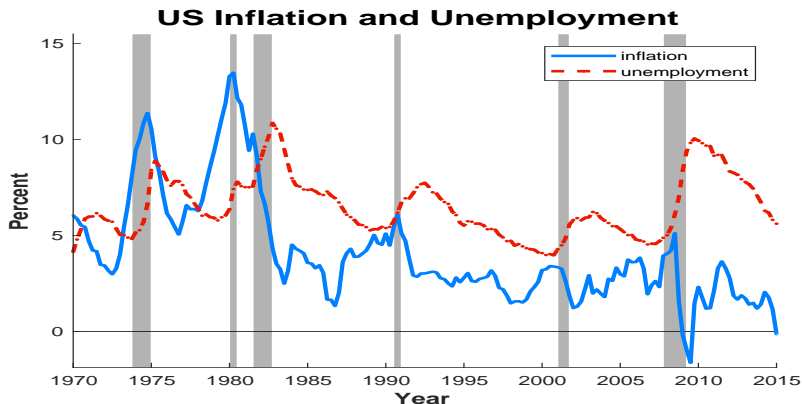
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Shocks to the General Equilibrium System

Recession exhibits high unemployment. But why is inflation high in some recessions and not others? **What causes recessions?**

- **The economy's behavior can be explained, predicted, and potentially manipulated by looking at**
 - Total Demand or **Aggregate Demand**
 - Total Supply or **Aggregate Supply**



The Aggregate Demand Curve

- The aggregate demand curve represents the relationship between the aggregate price level and the quantity of aggregate output demanded by households, businesses, the government, and the rest of the world.

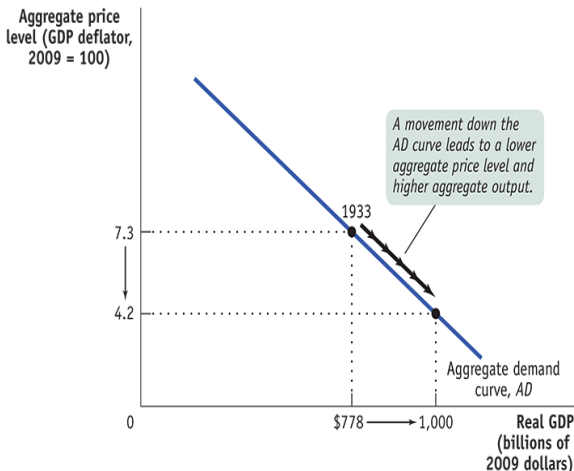


FIGURE 12-1 Krugman/Wells, *Macroeconomics*, 5e, © 2018 Worth Publishers

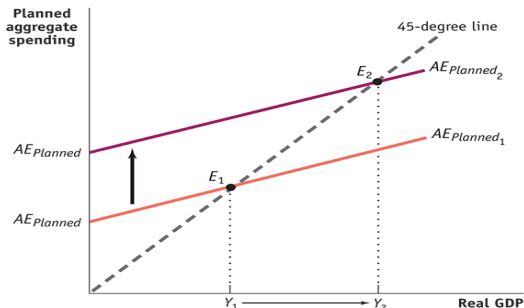
The Aggregate Demand Curve: Why Downward Sloping?

- The aggregate demand curve is downward sloping, indicating a **negative relationship** between the aggregate price level and the quantity of aggregate output demanded.
- **Why does the AD curve slope downward?** Recall: $GDP = Y = C + I + G + NX$
- Why does a rise in the aggregate price level reduce the quantity of C, I, and NX?
- Is this obvious by **the law of demand**? **No, the law of demand for an individual good is misleading.** The GDP deflator is aggregate price index of which change induces the simultaneous change of prices of all goods: consumption substitutes, consumption complements, production substitutes, production complements, etc.
 - ▷ **The Wealth Effect:** A higher aggregate price level reduces the purchasing power of households' wealth and reduces consumer spending,
Max Util(C, 24 - L) s.t. $P_C \times Consumption + Savings = Wage \times Labor + \Delta Wealth$.
 - ▷ **The Interest Rate Effect:** A higher aggregate price level makes households and firms hold **more cash**. They can increase their money holdings by **borrowing more or selling financial assets**. This shifts the demand upward in a loanable fund market, leading to **a rise in interest rates** and a fall in investment spending and consumer spending.

The Aggregate Demand Curve

The aggregate demand curve relates the overall demand for goods and services to the overall price level. What is the relation between the AD curve and the income-expenditure model?

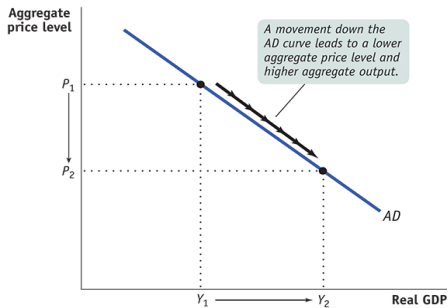
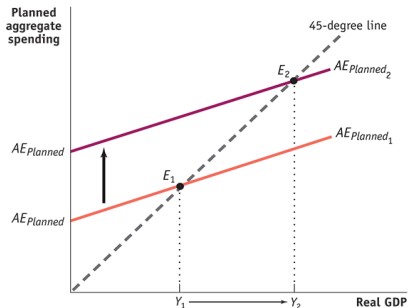
- The AD curve is the application of the income-expenditure model at different prices.
- We now drop the assumption that the overall price level is fixed. When the aggregate price level changes, the $AE_{planned}$ curve shifts.
- The AD curve summarizes what the income-expenditure model says about the effects of changes in the aggregate price level. In practice, economists often use the income-expenditure model to analyze the short-run economic fluctuations. In the short-run, this is usually a reasonable shortcut.



The Aggregate Demand Curve

The Relation between the AD curve and the Income-Expenditure Model:

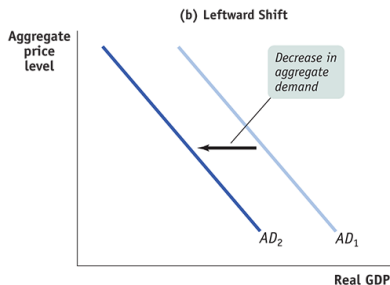
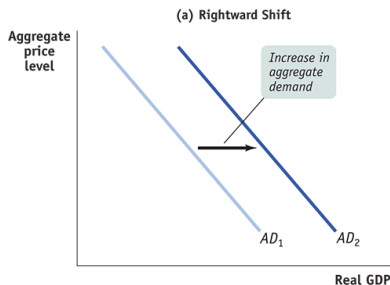
- Suppose the aggregate price level drops. Then planned aggregate expenditure (or spending) rises at all output levels due to:
 - ▷ **The Wealth Effect:** A lower aggregate price level enhances the purchasing power of households' wealth and spurs consumer spending. $P_C \times Consumption + Savings = Wage \times Labor + \Delta Wealth$.
 - ▷ **The Interest Rate Effect:** A lower aggregate price level makes households and firms hold less cash. They don't borrow or they buy financial assets. This leads to a drop in interest rates and a rise in investment spending and consumer spending.
- Then a multiplier process occurs and it moves the income-expenditure equilibrium from E_1 to E_2 and raises real GDP from Y_1 to Y_2 .



The AD Curve: Movement along the Curve vs Shifts of the Curve

What leads to changes in the quantity of goods and services at every price level?

- A movement along the AD curve represents a change in the aggregate quantity of goods and services demanded as the aggregate price level changes.
- The aggregate demand curve shifts because of changes in:
 - ▷ **Expectations:** The consumer and business sentiments affect C and $I_{planned}$.
 - ▷ **Wealth:** A rise in stock prices and house prices increases the purchasing power of households, leading to an increase in aggregate spending.
 - ▷ **Size of the existing stock of physical capital:** Firms need not engage in planned investment spending to add to their stock of physical capital when there is much physical capital already.
 - ▷ **Government Policies:** Fiscal Policy and Monetary Policy



The AD Curve: Movement along the Curve vs Shifts of the Curve

What changes the quantity of goods and services at every price level? **Government Policies**

$$AE_{planned} = A + MPC \times (Y - Tax + Transfer) + I_{planned} + G$$

- First Principles: (1) When markets don't achieve efficiency, government intervention can improve society's welfare. (2) Government policies can change spending.

▷ **Fiscal Policy:** The use of either government spending (purchases of goods and services, and transfers) or tax policy

▷ **Monetary Policy:** The central bank controls monetary policy – the use of changes in the quantity of money or the interest rate to stabilize economy. Increasing the quantity of money in circulation drives the interest rate down and boosts the aggregate demand.

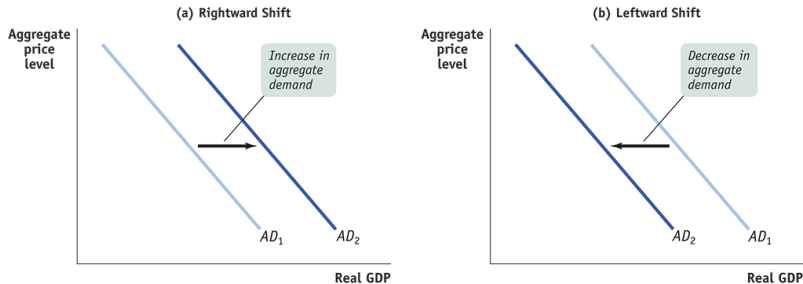
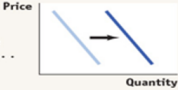
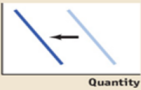
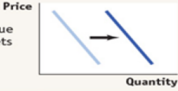
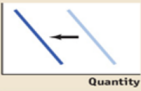
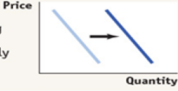
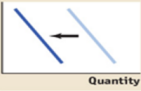
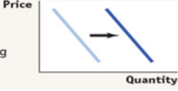
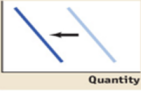
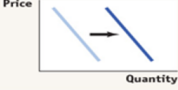
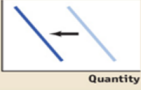


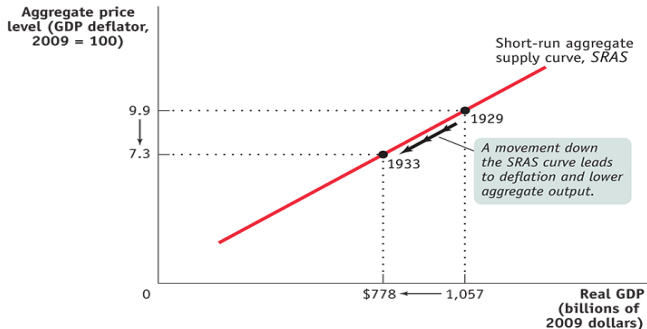
FIGURE 12-4 Krugman/Wells, *Macroeconomics*, 5e, © 2018 Worth Publishers

Factors that shift AD curve

When this happens aggregate demand increases	But when this happens aggregate demand decreases
Changes in expectations			
When consumers and firms become more optimistic . . .		When consumers and firms become more pessimistic . . .	
Changes in wealth			
When the real value of household assets rises . . .		When the real value of household assets falls . . .	
Size of the existing stock of physical capital			
When the existing stock of physical capital is relatively small . . .		When the existing stock of physical capital is relatively large . . .	
Fiscal policy			
When the government increases spending or cuts taxes . . .		When the government reduces spending or raises taxes . . .	
Monetary policy			
When the central bank increases the quantity of money . . .		When the central bank reduces the quantity of money . . .	

The Short-Run Aggregate Supply Curve

- The aggregate supply curve shows the relationship between the aggregate price level and the quantity of aggregate output in the economy.
- Why does the SRAS curve slope upward? [Details](#)
 - **Keynesian:** Because nominal wages are sticky in the short run.
 - **Keynesian: Sticky wages** represent nominal wages that are slow to fall even in the face of high unemployment and slow to rise even in the face of labor shortages.
 - **Classical:** Because there is imperfect information



Short-Run vs. Long-Run

- Short run:

Prices are sticky. Prices are not adjusted even if there are surpluses or shortages. In our simple model, sticky prices indicate sluggish wage adjustment, so that the labor markets are not cleared in the short run. But consumption goods markets are assumed to be cleared through flexibly changing consumption goods prices.

- Medium run:

Prices are flexible, but there are some factors fixed.

- Long run:

Prices are flexible, and all factors are varying.

Nominal wages cannot be sticky forever. Formal contracts and informal agreements will be renegotiated to take into account changed economic circumstances. How long it takes for nominal wages to become flexible is an integral component of what distinguishes the short run from the long run.

The Short-Run Aggregate Supply Curve: Sticky Wages

How do sticky wages affect SRAS? Consider a firm's profit at a given period t :

$$\begin{aligned}\Pi &= PY - rK - wL - \text{fixed costs} \\ &= PF(K, L) - rK - wL - \text{fixed costs} \\ &= P \left[A \cdot K^{\frac{1}{3}} L^{\frac{2}{3}} \right] - rK - wL - \text{fixed costs}\end{aligned}$$

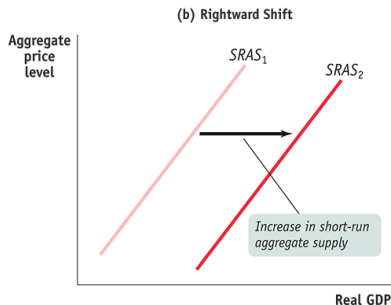
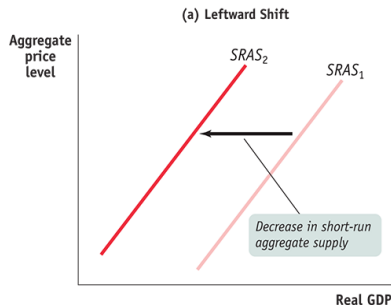
A higher aggregate price level leads to higher profits and increased aggregate output in the short run.

- [Maximize Profits] Marginal Profit = Marginal Revenue – Marginal Cost
- Total Costs: variable costs for labor, replacement costs for depreciated physical capital, interest payments, utility costs, etc.
- The labor cost is the major portion of total costs in the short-run.
- Nominal wages are often determined by contracts that were signed some time ago. Even when there are no formal contracts, there are often informal contracts between management and workers to fix wages for some period of time in spite of changes in economic conditions.

The SRAS Curve: Shifts of the Curve

What shifts the short-run aggregate supply curve?

- What happens when something changes production levels at every price level?
- The short-run aggregate supply curve shifts because of changes in:
 - ▷ Commodity prices such as oil prices
 - ▷ Nominal wages such as health care insurance premiums, employer-paid compensation, etc.
 - ▷ Productivity
- Each of these factors changes producers' profits and therefore shifts the SRAS.

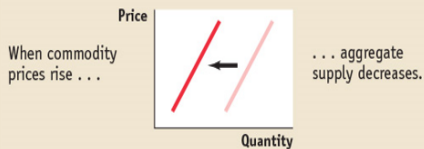
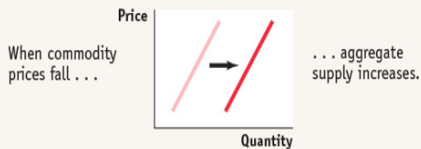


Factors that shift AS curve

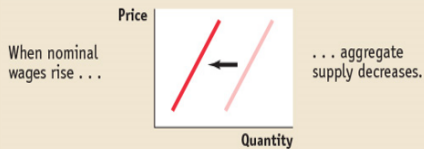
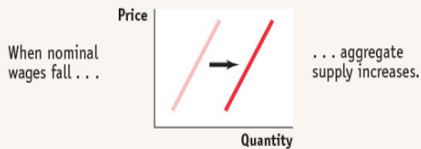
When this happens aggregate supply increases

But when this happens aggregate supply decreases

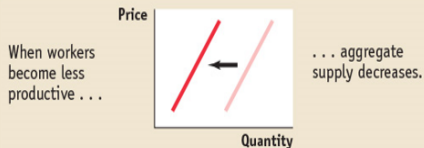
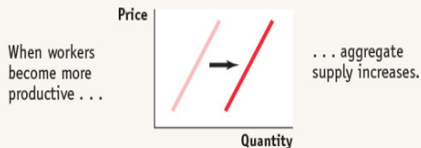
Changes in commodity prices



Changes in nominal wages

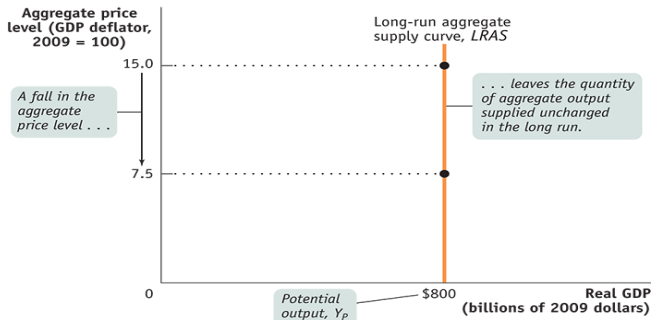


Changes in productivity



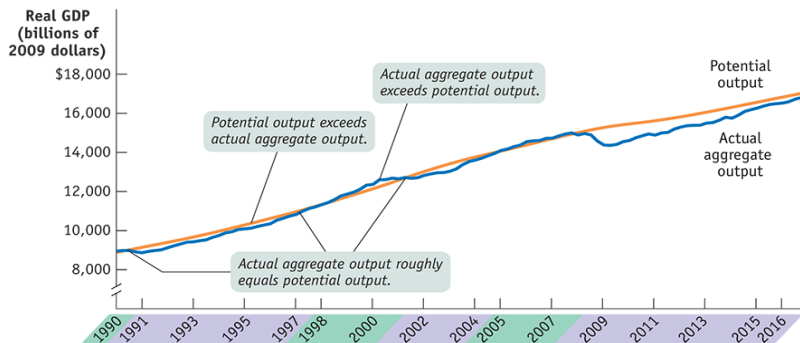
The Long-Run Aggregate Supply Curve

- The long-run aggregate supply curve shows the relationship between the aggregate price level and the quantity of aggregate output supplied that would exist if all prices, including nominal wages, were fully flexible.
- In the long run, contracts and informal agreements are renegotiated, and so there is no price stickiness.
- Hence there is no change to profits simply because “all prices” have changed, including nominal wages as well as the prices of final goods and services.
- The economy's potential output is the level of real GDP the economy would produce if all prices, including nominal wages, were fully flexible. Hence, it is the level of output when the unemployment is equal to its natural level.



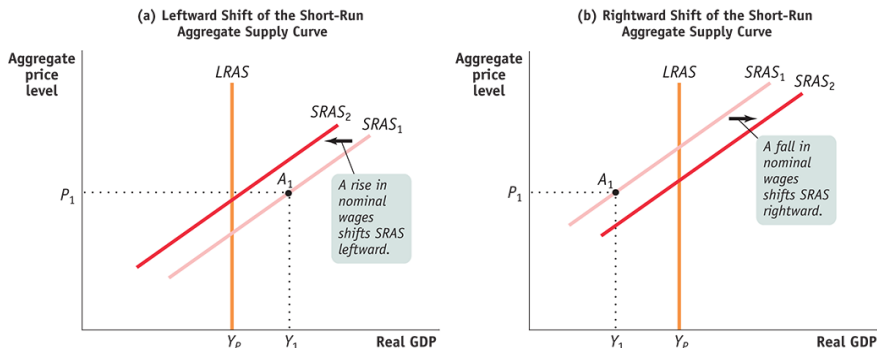
Actual and Potential Output, 1990 – 2016

- The level of real GDP is almost always either above or below potential output because of short-run fluctuations.
- An economy's potential output is an important number because it defines the trend around which actual aggregate output fluctuates from year to year.
- Years shaded purple on the horizontal axis correspond to periods in which actual aggregate output fell short of potential output; years shaded green correspond to periods in which actual aggregate output exceeded potential output.
- As shown, significant shortfalls occurred in the recessions of the early 1990s and after 2000. Actual aggregate output was significantly above potential output in the boom of the late 1990s, and a huge shortfall occurred after the recession of 2007–2009.



The Short-Run and Long-Run Aggregate Supply Curve

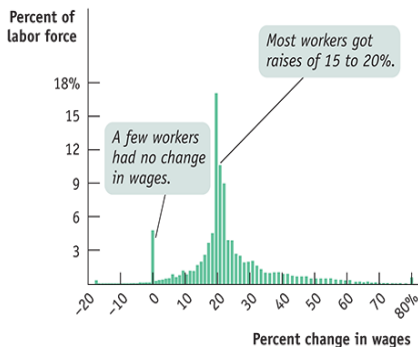
- Producing an aggregate output level that is higher than potential output Y_P is possible only because nominal wages have not yet fully adjusted upward. $Y_1 > Y_P$ means a low level of unemployment. Jobs are abundant and workers are scarce and thus nominal wages will rise over time, shifting the SRAS curve gradually to the left.
- Producing an aggregate output level that is lower than potential output Y_P is possible only because nominal wages have not yet fully adjusted downward. $Y_1 < Y_P$ means a high level of unemployment. Workers are willing to supply labor at a lower wage and thus nominal wages will fall over time, shifting the SRAS curve gradually to the right.
- If the economy finds itself at a price and output level away from the $LRAS$, wages will adjust and the $SRAS$ curve will shift toward equilibrium.



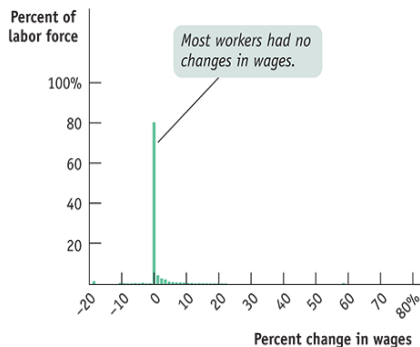
Sticky Wages in Portugal during the Great Recession

- We've asserted that the aggregate supply curve is upward-sloping in the short run mainly due to sticky wages – in particular, because employers are reluctant to cut nominal wages (and workers are unwilling to accept wage cuts) even when labor is in excess supply.
- If the theory of sticky wages were true, we would find evidence that wages fail to fall even during periods of high unemployment. What is the evidence?
- The figure below shows the case of Portugal, which suffered a severe, prolonged slump starting in 2008, with the unemployment rate peaking at more than 17% in early 2013.

(a) In a Prosperous Economy, 1984

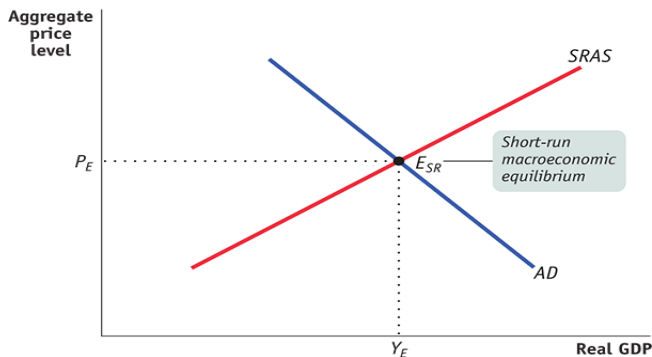


(b) In a Deeply Depressed Economy, 2012



The $AD - AS$ Model

- The $AD - AS$ model uses the aggregate supply curve and the aggregate demand curve together to analyze economic fluctuations.
- The short-run macroeconomic equilibrium is the point at which the quantity of aggregate output supplied is equal to the quantity demanded by domestic households, businesses, the government, and the rest of the world.
- In reality, there is a long-term upward trend in both aggregate output and the aggregate price level. We'll assume that a fall in either variable really means a fall compared to the long-run trend. For example, a 1% decline in the aggregate price level means one percent drop from the long-run trend of the aggregate price level.



Shifts of Aggregate Demand and Supply: Short-Run

The economy is in short-run macroeconomic equilibrium when the quantity of aggregate output supplied is equal to the quantity demanded. The short-run equilibrium aggregate price level is the aggregate price level in the short-run macroeconomic equilibrium. Short-run equilibrium aggregate output is the quantity of aggregate output produced in the short-run macroeconomic equilibrium.

- An event that shifts the aggregate demand curve is a demand shock: a change in expectations or wealth, the effect of the size of the existing stock of physical capital, or the use of fiscal or monetary policy. Demand shocks cause the aggregate price level and aggregate output to move in the same direction.
 - ▷ The Great Depression was caused by a negative demand shock, the collapse of wealth and of business and consumer confidence that followed the stock market crash of 1929 and the banking crisis of 1930–1931. It was ended by a positive demand shock – the huge increase in government purchases during World War II.
 - ▷ In 2008, the U.S. economy experienced another significant negative demand shock as the housing market turned from boom to bust, leading consumers and firms to scale back their spending.
- An event that shifts the aggregate supply curve is a supply shock: a change in commodity prices, nominal wages, or productivity. Supply shocks cause the aggregate price level and aggregate output to move in opposite directions.
 - ▷ The U.S. experienced a positive supply shock between 1995 and 2000, when the increasing use of the internet and other information technologies caused productivity growth to surge.
 - ▷ The combination of inflation and falling aggregate output has a special name: **stagflation**, for “stagnation plus inflation.” Stagflation indicates falling aggregate output leads to rising unemployment while the purchasing power of consumers is squeezed by rising prices. This poses a dilemma for policy makers.

Shifts of Aggregate Demand and Supply: Short-Run

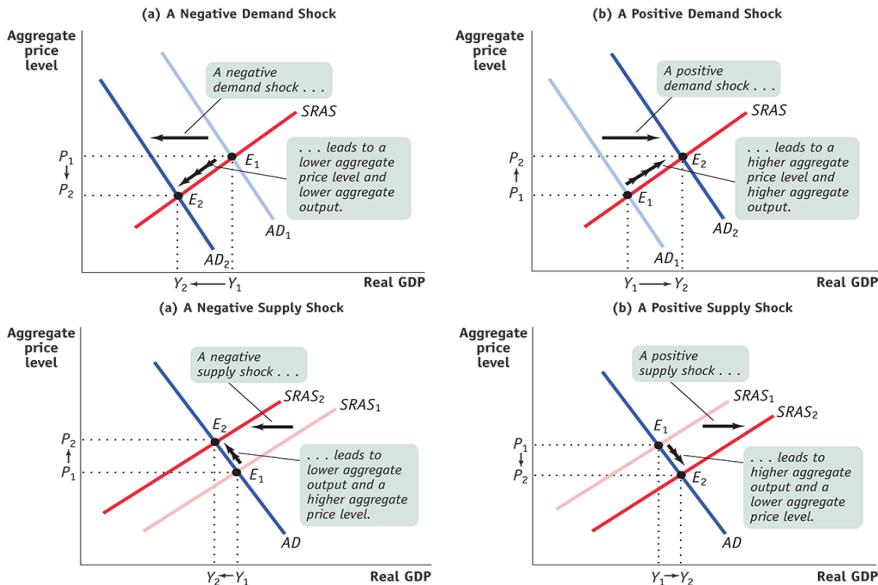


FIGURE 12-13 Krugman/Wells, *Macroeconomics*, 5e, © 2018 Worth Publishers

Supply Shocks vs. Demand Shocks in Action

- How often do supply shocks and demand shocks, respectively, cause recessions?
- Demand shocks are the usual culprit.
- Negative supply shocks are rare but its aftermath tends to be severe. Macroeconomic policy has a much harder time dealing with supply shocks than with demand shocks.

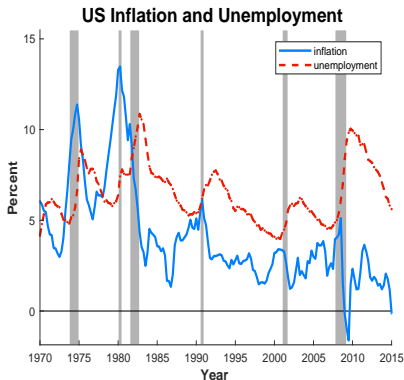
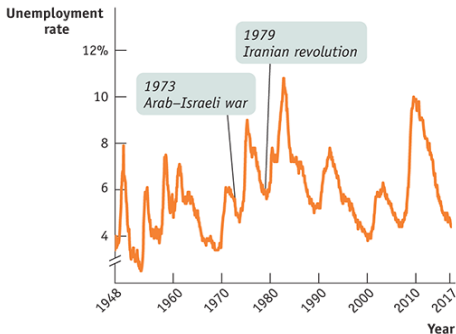
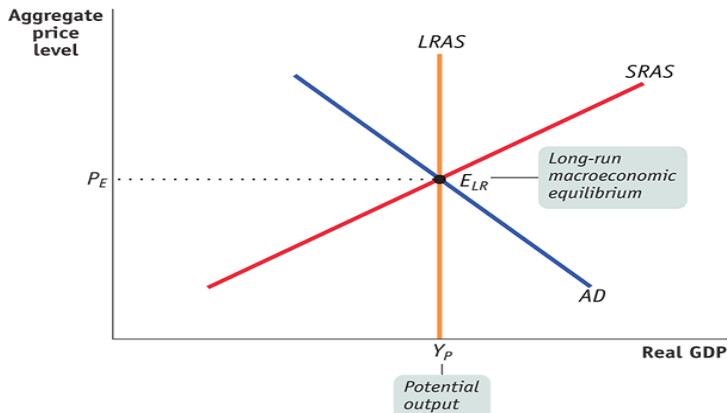


FIGURE 12-17 Krugman/Wells, *Macroeconomics*, 5e,
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Data from: Bureau of Labor Statistics; Federal Reserve Bank of St Louis.

Long-Run Macroeconomic Equilibrium

- The economy is in long-run macroeconomic equilibrium when the point of short-run macroeconomic equilibrium is on the long-run aggregate supply curve.
- Enough time has elapsed that the economy is at the intersection of all three curves – SRAS, LRAS, and AD. Thus, short-run equilibrium aggregate output is equal to potential output Y_P .



Short-Run vs. Long-Run Effects of Demand Shocks

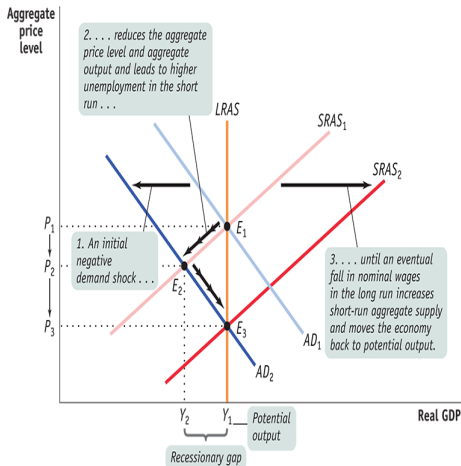


FIGURE 12-15 Krugman/Wells, *Macroeconomics*, 5e, © 2018 Worth Publishers

A Negative Demand Shock

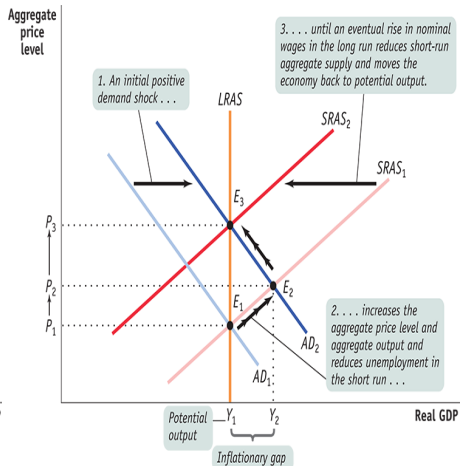


FIGURE 12-16 Krugman/Wells, *Macroeconomics*, 5e, © 2018 Worth Publishers

A Positive Demand Shock

Long-Run Macroeconomic Equilibrium: Gap Recap

$$\text{Output Gap} = \frac{\text{Actual aggregate output} - \text{Potential output}}{\text{Potential output}} \times 100$$

- **Recessionary gap** is the situation where aggregate output is below potential output. Nominal wages eventually fall, moving the economy back to potential output in the long run.
- **Inflationary gap** is the situation where when aggregate output is above potential output. Nominal wages rise, moving the economy back to potential output in the long run.
- **Output gap** is the percent difference between actual aggregate output and potential output, which eventually becomes zero since the economy is self-correcting in the long run.

Macroeconomic Policy: Responding to Disequilibrium

- The economy is self-correcting in the long run. However, the process of self-correcting typically takes a decade or more.
- If aggregate output is below potential output, the economy can suffer an extended period of depressed aggregate output and high unemployment before it returns to normal.
- John Maynard Keynes (1883-1946) created the modern field of macroeconomics: “In the long run we are all dead.”
- The government should use an active stabilization policy to reduce the severity of recessions and rein in excessively strong expansions.
- Then the question is, can stabilization policy improve the economy’s performance? (certainly seems to be yes)

Macroeconomic Policy: Responding to Demand Shocks

- If policy makers react quickly to the fall in aggregate demand, they can use monetary or fiscal policy to shift the aggregate demand curve back to the right. Why might a policy that short-circuits the adjustment and maintains the economy at its original equilibrium be desirable?
- The temporary fall in aggregate output causes high unemployment.
- Price stability is a desirable goal. Preventing deflation is a good thing.
- So always desirable? Not necessarily. Some policy measures which increase budget deficits may cause lower long-run growth. Furthermore, policy makers are not perfectly informed and the effects of their policies are not predictable. This creates the danger that stabilization policy will do more harm than good.
- Even if inflation may be a bad thing, isn't more output and lower unemployment a good thing? Not necessarily. Most economists believe that any short-run gains from an inflationary gap must be paid back later. Policy makers today try to offset positive as well as negative demand shocks.

Macroeconomic Policy: Responding to Supply Shocks

- Policy makers can respond to a negative demand shock by using monetary and fiscal policy to return aggregate demand to its original level. But what can or should they do about a negative supply shock?
- There are no easy policies that can affect producers' profitability and compensate for shifts of the SRAS curve.
- Negative supply shocks pose a policy dilemma:
 - To stabilize aggregate output requires increasing aggregate demand. This will lead to even more inflation.
 - But to stabilize prices requires reducing aggregate demand. This will curb inflation but deepen the output slump.
- It is a trade-off with no good answer.

The AD and AS Curve

Practice Question

- If the economy is in equilibrium and the real estate market collapses, what will likely happen?
 - 1 The AD curve will shift rightward.
 - 2 The AD curve will shift leftward.
 - 3 The SRAS curve will shift rightward.
 - 4 The SRAS curve will shift leftward.
- The short-run aggregate supply curve will shift to the right:
 - 1 when input costs rise.
 - 2 when taxes rise.
 - 3 when interest rates rise.
 - 4 when productivity rises.
- The AD-AS model is said to have a self-correcting mechanism. Explain what this means and how this self-correcting mechanism works. Use a graph to illustrate your answer.

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The AD and AS Curve

Practice Question

- Suppose an economy is in short-run equilibrium but the level of real GDP is less than potential output. Which of the following statements is true?
 - 1 In the long run, nominal wages will fall and the *SRAS* curve will shift left, restoring the economy to potential output.
 - 2 In the long run, nominal wages will fall and the *SRAS* curve will shift right, restoring the economy to potential output.
 - 3 In the long run, nominal wages will fall and the *AD* curve will shift left, restoring the economy to potential output.
 - 4 In the long run, nominal wages will fall and the *AD* curve will shift right, restoring the economy to potential output.
- Suppose short-run equilibrium real GDP for an economy is greater than potential output. This implies that:
 - 1 nominal wages will have to adjust upward as the economy moves from the short run to the long run.
 - 2 the level of unemployment is very low.
 - 3 jobs are plentiful.
 - 4 to reach long-run equilibrium, the *SRAS* curve will shift to the left, resulting in a higher aggregate price level.
 - 5 Answers (1), (2), (3), and (4) are all correct.

The AD and AS Curve

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Appendix

The AD Curve: Movement along the Curve vs Shifts of the Curve

- [Q] Does a change in wealth move the economy along the AD curve (wealth effect) or shift it?
- [A] It depends on the source of the change in wealth.
 - If it is a change in price level that affects our wealth, it is a movement along the AD curve. (e.g.) Rapid inflation shrinks our wealth.
 - If it is a change in something else that affects our wealth, it is a shift in the AD curve. (e.g.) The housing market or the stock market crashes.
- [Q] How do we distinguish between shifts of the AD curve and movements along it?
- [A] It is hard to distinguish, but one telling exception is what happened right after the oil crisis of 1979.
 - The consumer prices rose 14.8% in March of 1980 while consumer and investment spending dropped due to a surge in interest rates.
 - What was the culprit for the rise of the aggregate price level? It was a leftward shift in the short-run aggregate supply curve which induced the movement along the AD curve from right to left.

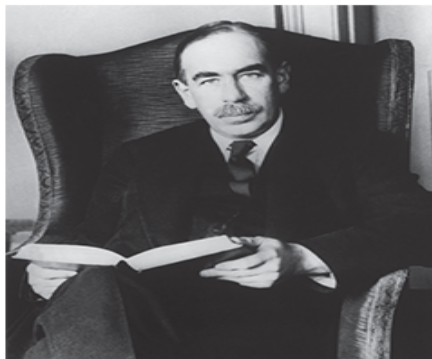
Why does the SRAS curve slope upward?

- **[Rigid Nominal Wage]** Many prices in the economy are written into long-term contracts and cannot be changed immediately. The most important prices of this type are workers' wages, which are negotiated only periodically in many industries. Wages do not enter indices of the price level directly, but they make up a large fraction of the cost of producing goods and services. Since output prices depend heavily on production costs, the behavior of the overall price level is influenced by the sluggishness of wage movements. Economists developed labor contract model and overlapping staggered labor contract model to explain the rigidity of nominal wages.
- **[Imperfect Information on Prices]** Classical economists rationalize the upward sloping short-run aggregate supply curve by using Lucas Island Model. In this model, prices and wages are flexible and hence markets clear. There is informational friction: producers know the price of the good they provide, but they cannot observe the aggregate price level. When the price of their products rises, producers cannot distinguish whether the rise is only for their goods or it is the rise of all goods in the economy. This friction can explain why the short-run aggregate supply curve is upward sloping.

Keynes and the Long Run

John Maynard Keynes(1883-1946),

“But this long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is long past the ocean is flat again.”



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