RUDIGER DORNBUSCH
STANLEY FISCHER
RICHARD STARTZ

TENTH EDITION |

MACROECONOMICS

Chapter 1

Introduction

What Is Macroeconomics?

- Macroeconomics is the study of the behavior of the economy as a whole and the policy measures that the government uses to influence it

  - Utilizes measures including total output, rates of unemployment and inflation, and exchange rates

- Examines the economy in the short and long run

  - <u>Short run</u>: movements in the business cycle

  - <u>Long run</u>: economic growth

- Macroeconomics aggregates the individual markets vs. microeconomics examines the behavior of individual economic units and the determination of prices in individual markets

Macroeconomics In Three Models

- Study of macroeconomics is grounded in three models, each appropriate for a particular time period
  1. Very Long Run Model: domain of growth theory $\rightarrow$ focuses on growth of the production capacity of the economy
  2. Long Run Model: a snapshot of the very long run model, in which capital and technology are largely fixed
     - The given level of capital and technology determine the level of potential output
     - Output is fixed, but prices determined by changes in AD
  3. Short Run Model: business cycle theories
     - Changes in AD determine how much of the productive capacity is used and the level of output and unemployment
   - Prices are fixed in this period, but output is variable

Very Long Run Growth

- Figure 1-1a illustrates growth of income per person in the U.S. over last century $\rightarrow$ growth of 2-3% per year

- Growth theory examines how the accumulation of inputs and improvements in technology lead to increased standards of living

- Rate of saving is a significant determinant of future well being and economic growth.
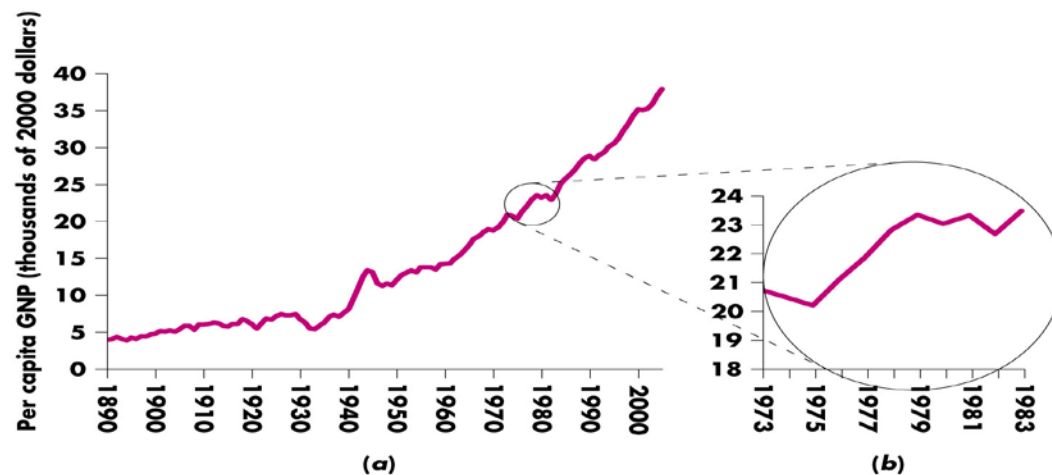
The Long Run Model

- In the long run, the AS curve is vertical and pegged at the potential level of output
  - Output is determined by the supply side of the economy and its productive capacity
  - The price level is determined by the level of demand relative to the productive capacity of the economy
- Conclusion: high rates of inflation are always due to changes in AD in the long run
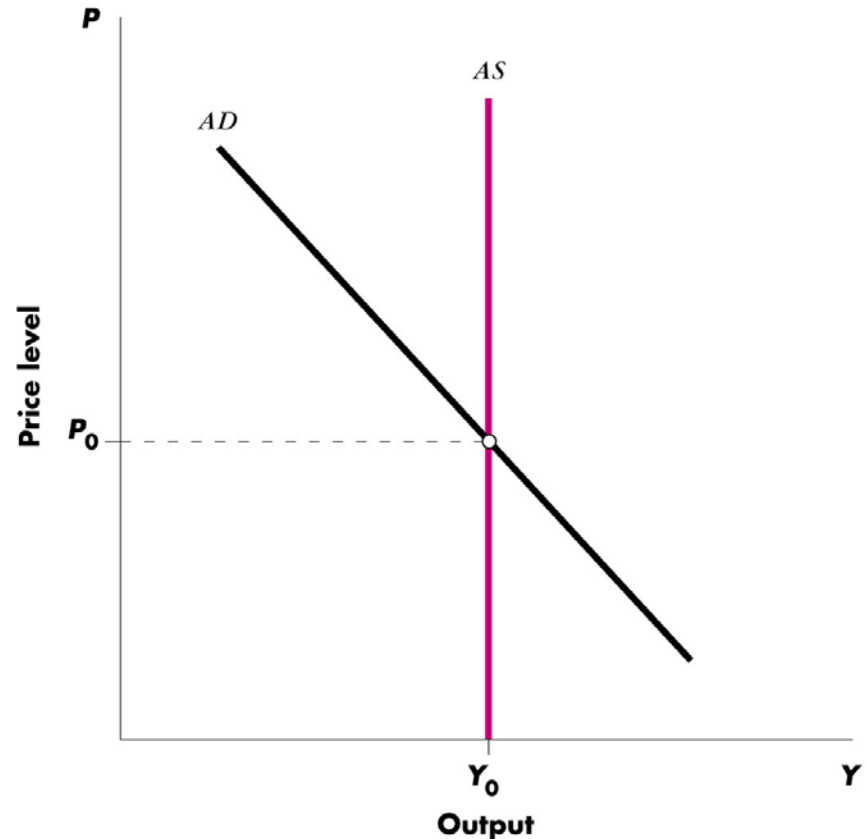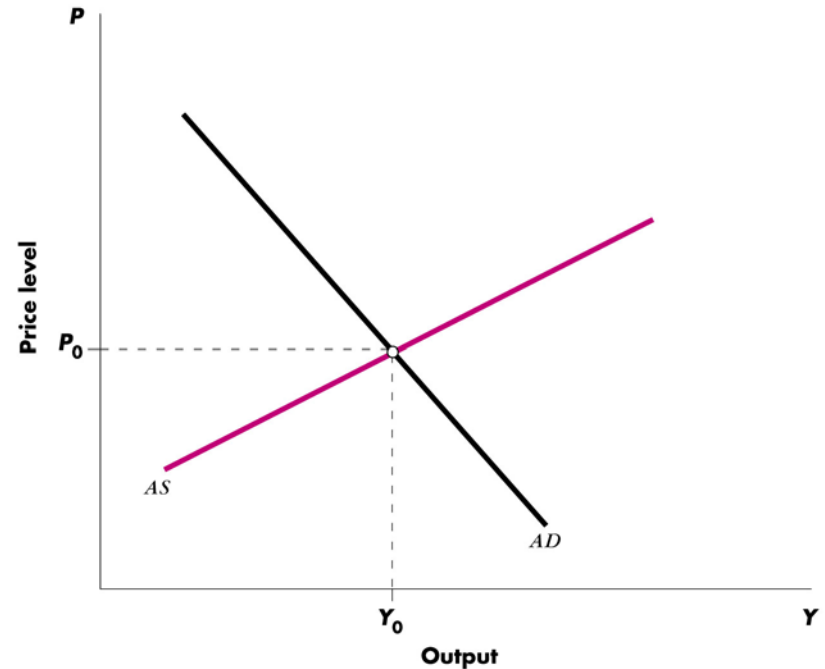
The Short Run Model

- Short run fluctuations in output are largely due to changes in AD

  - The AS curve is flat in the short run due to fixed/rigid prices, so changes in output are due to changes in AD

- Changes in AD in the short run constitute phases of the business cycle

 - In the short run, AD determines output, and thus unemployment
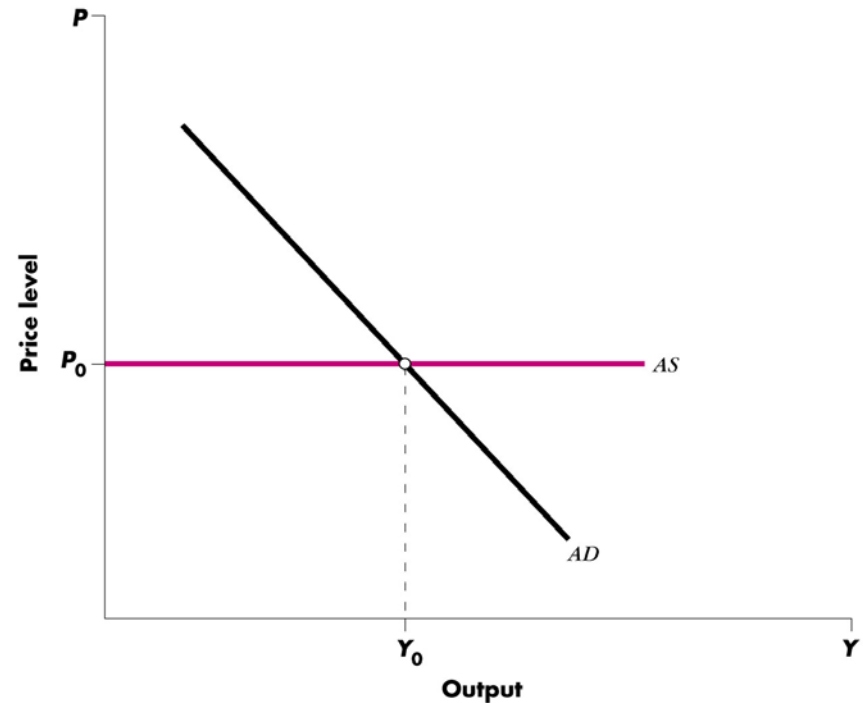
The Medium Run

- How do we get from the horizontal short run AS curve to the vertical long run AS curve?

- The medium run AS curve is tilting upwards towards the long run AS curve position
  - When AD pushes output above the sustainable level, firms increase prices
  - As prices increase, the AS curve is no longer pegged at a particular price level

The Phillips Curve

- Prices tend to adjust slowly → AD drives the economy in the meantime

- The speed of price adjustment is illustrated by the Phillips curve, which plots the inflation rate against the unemployment rate

- In the short run, AS curve is relatively flat, and movements in AD drive changes in prices, output, and unemployment
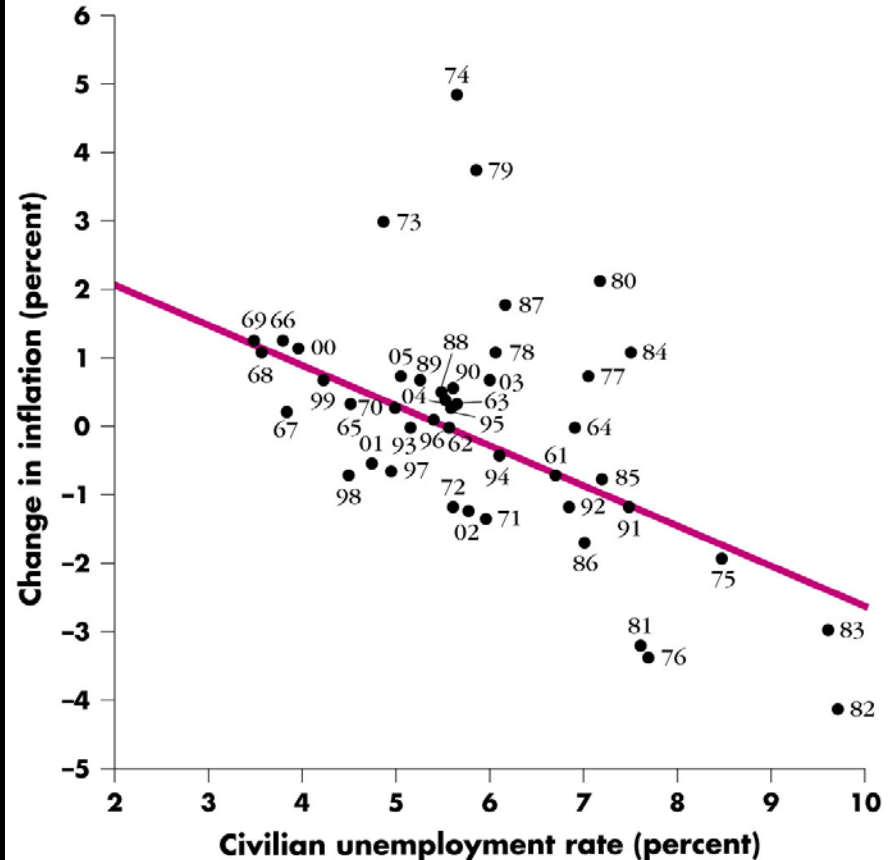
Growth and GDP

- The growth rate of the economy is the rate at which GDP is increasing
  - Most developed economies grow at a rate of a few percentage points per year
    - For example, the US real GDP grew at an average rate of 3.4 percent per year from 1960 to 2005
  - Growth rate is far from smooth (See Figure 1-1b)
- Growth in GDP is caused by:
  1. Increases in available resources (labor and capital)
  2. Increases in the productivity of those resources

The Business Cycle and the Output Gap

- Business cycle is the pattern of expansion and contraction in economic activity about the path of trend growth
  - Trend path of GDP is the path GDP *would* take if factors of production were fully utilized
- Deviation of output from the trend is referred to as the output gap
  - Output gap = actual output – potential output
  - Output gap measures the magnitude of cyclical deviations of output from the potential level
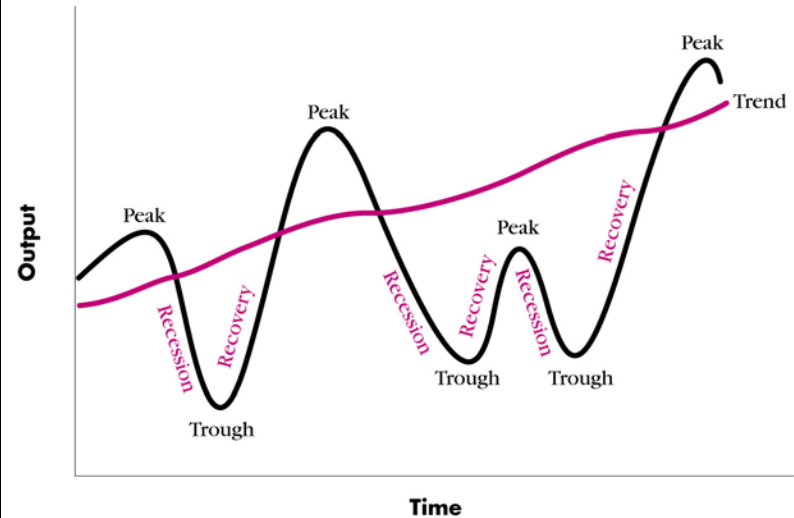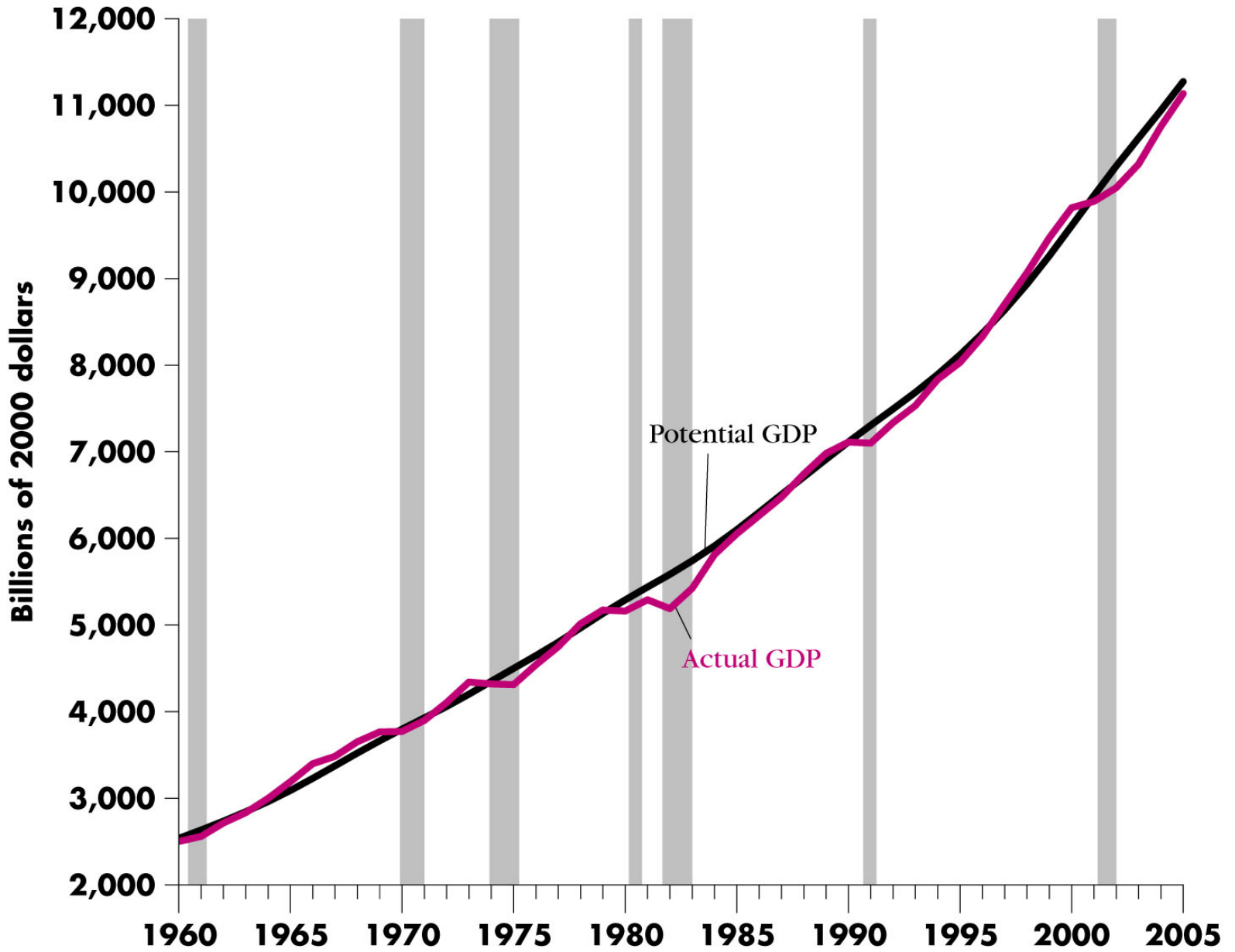
Inflation and the Business Cycle

- The inflation rate can be estimated by the percentage change in the consumer price index (CPI)
  - CPI is a price index that measures the cost of a given basket of goods bought by the average household
- If AD is driving the economy, periods of growth are accompanied by increases in prices and inflation, while periods of contraction associated with reduced prices and negative inflation rates
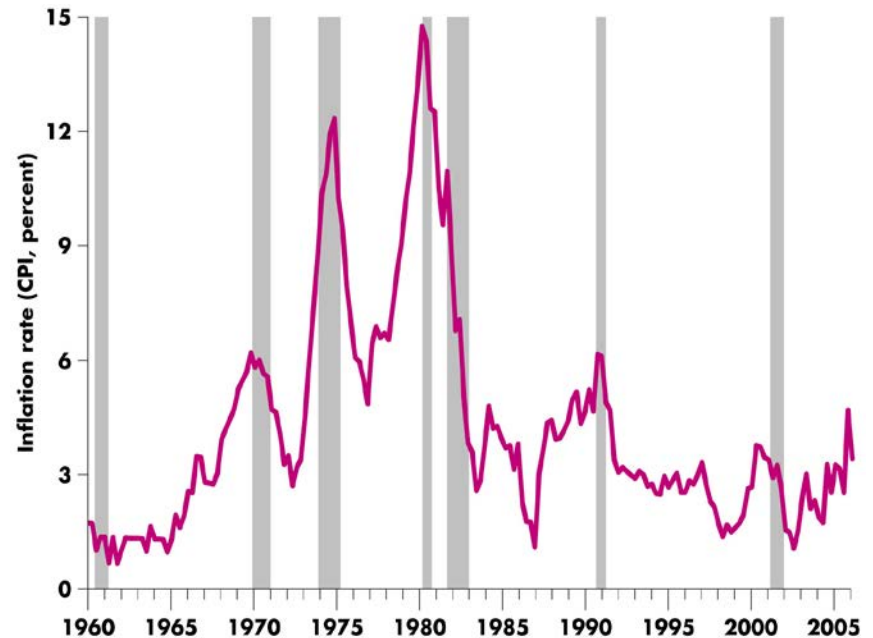
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Chapter 2

National Income Accounting

Introduction

- Why do we study the national income accounts?
    1. National income accounting provides structure for our macroeconomic theory models
    2. Introduces statistics that characterize the economy
- Output defined in two ways
    1. Production side: output = payments to workers in wages, capital in interest and dividends
    2. Demand side: output = purchases by different sectors of the economy
        $\rightarrow$ as per accounting, output measured via demand and production equal in equilibrium
- Output typically measured as GDP = value of all final goods and services produced within a country over a particular period of time.

Production Side of the Economy

- The production side of the economy transforms inputs (labor, capital) into output (GDP)
  - Inputs referred to as factors of production
  - Payments to these factors are referred to as factor payments
- The relationship between inputs and outputs is defined by the production function → $Y = f(N, K)$ (1)

  where Y = output, N = labor, K = capital
  - "Output is a function of labor and capital," where the functional form can be defined in various ways
  - The production function is crucial to the discussion of growth theory in chapters 3 and 4

From GDP to National Income

- Use the terms output and income interchangeably in macroeconomics, but are they really equivalent?
  - There are a few crucial distinctions between them:
    1. Capital wears down over time while it is being used in the production process $\rightarrow$ Net domestic product = GDP – depreciation
       - NDP is the total value of production minus the value of the amount of capital used up in producing that output
       - NDP is usually 89% of GDP
    2. Businesses pay indirect taxes (i.e. taxes on sales, property, and production) that must be subtracted from NDP before making factor payments $\rightarrow$ National Income = NDP – indirect business taxes
       - Indirect business taxes account for nearly 10% of NDP
   - National income is roughly 80% of GDP

Components of Demand

- Total demand for domestic output is made up of four components:

  1. Consumption spending by households (C)
  2. Investment spending by firms (I)
  3. Government spending (G)
  4. Foreign demand for our net exports (NX)

  → The fundamental national income accounting identity is

  $$Y = C + I + G + NX \quad (3)$$

Consumption

- Consumption = purchases of goods and services by the household sector
  - Includes spending on durable (ex. Cars), non-durable (ex. Food), and services (ex. Medical services)
  - Consumption is the primary component of demand
- Consumption as a share of GDP varies by country
  - Figure 2-2 compares consumption as a share of GDP for the U.S. to Japan
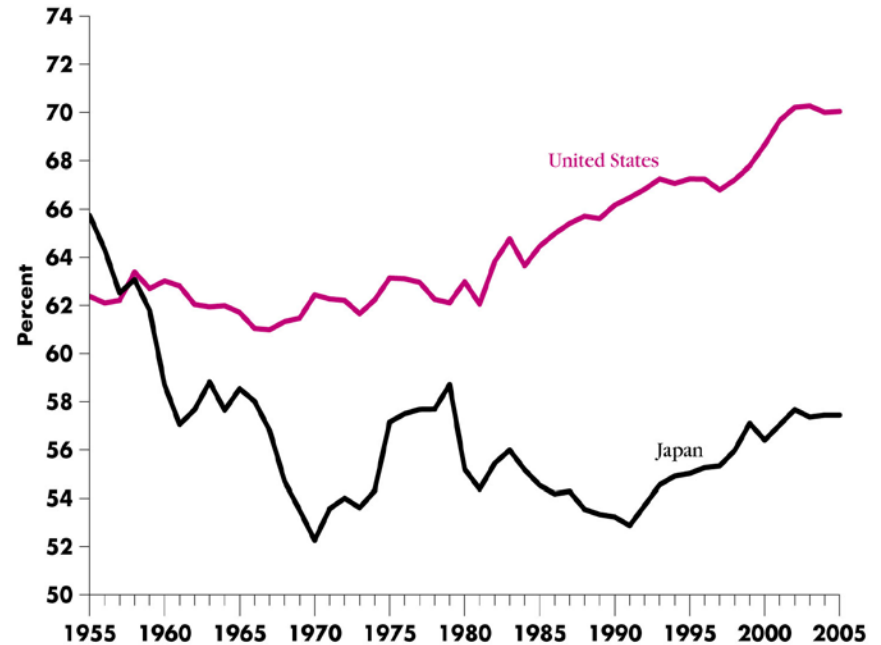
Government

- Government purchases of goods and services include items such as national defense expenditures, costs of road paving by state and local governments, and salaries of government employees

- Government also makes transfer payments = payments made to people without their providing a current service in exchange
  - Ex. Social security, unemployment benefits
  - Transfer payments are NOT included in GDP since not a part of current production
  - Government expenditure = transfers + purchases

Investment

- Investment = additions to the physical stock of capital (i.e. building machinery, construction of factories, additions to firms inventories)

- In the national income accounts, investment associated with *business sector's* adding to the physical stock of capital, including inventories

  - Household's building up of inventories is considered consumption, although new home constructions considered part of I, not C

- Gross investment included in GDP measure, which is net investment plus depreciation

Net Exports

- Accounts for domestic purchases of foreign goods (imports) and foreign purchases of domestic goods (exports) $\rightarrow$ NX = Exports – Imports
  - Subtract imports from GDP since accounting for total demand for domestic production
- NX can be $>$, $<$, or $= 0$
  - U.S. NX has been negative since the 1980's $\rightarrow$ trade deficit
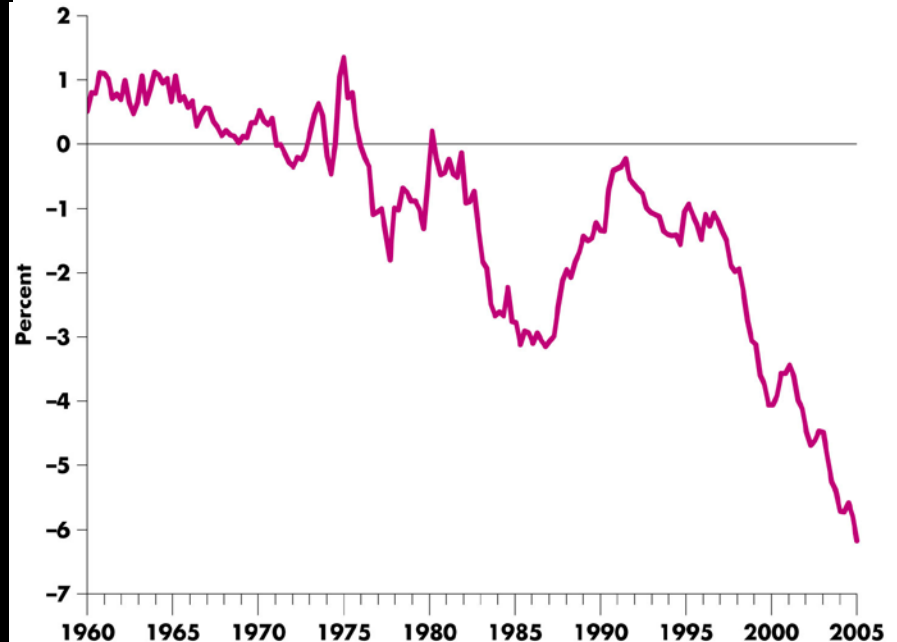
Some Identities: A Simple Economy

- Assume national income equals GDP, and thus use terms income and output interchangeably (convenience)

- Begin with a simple economy: closed economy with no public sector → output expressed as $Y \equiv C + I$ (4)

- Only two things can do with income: consume and save → national income expressed as $Y = C + S$ (5), where S is private savings

- Combine (4) and (5): $\underbrace{C + I}_{demand} \equiv Y \equiv \underbrace{C + S}_{income}$ (6)

- Rearrange (6) s.t. $I \equiv Y - C \equiv S$ (7), or investment = savings

Some Identities: Adding G and NX

- When add the government and the foreign sector, the fundamental identity becomes $Y \equiv C + I + G + NX$ (8)

- Disposable (after-tax) income, YD, is what consumers split between C and S when have a public sector, or

$YD = Y + TR - TA$ (9), where TR = transfer payments and TA = taxes $\rightarrow$ $YD \equiv C + S$ (10)

- If rearrange (9) and substitute (8) for Y, then

$YD - TR + TA \equiv C + I + G + NX$ (11)

- Substituting (10) into (11): $C + S - TR + TA \equiv C + I + G + NX$ (12)

- Rearranging: $S - I \equiv (G + TR - TA) + NX$ (13)

S, I, Government Budget, and Trade

- $S - I \equiv \underbrace{(G + TR - TA)}_{BudgetDeficit} + \underbrace{NX}_{TradeSurplus}$, where G + TR is total

  government expenditures and TA is government income
    $\rightarrow$ difference between expenditures and income is the
  government budget deficit

  - Excess of savings over investment (S > I) in the private sector
    is equal to the government budget deficit plus the trade surplus

  - Any sector that spends more than it receives in income has to
    borrow to pay for the excess spending

    - Private sector can dispose of savings in three ways:
      1. Make loans to the government
      2. Private sector can lend to foreigners
      3. Private sector can lend to firms who use the funds for I

Measuring Gross Domestic Product

- GDP = the value of <u>final</u> goods and services <u>currently</u> produced <u>within a country</u> over a period of time
  - Only count <u>final</u> goods and services → NO DOUBLE COUNTING
    - Ex. Would not include the full price of a car AND the tires bought by the manufacturer for the car → tires = *intermediate goods*
  - Only count goods and services <u>currently</u> (in the time period being considered) produced & excludes transactions involving used goods
    - Ex. Include the construction of new homes in current GDP, but not the sale of existing homes
  - Only count goods and services produced <u>within a country</u>, regardless of the ownership/nationality of the producing firm
    - Ex. Include the sale of a car produced by a Japanese car manufacturer located in the U.S. in U.S. GDP

Problems of GDP Measurement

- There are three major criticisms of the GDP measure:
  1. Omits non-market goods and services
     - Ex. Work of stay-at-home mothers and fathers not included in GDP
  2. No accounting for "bads" such as crime and pollution
     - Ex. Crime is a detriment to society, but there is no subtraction from GDP to account for it
  3. No correction for quality improvements
     - Ex. Technological improvements are beneficial to the economy, but nothing is added to GDP to account for them

→ Despite these drawbacks, GDP is still considered one of the best economic indicators for estimating growth in an economy

Nominal vs. Real GDP

- <u>NGDP</u> is the value of output in a given period measured in current dollars
  - NGDP in 2007 is the sum of the value of all outputs measured in 2007 dollars:
  $$NGDP_{2007} = \sum_{i=1}^{N} P_i^{2007} * Q_i^{2007}$$
  - Changes in NGDP could be purely due to changes in prices $\rightarrow$ if GDP is to be used as a measure of output, need to control for prices

- <u>RGDP</u> is the value of output in constant dollars $\rightarrow$ scaled by a based year price, so that any change in GDP is due to change in production, not prices
  - If P^B is the price in the base year for good i, RGDP in 2007 is:
  $$RGDP_{2007} = \sum_{i=1}^{N} P_i^{B} * Q_i^{2007}$$

Inflation and Prices

- Inflation, Π, is the rate of change of prices: $$\Pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

  where P_t is today's price and P_{t-1} is last period's price
- Additionally, $P_t = P_{t-1} + (P_{t-1} * \Pi)$, or today's price equals last year's price, adjusted for inflation
- If $\Pi > 0$, prices are increasing over time $\rightarrow$ inflation
- If $\Pi < 0$, prices are decreasing over time $\rightarrow$ deflation
- How do we measure prices?
  - For the macroeconomy, need a measure of overall prices = price index
  - There are several price indexes, but most common are CPI, PPI, and the GDP deflator

Price Indexes: GDP Deflator

- GDP deflator is the ratio of NGDP in a given year to RGDP of that year

  - Since GDP deflator is based on a calculation involving all goods produced in the economy, it is a widely based price index that is frequently used to measure inflation

  - Measures the change in prices between the base year and the current year

- Ex. If NGDP in 2006 is $6.25 and RGDP in 2006 is $3.50, then the GDP deflator for 2006 is $6.25/$3.50 = 1.79 $\rightarrow$ prices have increased by 79% since the base year

Price Indexes: CPI

- CPI measures the cost of buying a fixed basket of goods and services representative of the purchases of urban consumers

  - Measure of the cost of living for the average household

- Differs from GDP deflator in three ways:

  1. CPI measures prices of a more limited basket of goods and services (only household goods and services)
  2. The bundle of goods in the consumer basket is fixed, while that of the deflation is allowed to vary
  3. CPI includes prices of imports, while GDP deflator only considers those goods produced within the U.S.

Price Indexes: PPI

- PPI measures the cost of buying a fixed basket of goods and services representative of a firm
  - Captures the cost of production for a typical firm
  - Market basket includes raw materials and semi-finished goods
- PPI is constructed from prices at an earlier stage of the distribution process than the CPI
- PPI signals changes to come in the CPI and is thus closely watched by policymakers
  - $\rightarrow$ Over long periods of time, the two measures yield similar values and trends for inflation

Unemployment

- The unemployment rate measures the fraction of the workforce that is out of work and looking for a job or expecting a recall from a layoff
  - Important indicator of well-being of an economy as being without a job suggests a reduction in income and purchases
  - Optimal unemployment rates differ from country to country → optimal unemployment rate linked to the potential level of output for a given economy (see figure 2-8)
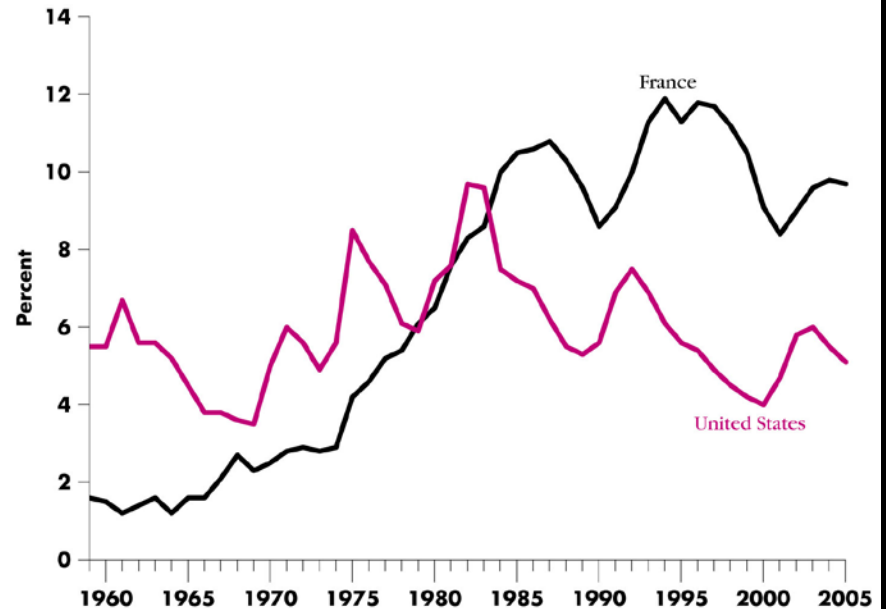
Interest Rates and Real Interest Rates

- Interest rate = rate of payment on a loan or other investment over and above the principle repayment in terms of an annual percentage

  - Cost of borrowing money OR benefit of lending money

- Nominal interest rate = return on an investment in current dollars

- Real interest rate = return on an investment, adjusted for inflation

- If R is the nominal rate, and r is the real rate, then we can define the nominal rate as: $R = r + \Pi$

Exchange Rate

- Each country has its own currency in which prices are quoted
  - In the U.S. prices are quoted in U.S. dollars, while in Canada prices are quoted in Canadian dollars and most of Europe uses the euro
- Exchange rate = the price of a foreign currency
  - Ex. The British pound is worth U.S. $1.84
- Floating exchange rate → price of a currency is determined by supply and demand
- Fixed exchange rate → price of a currency is fixed
  - Ex. A Bermuda dollar is always worth one U.S. dollar

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Chapter 3

Growth and Accumulation

Introduction

- Per capita GDP = income per person has been increasing over time in industrialized nations, yet remains stagnant in many developing nations (Ex. U.S. vs. Ghana)

- <u>Growth accounting</u> explains what part of growth in total output is due to growth in different factors of production

- <u>Growth theory</u> helps us understand how economic decisions determine the accumulation of factors of production

  - Ex. How does the rate of saving today affect the stock of capital in the future?
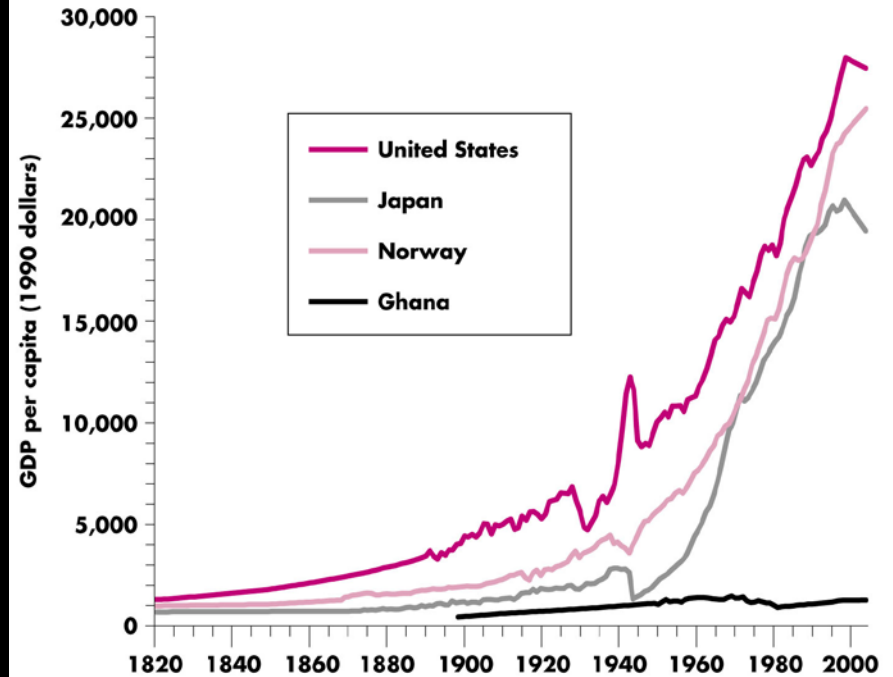
The Production Function

- The production function defines the relationship between inputs

- Can use the production function to study two sources of output growth:
    1. Increases in inputs (N, K)
    2. Increases in productivity (technology)

- If N and K are the only inputs, the production function is $Y = AF(K, N)$ (1), where output depends upon inputs and technology (A)

  - An increase in A = increase in productivity $\rightarrow$ output increases for given level of inputs N and K

  - Assume MPN and MPK > 0, so that an increase in inputs $\rightarrow$ increase in output

Growth Accounting Equation

- Equation (1) relates the level of output to the level of inputs and technology
- Transform the production function into growth rate form to show the relationship between input growth and output growth
  - The growth accounting equation is:

$$\frac{\Delta Y}{Y} = \underbrace{(1-\Theta)\times\frac{\Delta N}{N}}_{Nshare \times Ngrowth} + \underbrace{\Theta\times\frac{\Delta K}{K}}_{Kshare \times Kgrowth} + \underbrace{\frac{\Delta A}{A}}_{tech.progress} \quad (2)$$

  - Growth rates of K and N are weighted by their respective income shares, so that each input contributes an amount equal to the product of the input's growth rate and their share of income to output growth

Growth Accounting: Examples

- If $\Theta = 0.25, (1 - \Theta) = 0.75$, the growth rates of N and K are 1.2% and 3% respectively, and the rate of technological progress is 1.5%, then output growth is:

$$\frac{\Delta Y}{Y} = (0.75 \times 1.2\%) + (0.25 \times 3\%) + 1.5\% = 3.15\%$$

- Since labor share is greater than capital share, a 1% point increase in labor increases output by more than a 1% point increase in capital

- Suppose the growth rate of capital doubles from 3% to 6%. What is the growth rate of output?

$$\frac{\Delta Y}{Y} = (0.75 \times 1.2\%) \times (0.25 \times 6\%) + 1.5\% = 3.9\%$$

→ Output increases by less than a percentage point after a 3% point increase in the growth rate of capital

- If the growth rate of labor doubled to 2.4% instead, output growth would increase from 3.15% to 4.05%

Growth In Per Capita Output

- Important to consider per capita output/income since total values might be misleading if population is large (total output can be large even though per capita output/income is low)

  - Income for an average person is estimated by GDP per capita, $\frac{Y}{N} \rightarrow$ used as an estimate for individual standard of living

- Traditional to use lower case letters for per capita values $\rightarrow$ $y \equiv \frac{Y}{N}, k \equiv \frac{K}{N}$, where k is the capital-labor ratio

- Additionally, $\frac{\Delta Y}{Y} = \frac{\Delta y}{y} + \frac{\Delta N}{N}, \frac{\Delta K}{K} = \frac{\Delta k}{k} + \frac{\Delta N}{N}$

Growth Accounting Equation In Per Capita Terms

- To translate the growth accounting equation into per capita terms, subtract the population growth rate from both sides of equation (2) and rearrange terms:

$$\frac{\Delta Y}{Y} - \frac{\Delta N}{N} = (1 - \Theta)\frac{\Delta N}{N} - \frac{\Delta N}{N} + \Theta\frac{\Delta K}{K} + \frac{\Delta A}{A}$$

$$= \frac{\Delta N}{N} - \Theta\frac{\Delta N}{N} - \frac{\Delta N}{N} + \Theta\frac{\Delta K}{K} + \frac{\Delta A}{A}$$

$$= -\Theta\frac{\Delta N}{N} + \Theta\frac{\Delta K}{K} + \frac{\Delta A}{A}$$

$$= \Theta\left(\frac{\Delta K}{K} - \frac{\Delta N}{N}\right) + \frac{\Delta A}{A} \qquad (3)$$

- If $\dfrac{\Delta y}{y} = \dfrac{\Delta Y}{Y} - \dfrac{\Delta N}{N}, \dfrac{\Delta k}{k} = \dfrac{\Delta K}{K} - \dfrac{\Delta N}{N}$, then the growth accounting equation

becomes $\dfrac{\Delta y}{y} = \Theta\dfrac{\Delta k}{k} + \dfrac{\Delta A}{A}$ (4)

Factors Other Than N and K: Human Capital

- The production function, and thus equations (2) and (4), omit a long list of inputs other than N and K
  - While N and K are the most important factors of production, others matter
- Investment in human capital (H) through schooling and on-the-job training is an important determinant of output in many economies
  - With the addition of H, the production function becomes
    $$Y = AF(K, H, N) \text{ (5)}$$
  - Mankiw, Romer, and Weil (1992) suggest that H contributes equally to Y as K and N $\rightarrow$ factor shares all equal to 1/3

Factors Other Than N and K: Human Capital

- Figure 3-2 (a) illustrates a positive relationship between the rate of investment and per capita output and income across many selected nations

- Figure 3-2 (b) illustrates a similar relationship between human capital, using years of schooling as a proxy for H, and per capita output and income across many selected nations
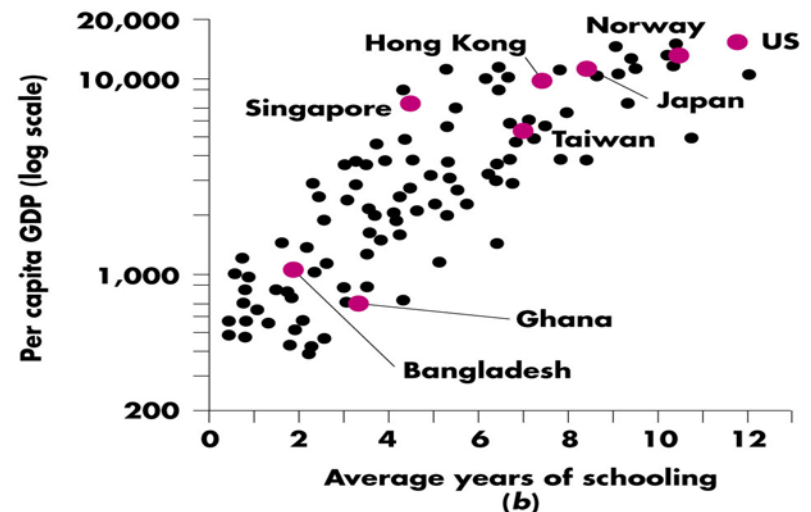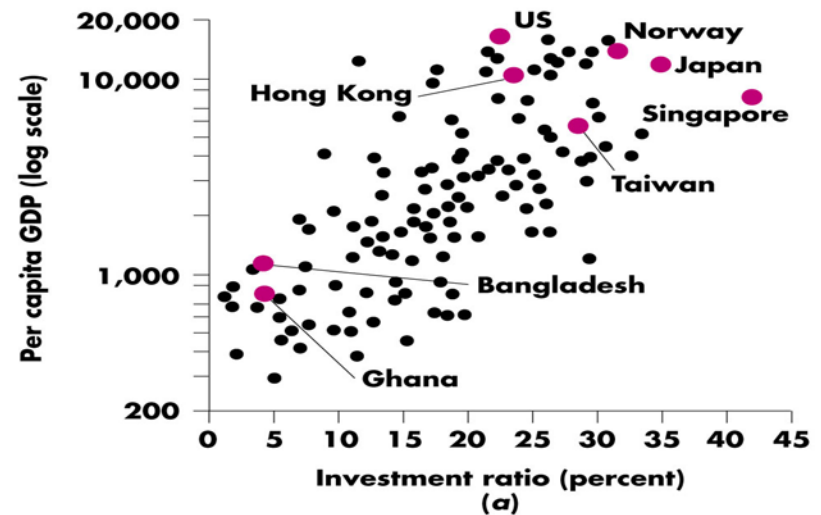
Growth Theory: The Neoclassical Model

- Neoclassical growth theory focuses on K accumulation and its link to savings decisions (Robert Solow)

- Begin with a simplifying assumption: no technological progress $\rightarrow$ economy reaches a long run level of output and capital = steady state equilibrium

  - *The steady state equilibrium for the economy is the combination of per capita GDP and per capita capital where the economy will remain at rest, or where per capita economic variables are no longer changing* OR

    $$\Delta y = 0, \Delta k = 0$$

- Present growth theory in three broad steps:

  1. Examine the economic variables that determine the economy's steady state
  2. Study the transition from the economy's current position to the steady state
  3. Add technological progress to the model

Determinants of the Economy's Steady State

- The production function in per capita form is y = f(k) (6) and is depicted in Figure 3-3
  - As capital increases, output increases, but at a decreasing rate $\rightarrow$ diminishing MPK
- An economy is in a steady state when per capita income and capital are constant
  - Arrive at steady state when investment required to provide new capital for new workers and to replace worn out machines = savings generated by the economy


Capital-labor ratio
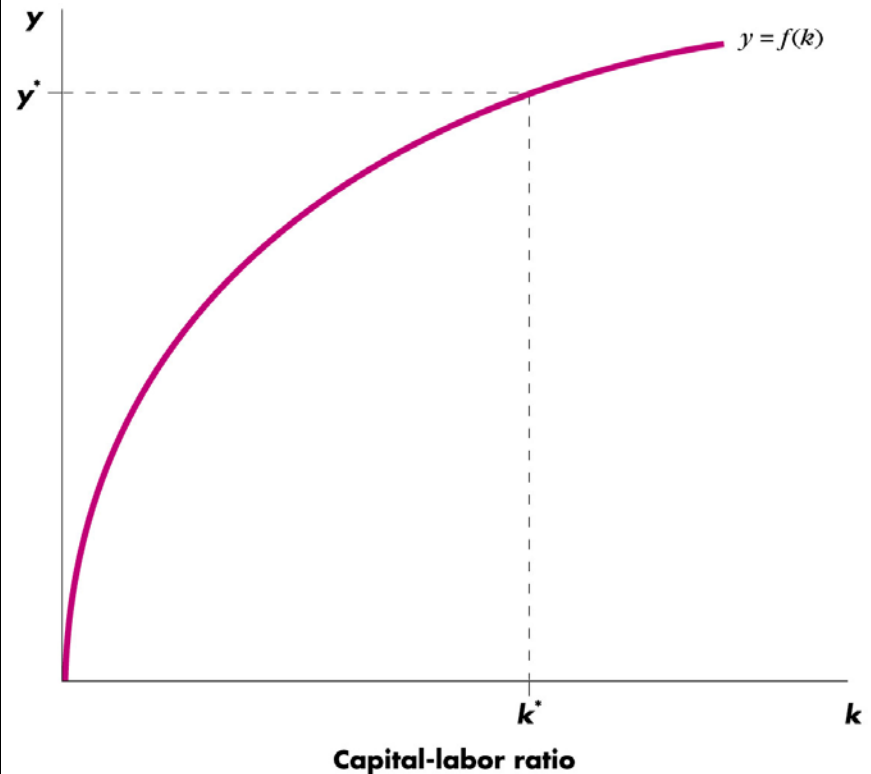
Savings and Investment

- The investment required to maintain a given level of k depends on the population growth rate and the depreciation rate (n and d respectively)
    - Assume population grows at a constant rate, $n = \dfrac{\Delta N}{N}$, so the economy needs nk of investment for new workers
    - Assume depreciation is a constant, d, of the capital stock, adding dk of needed investment
    - → The total required investment to maintain a constant level of k is (n+d)k
- If savings is a constant function of income, s, then per capital savings is sy
   - If income equals production, then sy = sf(k)

Solution for the Steady State

- Δk is the excess of saving over required I: $\Delta k = sy - (n+d)k$ (7)

- $\Delta k = 0$ in the steady state and occurs at values of y* and k*, satisfying $sy* = sf(k*) = (n+d)k*$ (8)

- In Figure 3-4, savings and required investment are equal at point C with a steady state level of capital k*, and steady state level of income y* at point D
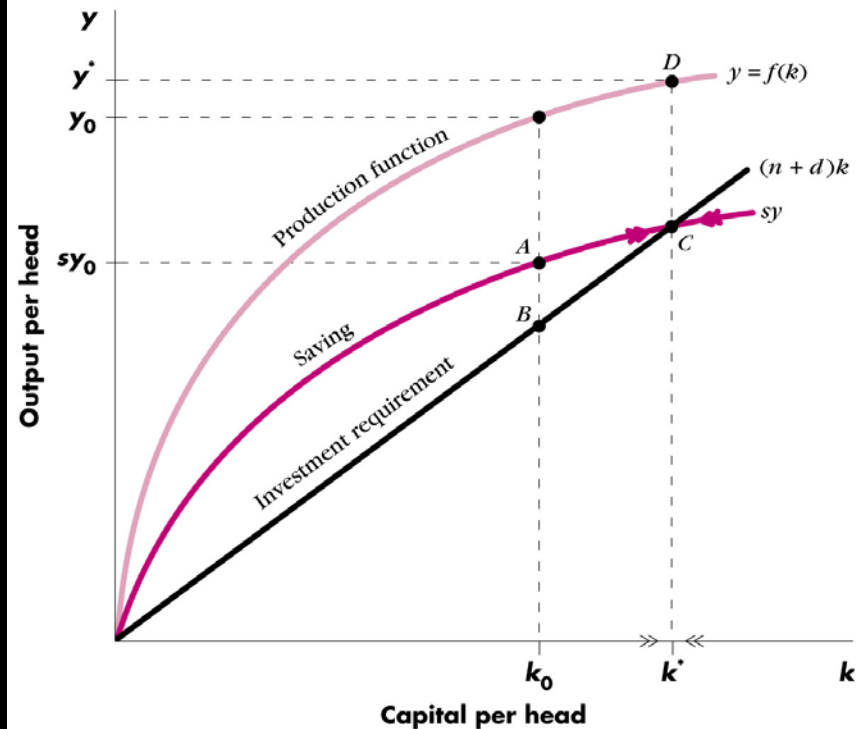
The Growth Process

- The critical elements in the transition from the initial k to k* are the rate of savings and investment compared to the rate of population and depreciation growth

- Suppose start at k_0: $sy > (n+d)k$ Savings exceeds the investment required to maintain a constant level of k

  - $\rightarrow$ k increases until reach k* where savings equals required investment
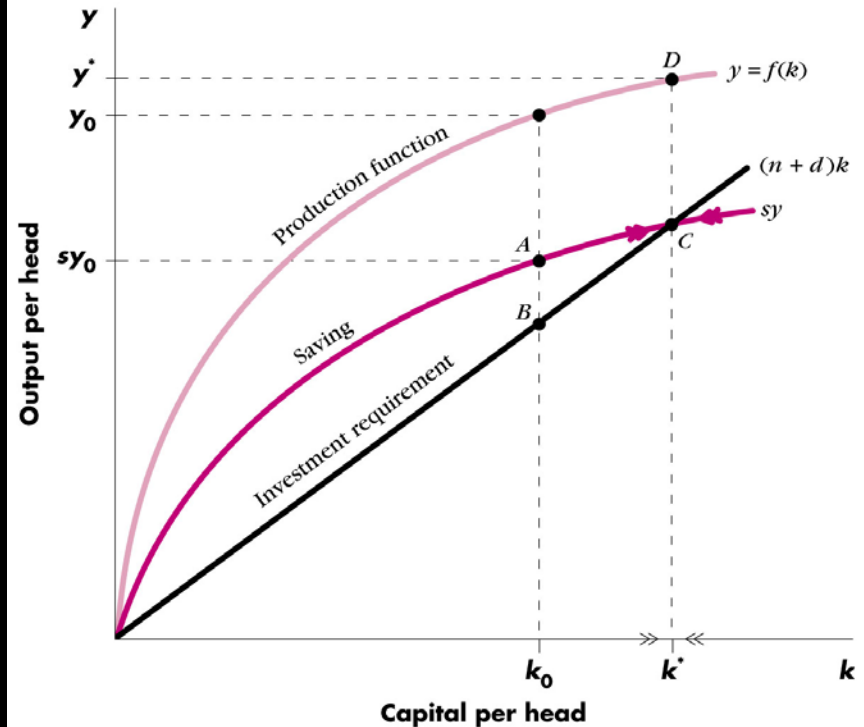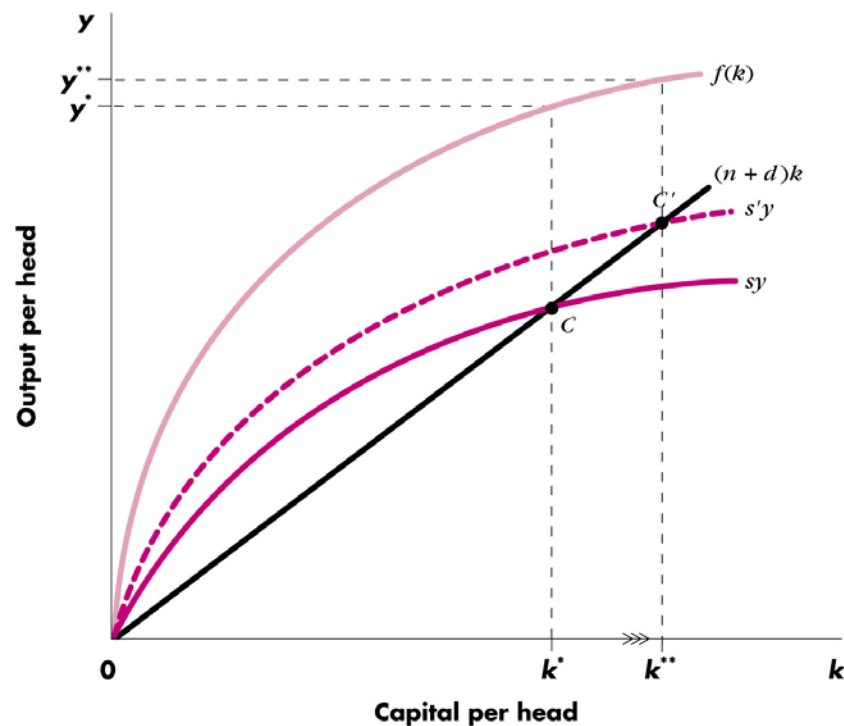
The Growth Process

Conclusions:

1. Countries with equal savings rates, rates of population growth, and technology should converge to equal incomes, although the convergence process may be slow

2. At the steady state, k and y are constant, so aggregate income grows at the same rate as the rate of population growth, n

→ Steady state growth rate is not affected by s
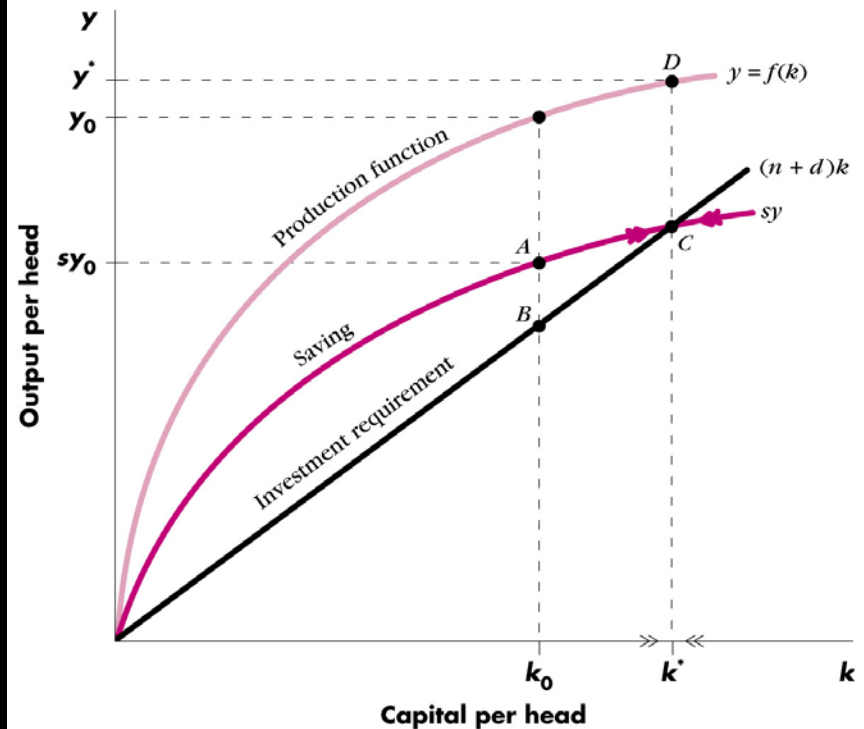
An Increase in the Savings Rate

- According to neoclassical growth theory, savings does not affect the growth rate in the long run $\rightarrow$ WHY?

- Suppose savings rate increases from s to s':
  - When s increases, $sy > (n+d)k$ at k*, thus k increases to k** (and y to y**) at point C'
  - At point C', the economy returns to a steady state with a growth rate of n
  - $\rightarrow$ Increase in s will increase levels of y* and k*, but not the growth rate of y

The Transition Process: s to s′

- In the transition process, the higher savings rate increases the growth rate of output and the growth rate of per capita output
  - Follows from fact that k increases from k* to k** → only way to achieve an increase in k is for k to grow faster than the labor force and depreciation
- Figure 3-6 (a) shows the transition from y* to y** between t_0 and t_1
  - After the savings rate increases, so does savings and investment, resulting in an increase in k and y
  - Y continues to increase at a decreasing rate until reach new steady state at y**
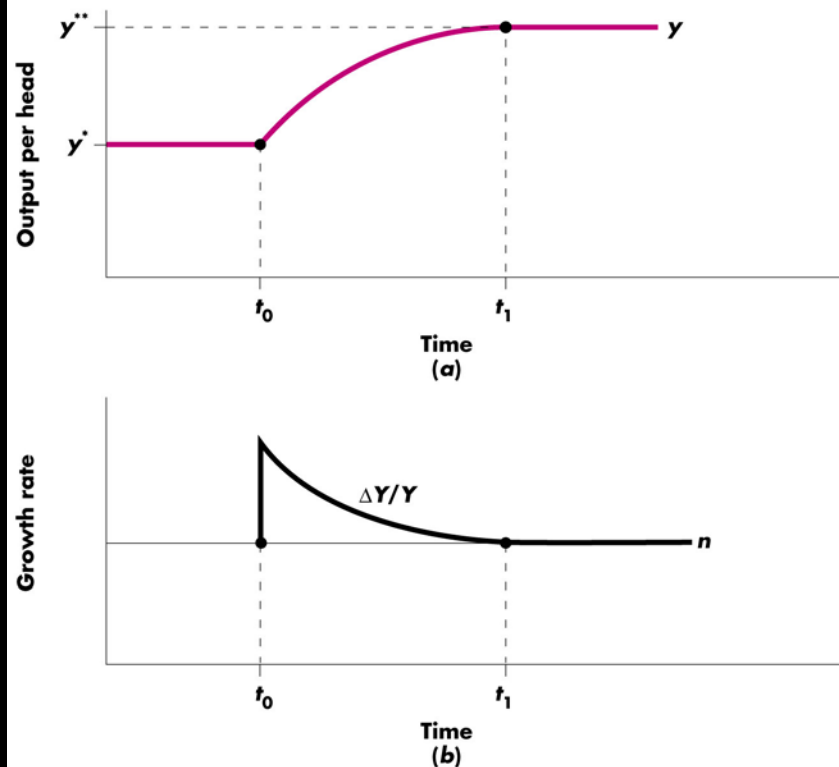
The Transition Process: s to s′

- During the transition process, the higher savings rate increases the growth rate of output and the growth rate of per capita output
  - Follows from fact that k increases from k* to k** → only way to achieve an increase in k is for k to grow faster than the labor force and depreciation
- Figure 3-6 (b) illustrates the growth rate of Y between t_0 and t_1
  - The increase in s increases the growth rate of Y due to the faster growth in capital, $\frac{\Delta Y}{Y} > n$
 - As capital accumulates, the growth rate returns to n
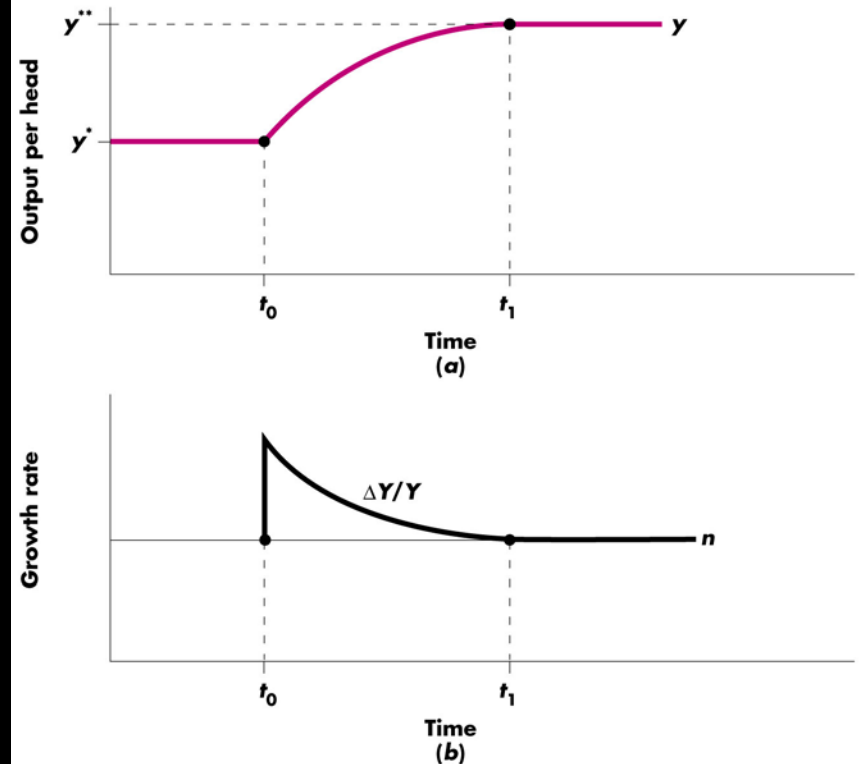
Population Growth

- An increase in the population growth rate is illustrated by an increase in (n+d)k $\rightarrow$ rotate line up and to the left
  - An increase in n reduces the steady state level of k and y
  - An increase in n increases the steady state rate of growth of aggregate output
- $\rightarrow$ The decline in per capita output as a consequence of increased population growth is a phenomenon observed in many developing countries (discussed in Chapter 4)
- Conversely, a decrease in the population growth rate is illustrated by a decrease in (n+d)k $\rightarrow$ rotate line down and to the right
  - A decrease in n increases the steady state level of k and y
  - A decrease in n decreases the steady state rate of growth of aggregate output

Growth with Exogenous Technological Change

- Thus far have assumed technology is constant, or $\frac{\Delta A}{A} = 0$, for simplicity, but need to incorporate to explain long term growth theory

- If rate of growth is defined as $g = \frac{\Delta A}{A}$, the production function, y = Af(k), increases at g percent per year (Fig. 3-7)

- Savings function grows in a parallel fashion, and y* and k* increase over time
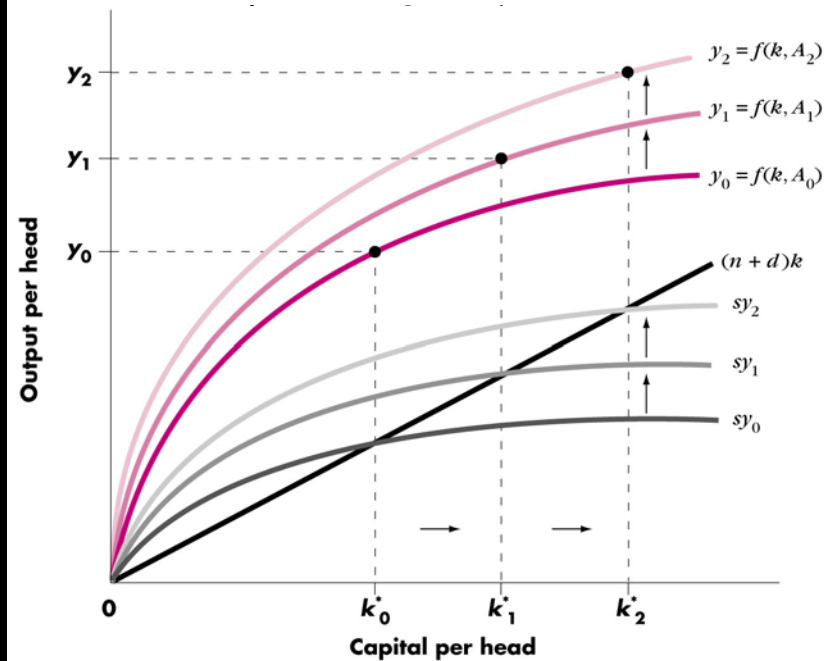
How Is A Incorporated?

- The technology parameter can enter the production function in several ways:

  1. Technology can be labor augmenting, or new technology increases the productivity of labor $\rightarrow$ $Y = F(K, AN)$

     - Equation (4) becomes $\dfrac{\Delta y}{y} = \Theta \dfrac{\Delta k}{k} + (1 - \Theta)\dfrac{\Delta A}{A}$ and y* and k* both

       increase at the rate of technological progress, g

  2. Technology can augment all factors, or represent total factor productivity $\rightarrow$ Y = AF(K,N)

     - Equation (4) is $\dfrac{\Delta y}{y} = \Theta \dfrac{\Delta k}{k}$ and $g = \dfrac{\Delta y}{y} - \Theta \dfrac{\Delta k}{k}$

RUDIGER DORNBUSCH

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Chapter 4

Growth and Policy

Introduction

- Chapter 3 explained how GDP and GDP growth are determined by the savings rate, rate of population growth, and the rate of technological progress

- The question analyzed in this chapter is "How do society's choices affect these parameters?"

  - In many developed countries, invention and advances in technology are the key determinants of growth

  - Technological advances are much less important for poor countries $\rightarrow$ more important to invest in human and physical capital and borrow technological advances from others

- <u>Endogenous growth theory</u> (Romer, Lucas) explains how society's choices lead to technological progress and growth

Trouble With Neoclassical Growth Theory

- By the late 1980's there was great dissatisfaction with neoclassical growth theory since:
  1. It does not explain the economic determinants of technological progress
  2. It predicts that economic growth and savings rates are uncorrelated in the steady state
- <u>Endogenous growth theory</u> emphasizes different growth opportunities in physical and knowledge capital
  - Diminishing marginal returns to physical capital, but perhaps not knowledge capital
  - The idea that increased investment in human capital increases growth is key to linking higher savings rates to higher equilibrium growth rates

Mechanics of Endogenous Growth

- Need to modify the production function to allow for self-sustaining, endogenous growth

- Figure 4-1 (a) shows the Solow growth diagram, with the steady state at point C where savings equals required investment

  - If savings above required investment, economy is growing as more capital is added → process continues until savings equals required investment (reach the steady state)
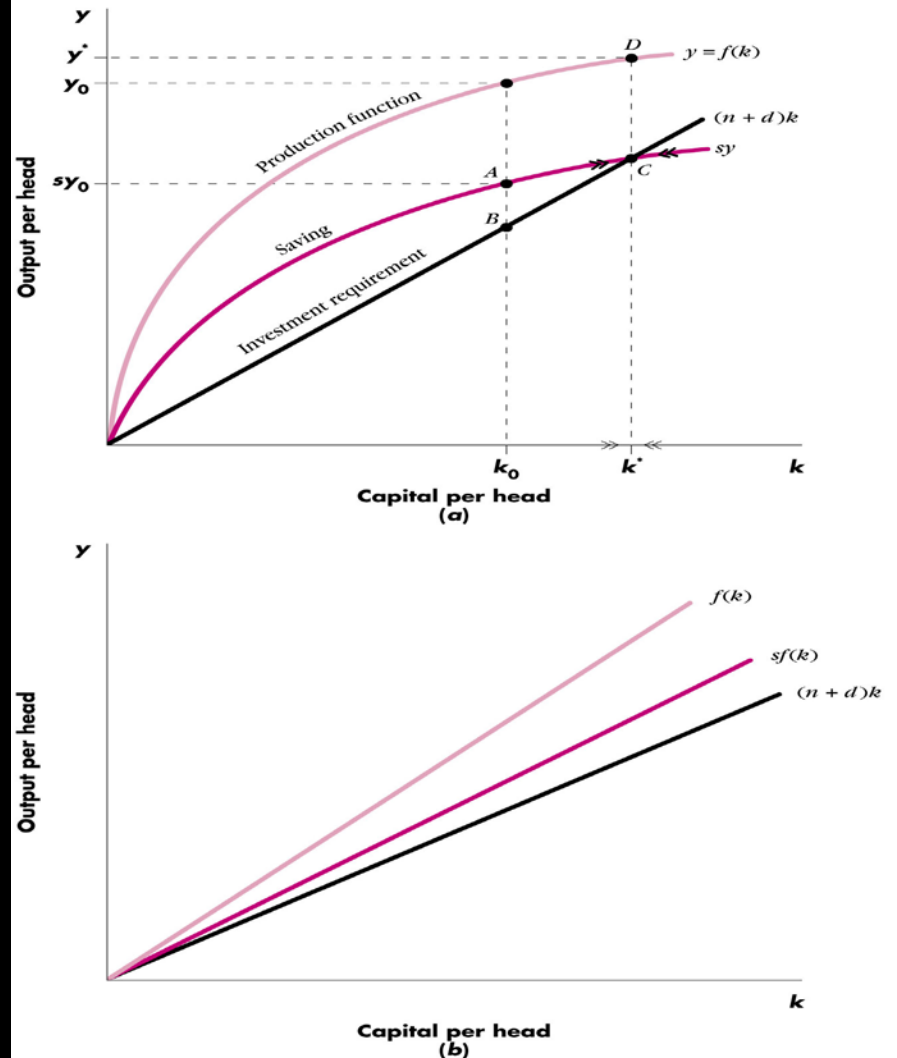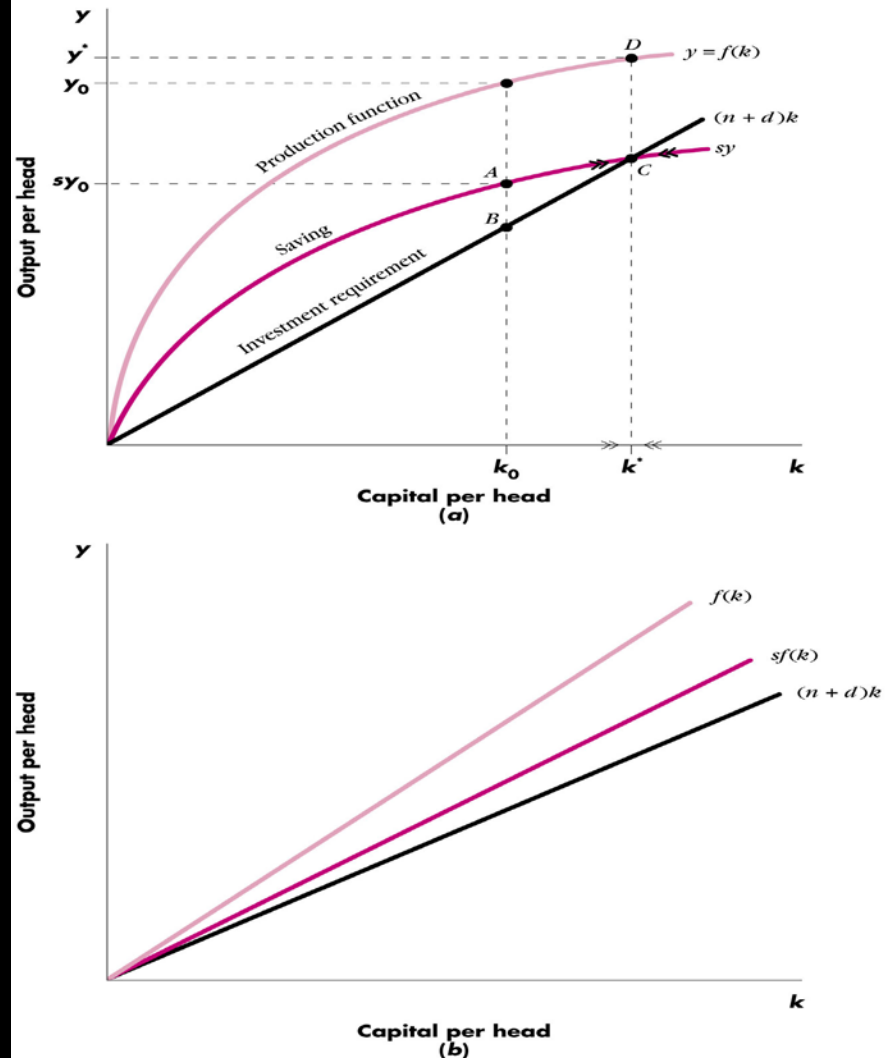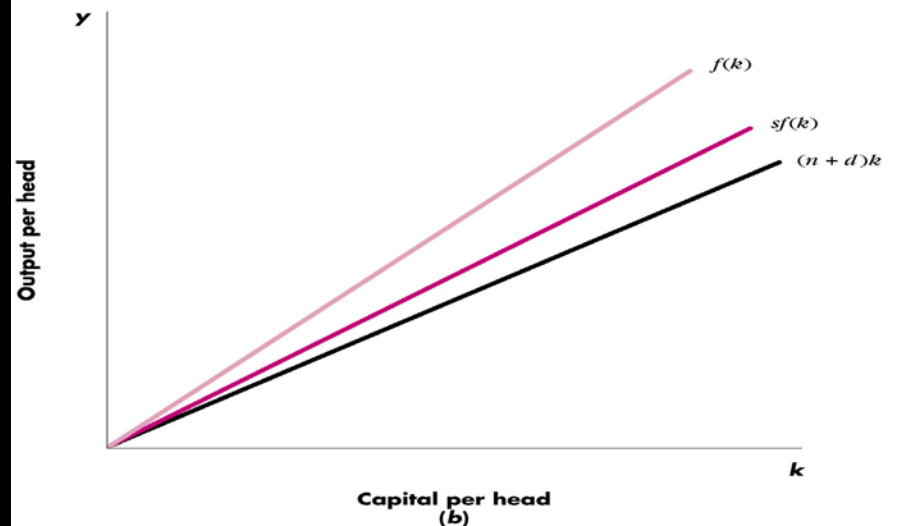
Mechanics of Endogenous Growth

- Need to modify the production function to allow for self-sustaining, endogenous growth

- Figure 4-1 (a) shows the Solow growth diagram, with the steady state at point C where savings equals required investment

  - Due to the diminishing MPK, the production function and savings function flatten out and cross the upward sloping required investment line once

Mechanics of Endogenous Growth

- Need to modify the production function to allow for self-sustaining, endogenous growth

- Economy illustrated in Figure 4-1 (b) is described by a production function with a constant MPK: $Y = aK$ (1)

  - K is the only factor, a is the MPK

  - Production function and savings curve become straight lines, and are always greater than required investment $\rightarrow$ the higher the savings rate, the bigger the gap between savings and required investment = faster the growth
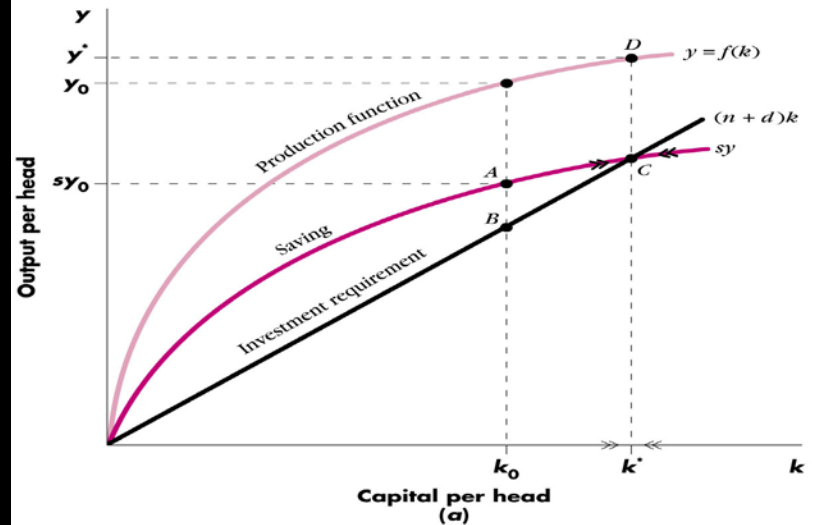
Mechanics of Endogenous Growth

- If the savings rate, s, is constant and there is neither population growth nor depreciation of capital, then the change in the capital stock is defined as:

$$\Delta K = sY = saK$$

$$OR$$

$$\frac{\Delta K}{K} = sa \qquad (2)$$

  → Growth rate of capital is proportional to the savings rate

- Output is proportional to capital, thus the growth rate of output is $\frac{\Delta Y}{Y} = sa$ (3)

  → The higher s, the higher the growth rate of output

Deeper Economics of Endogenous Growth

- Eliminating diminishing marginal returns to capital runs against prevailing microeconomic principles
  - If there are constant returns to capital alone, there will be increasing returns to scale to all factors taken together $\rightarrow$ larger and larger firms become increasingly efficient, and should see a single firm dominate the entire economy
    - Not realistic, so need to eliminate the possibility of increasing returns to scale to all factors, and constant returns to a single factor
- Alternatively, a single firm may not capture all benefits of capital $\rightarrow$ some <u>external</u> to the firm (Romer)
  - When a firm increases K, firm's production increases, but so does the productivity of other firms
  - As long as <u>private</u> return has constant returns to all factors, there will be no tendency towards monopolization

Private vs. Social Returns to Capital

- Investment produces not only new machines, but also new ways of doing things
  - Firms DO capture the production benefits of a new machine (<u>PRIVATE RETURNS</u>)
  - Firms may NOT capture the benefits of new technologies and ideas, since they are easy to copy (<u>SOCIAL RETURNS</u>)
- Endogenous growth theory hinges on the notion that there are substantial external returns to capital
  - Not realistic for physical capital, but quite for human capital:
    1. Contribution of new knowledge only partially captured by creator
    2. From one new idea springs another → knowledge can grow indefinitely

N and the Endogenous Growth Model

Assume:

1. Technology is proportional to the level of capital per worker, or

$$A = \alpha \frac{K}{N} = \alpha \, k$$

2. Technology is labor augmenting, $Y = F(K, AN)$

3. Technology growth depends on capital growth, or $\dfrac{\Delta A}{A} = \dfrac{\Delta K}{K} - \dfrac{\Delta N}{N}$

Deriving the growth equations requires some algebra . . .

- The GDP growth equation from Chapter 3 was

$$\frac{\Delta y}{y} = \Theta \frac{\Delta k}{k} + (1 - \Theta) \frac{\Delta A}{A}$$

- If $\dfrac{\Delta A}{A} = \dfrac{\Delta K}{K} - \dfrac{\Delta N}{N} = \dfrac{\Delta k}{k}$, then

$$\frac{\Delta y}{y} = \Theta \frac{\Delta k}{k} + (1 - \Theta) \frac{\Delta A}{A}$$

$$= \Theta \frac{\Delta k}{k} + (1 - \Theta) \frac{\Delta k}{k}$$

$$= \frac{\Delta k}{k}$$

Output and capital grow at the same rate.

N and the Endogenous Growth Model

Assume:

1. Technology is proportional to the level of capital per worker, or

$$A = \alpha \frac{K}{N} = \alpha\, k$$

2. Technology is labor augmenting, $Y = F(K, AN)$

3. Technology growth depends on capital growth, or $\dfrac{\Delta A}{A} = \dfrac{\Delta K}{K} - \dfrac{\Delta N}{N}$

Deriving the growth equations requires some algebra . . .

- Since the numerator and denominator of y/k grow at equal rates, y/k is constant
  - What is that constant? Find by dividing the production function by K and simplifying:

$$\frac{y}{k} = \frac{F(K, AN)}{K}$$

$$= F\left(\frac{K}{K}, A\frac{N}{K}\right)$$

$$= F\left(\frac{K}{K}, \alpha\frac{K}{N} \times \frac{N}{K}\right)$$

$$= F(1, \alpha) \equiv a$$

N and the Endogenous Growth Model

Assume:

1. Technology is proportional to the level of capital per worker, or
$$A = \alpha \frac{K}{N} = \alpha k$$

2. Technology is labor augmenting, $Y = F(K, AN)$

3. Technology growth depends on capital growth, or $\frac{\Delta A}{A} = \frac{\Delta K}{K} - \frac{\Delta N}{N}$

Deriving the growth equations requires some algebra . . .

- The equation for capital accumulation can be written as:
$$\frac{\Delta k}{k} = s\frac{y}{k} - (n+d)$$

- Making the substitution for y/k, the growth rate of y and k becomes:

$$\frac{\Delta y}{y} = \frac{\Delta k}{k} = g = s\frac{y}{k} - (n+d)$$

$$= sa - (n+d)$$

High rates of population growth and depreciation lead to a low growth rate.

Convergence

- Do economies with different initial levels of output eventually grow to equal standards of living or *converge*?
  - Neoclassical growth theory predicts *absolute convergence* for economies with equal rates of saving and population growth and with access to the same technology → should all reach the same steady state level of income
  - *Conditional convergence* is predicted for economies with different rates of savings and/or population growth → steady state level of income will differ, but the growth rates will eventually converge
- Endogenous growth theory predicts that a high savings rate leads to a high growth rate

Convergence

- Do economies with different initial levels of output eventually grow to equal standards of living or *converge*?
  - Robert Barro tested these competing theories, and found that:
    1. Countries with higher levels of investment tend to grow faster
    2. The impact of higher investment on growth is however transitory

    → Countries with higher investment will end in a steady state with higher per capita income, but not with a higher growth rate
    → Countries do appear to converge conditionally, and thus endogenous growth theory is not very useful for explaining international differences in growth rates

Growth Traps and Two Sector Models

- How do we explain a world with <u>BOTH</u> no growth <u>AND</u> high growth countries?

  - Ghana is an example of an economy that has experienced no growth since 1900

  - China is an example of an economy that has experienced rapid growth in recent years

- Need a model in which there is a possibility of both a no growth, low income equilibrium <u>AND</u> a high growth, high income equilibrium

  - → elements of both neoclassical and endogenous growth theories

Growth Traps and Two-Sector Models

- Suppose there are two types of investment opportunities:
    1. Those with diminishing MPK at low income levels
    2. Those with with constant MPK at high income levels
- Figure 4-2 illustrates such a situation
    - The production function has a curved segment at low levels of income and an upward sloping line at high levels
    - Point A is a neoclassical steady state equilibrium, while past point B there is ongoing growth (endogenous growth theory)
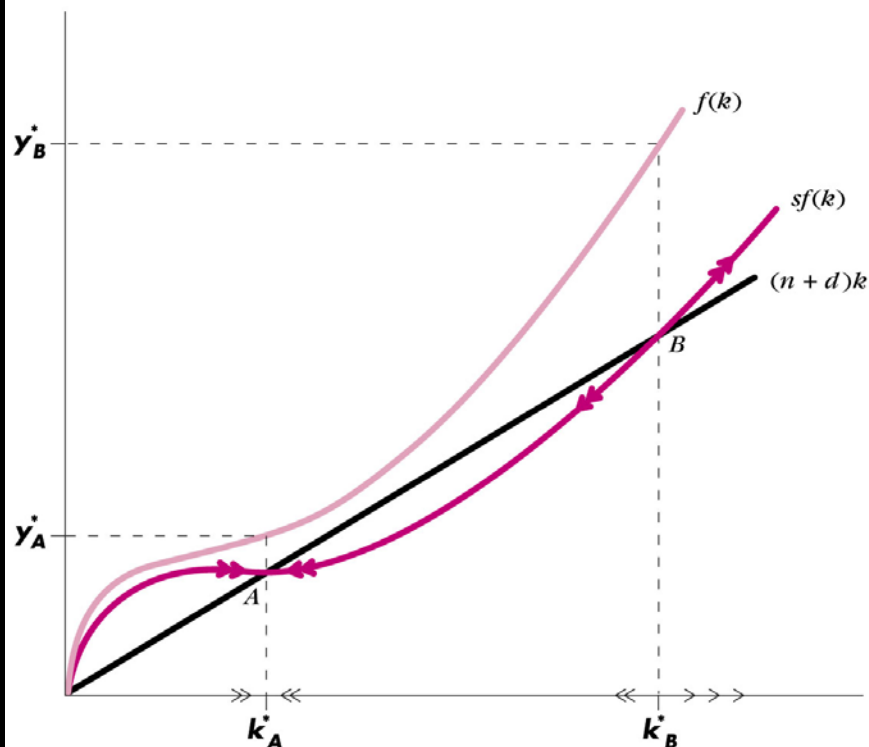
Growth Traps and Two-Sector Models

- Suppose there are two types of investment opportunities:
  1. Those with diminishing MPK at low income levels
  2. Those with with constant MPK at high income levels
- With two outlets for investment, society must choose not only total investment, but also the division between the two
  - Societies that direct I towards research and development will have ongoing growth
  - Societies that direct I toward physical capital may have higher output in the short run at the expense of lower long run growth
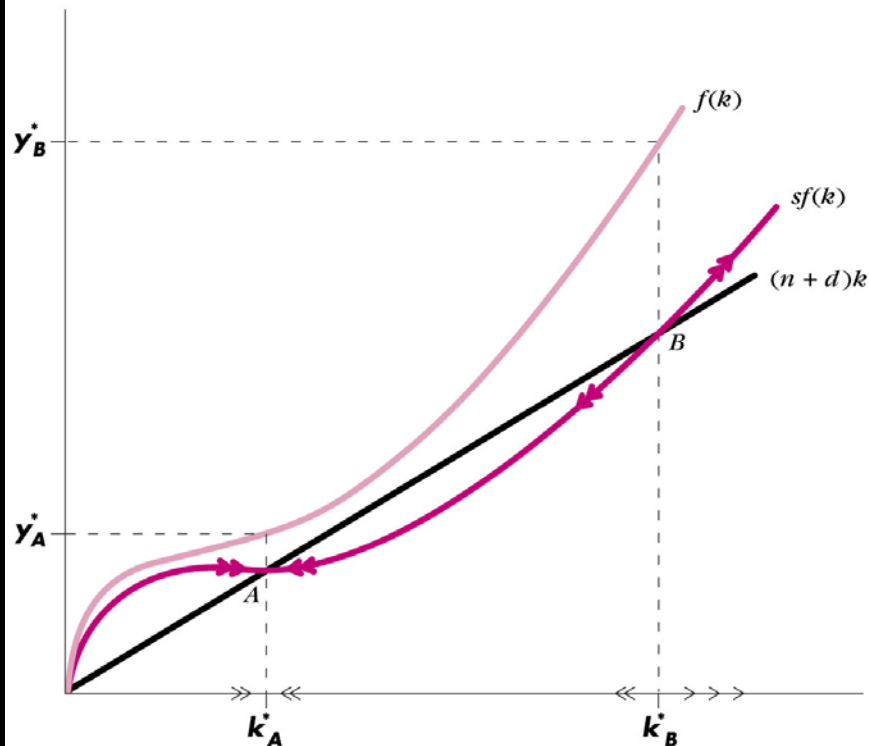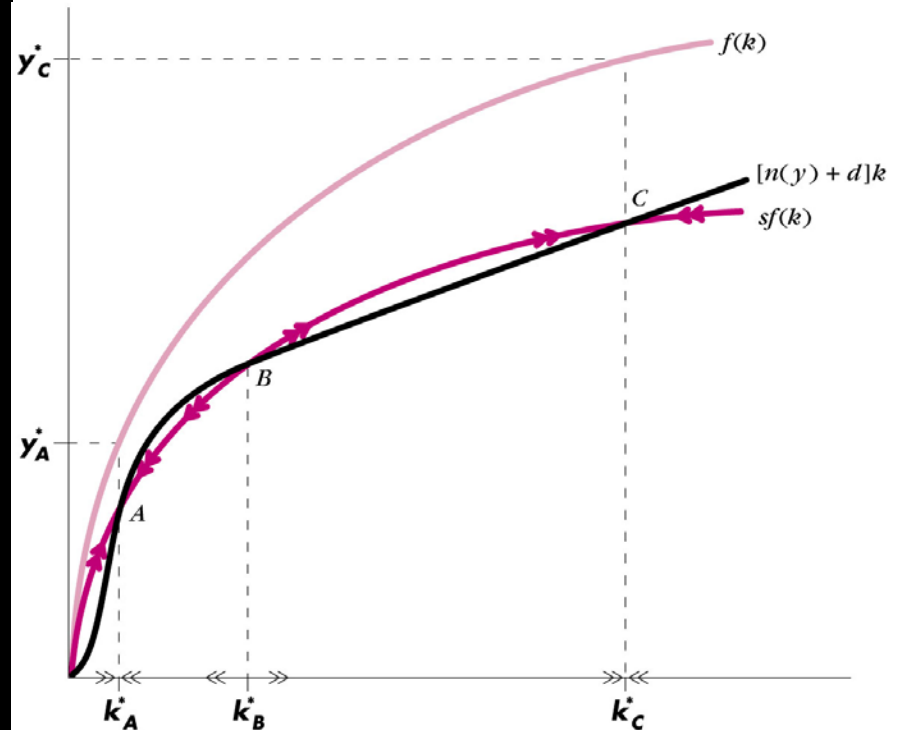
Solow Model with Endogenous Population Growth

- One of the oldest ideas in economics is that population growth works against the achievement of high income

  - The Solow growth model predicts that high population growth, n, means lower steady state income as each worker will have less capital to work with

- Over a wide range of incomes, population growth itself depends on income, n(y)

  - Very poor countries have high birth rates and high death rates, resulting in moderately high population growth

  - As income rises, death rates fall and population growth increases

  - At very high incomes, birth rates fall, some even approaching zero population growth (ZPG)
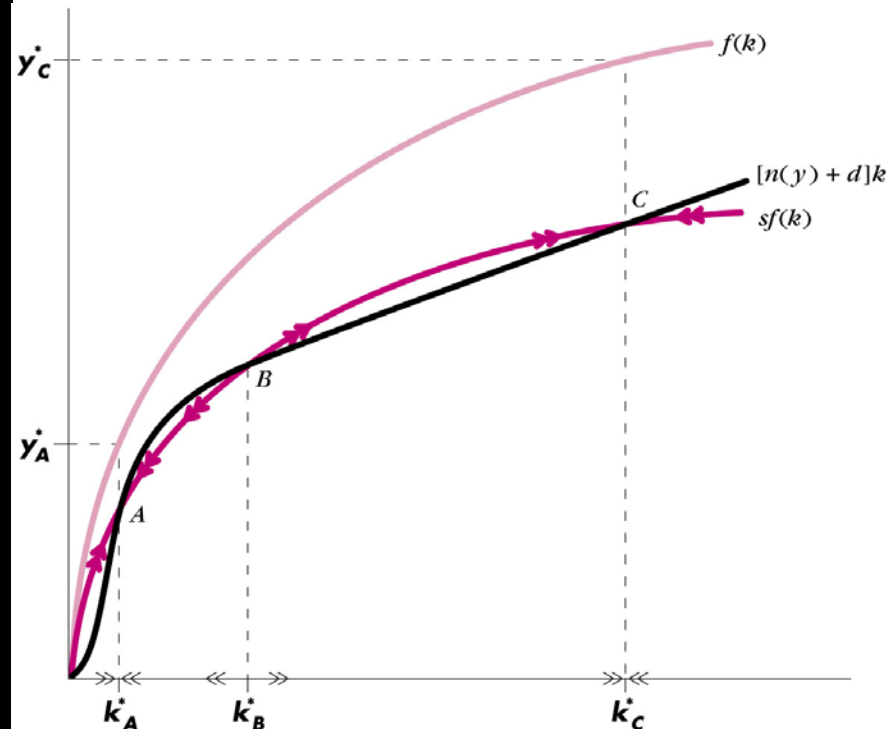
Solow Model with Endogenous Population Growth

- Figure 4-3 illustrates the modified investment requirement line on the Solow diagram to account for n as a function of y

- The investment requirement line, [n(y) + d]k, rises slowly at low levels of income, then sharply at higher levels, and finally levels off at high levels of income

Solow Model with Endogenous Population Growth

- The investment requirement line crosses the savings curve at points A, B, and C
  - Point A is a poverty trap with high population growth and low incomes
  - Point C has low population growth at high incomes
  - Points A and C are stable equilibriums because the economy moves towards these points
  - Point B is an unstable equilibrium since the economy moves away from it

Solow Model with Endogenous Population Growth

- How can an economy escape from the low-level equilibrium? There are two possibilities.

1. If a country can put on a "big push" that increases income past point B, the economy will continue unaided to the high-level at point C

2. A nation can effectively eliminate the low-level trap by moving the savings curve up or the investment requirement line down so that they no longer touch at points A or B

   → raising productivity or increasing the savings rate raises the savings line

   → population control policies lower the investment requirement line
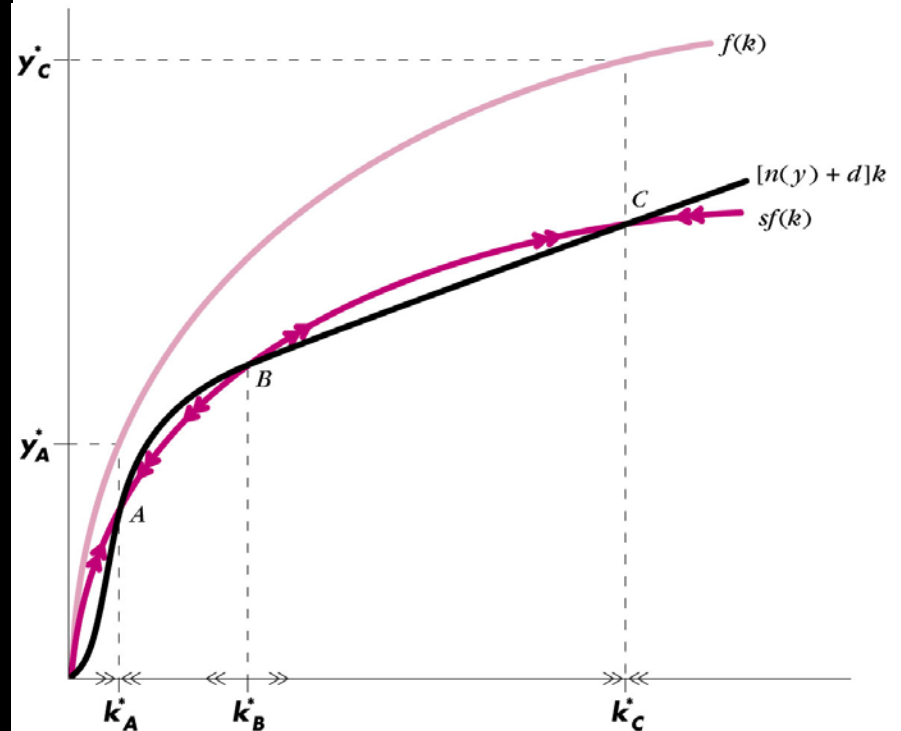
Truly Poor Countries

- Ghana, and many other countries, experienced very little growth in recent years
  - Income is so low that most of the population lives on the boarder of subsistence
- Can the Solow growth model explain these countries' experiences? <u>YES</u>
  - Savings in Ghana is quite low (9.3% of GDP vs. 34.3% and 19.4% of GDP in Japan and the US respectively)
  - Population growth is very high in Ghana and other poor countries relative to the US and Japan
- $\rightarrow$ The effect of low savings rates and high population growth rates are as predicted by the Solow growth model: low levels of income and capital per capita

RUDIGER DORNBUSCH

STANLEY FISCHER

RICHARD STARTZ

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Chapter 5

Aggregate Supply and Demand

Introduction

- The last few chapters have detailed models of long run economic growth → now turn to short run fluctuations in the economy that constitute the <u>business cycle</u>

- The AS/AD model is the basic macroeconomic tool for studying output fluctuations and the determination of the price level and the inflation rate

  - Can be used to explain how the economy deviates from a path of smooth growth over time, and to explore the consequences of government policies intended to reduce unemployment and output fluctuations, and maintain stable prices

AS and AD

- Aggregate supply curve describes, for each given price level, the quantity of output firms are willing to supply
  - Upward sloping since firms are willing to supply more output at higher prices
- Aggregate demand curve shows the combinations of the price level and the level of output at which the goods and money markets are simultaneously in equilibrium
  - Downward sloping since higher prices reduce the value of the money supply, which reduces the demand for output
- Intersection of AS and AD curves determines the equilibrium level of output and price level

AS, AD, and Equilibrium

- AS and AD intersect at point E in Figure 5-1

$\rightarrow$ <u>Equilibrium</u>: AS = AD
  - Equilibrium output is Y_0
    - Observed level of output in the economy at particular point in time
  - Equilibrium price level is P_0
    - Observed price level in the economy at particular point in time
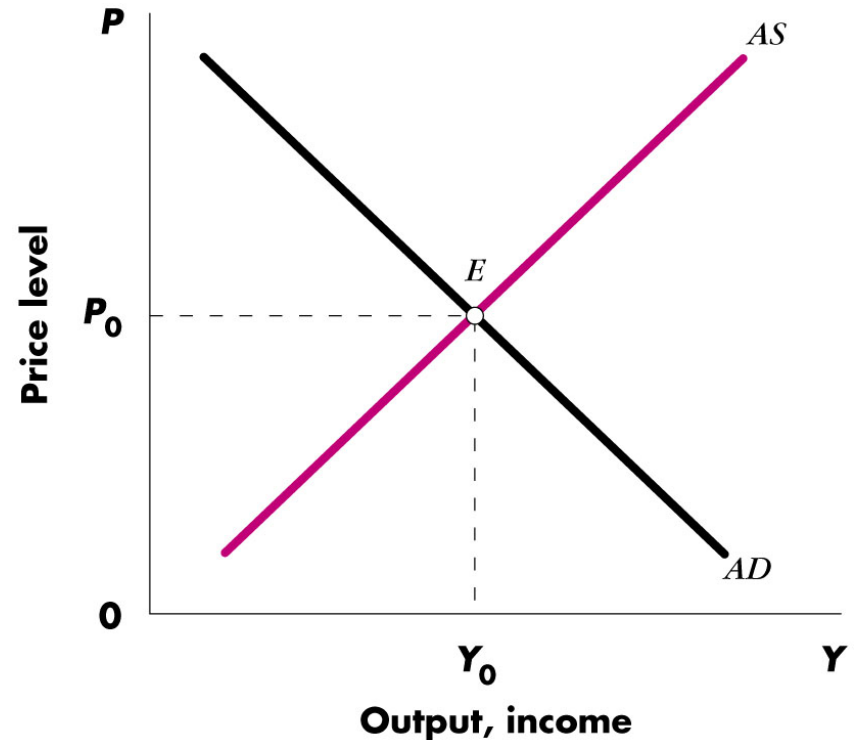
AS, AD, and Equilibrium

- Shifts in either the AS or AD schedule results in a change in the equilibrium level of prices and output
  - Increase in AD $\rightarrow$ increase in P and Y
  - Decrease in AD $\rightarrow$ decrease in P and Y
  - Increase in AS $\rightarrow$ decrease in P and increase in Y
  - Decrease in AS $\rightarrow$ increase in P and decrease in Y

  Figure 5-2 illustrates an increase in AD resulting from an increase in money supply.
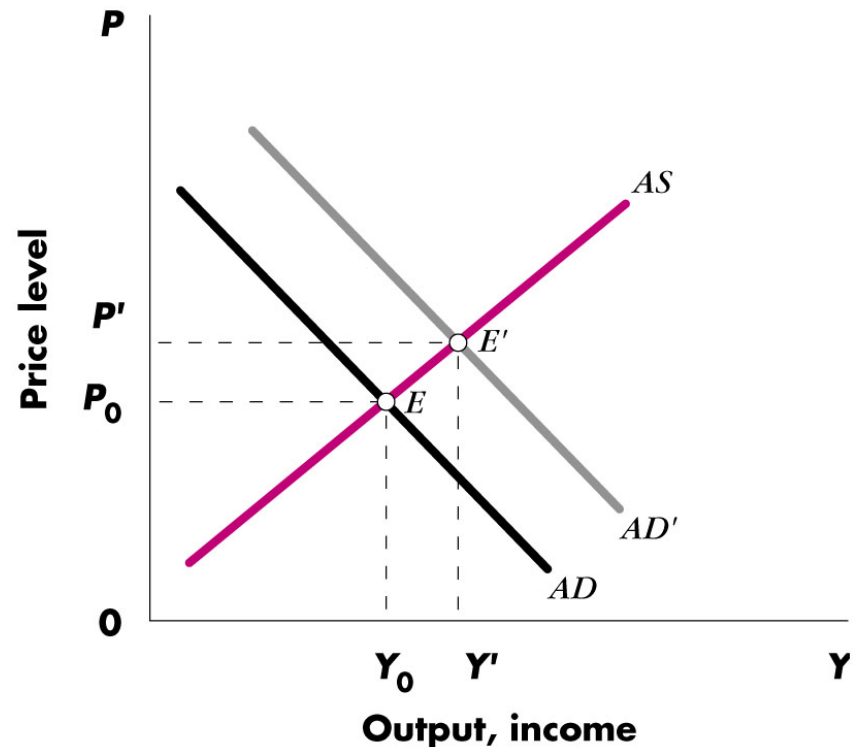
AS, AD, and Equilibrium

→ The amount of the increase/decrease in P and Y after a shift in either aggregate supply or aggregate demand depends on:

1. The slope of the AS curve
2. The slope of the AD curve
3. The extent of the shift of AS/AD

Figure 5-3 shows the result of an adverse AS shock:
↓AS → ↓Y, ↑P
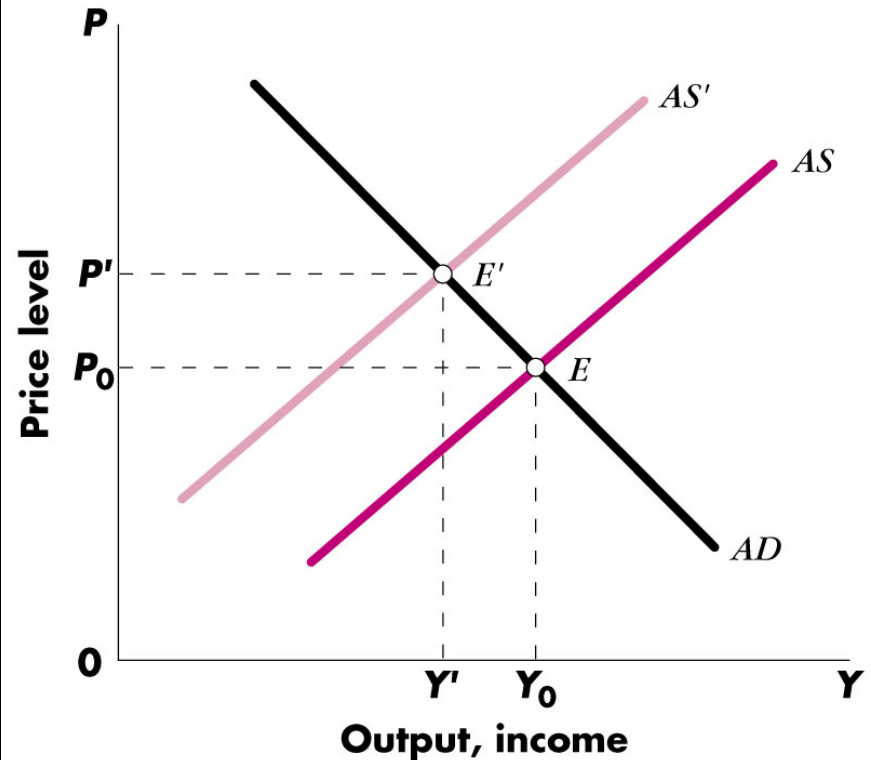
Classical Supply Curve

- The classical supply curve is vertical, indicating that the same amount of goods will be supplied, regardless of price [Figure 5-4 (b)]

  - Based upon the assumption that the labor market is in equilibrium with *full employment* of the labor force

  - The level of output corresponding to full employment of the labor force = potential GDP, Y*

  Long run version of the AS curve

P

Price level

P' ———————————— AS

0   Y

Output, income
(a)

P   AS

Price level

0   Y*   Y

Output, income
(b)
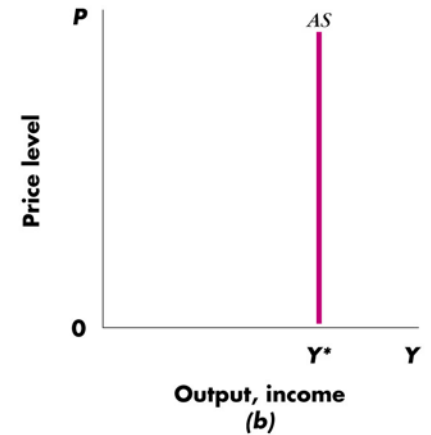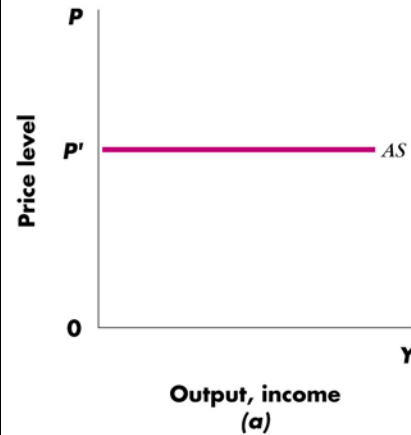
Classical Supply Curve

- Y* grows over time as the economy accumulates resources and technology improves → AS curve moves to the right
  - The growth theory models described in earlier chapters explain the level of Y* in a particular period
- Y* is "exogenous with respect to the price level"
- → illustrated as a vertical line since graphed in terms of the price level
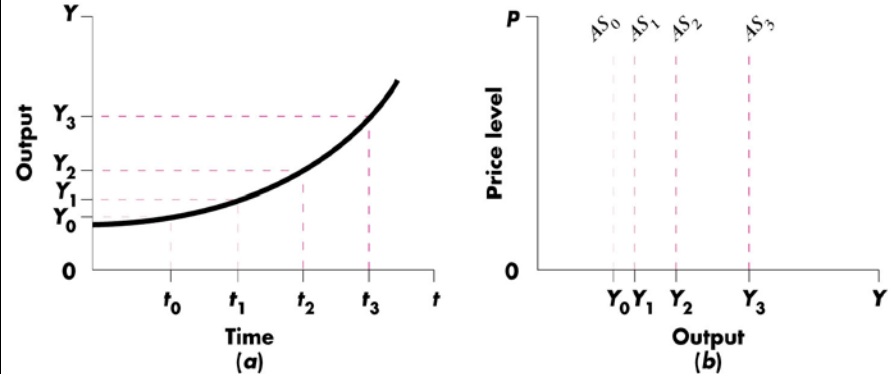
Keynesian Supply Curve

- The Keynesian supply curve is horizontal, indicating firms will supply whatever amount of goods is demanded at the existing price level [Figure 5-4 (a)]
  - Since unemployment exists, firms can obtain any amount of labor at the going wage rate
  - Since average cost of production does not change as output changes, firms willing to supply as much as is demanded at the existing price level
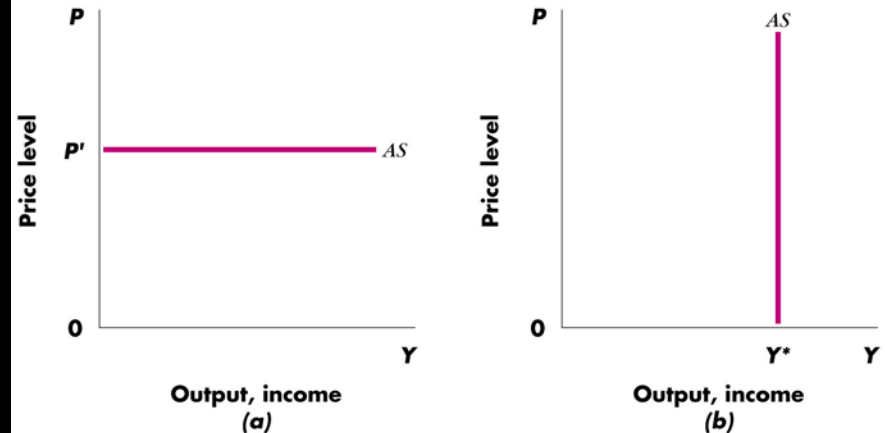
Keynesian Supply Curve

- Intellectual genesis of the Keynesian AS curve is found in the Great Depression, when it seemed firms could increase production without increasing P by putting idle K and N to work

- Additionally, prices are viewed as "sticky" in the short run, or firms are reluctant to change prices and wages when demand shifts

  - Instead firms increase/decrease output in response to demand shift = flat AS curve in the short run

Short run version of the AS curve

Frictional Unemployment and the Natural Rate of Unemployment

- Taken literally, the classical model implies that there is no involuntary unemployment → everyone who wants to work is employed

  - In reality there is some unemployment due to frictions in the labor market (Ex. Someone is always moving and looking for a new job)

- The unemployment rate associated with the full employment level of output is the <u>natural rate</u> of unemployment

  - Natural rate of unemployment is the rate of unemployment arising from normal labor market frictions that exist when the labor market is in equilibrium

AS and the Price Adjustment Mechanism

- AS curve describes the price adjustment mechanism within the economy

  - Figure 5-6 shows the SRAS curve in black and the LRAS in green, and the adjustment from the SR to the LR

- The AS curve is defined by the equation: $P_{t+1} = P_t[1 + \lambda(Y - Y^*)]$ (1) where

  - P_{t-1} is the price level next period
  - P_t is the price level today
  - Y^* is potential output
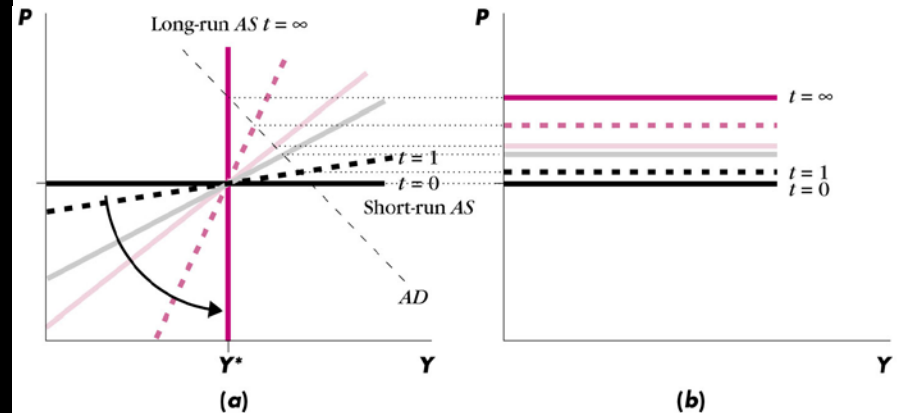
AS and the Price Adjustment Mechanism

$$P_{t+1} = P_t[1 + \lambda(Y - Y^*)] \quad (1)$$

- If output is above potential (Y>Y*), prices will increase and be higher next period

- If output is below potential (Y<Y*), prices will fall and be lower next period

- Prices will continue to rise/fall over time until Y=Y*
  - Today's price equals tomorrow's iif output equals potential (ignoring price expectations)

- The difference between GDP and potential GDP, Y-Y*, is called the <u>output gap</u>
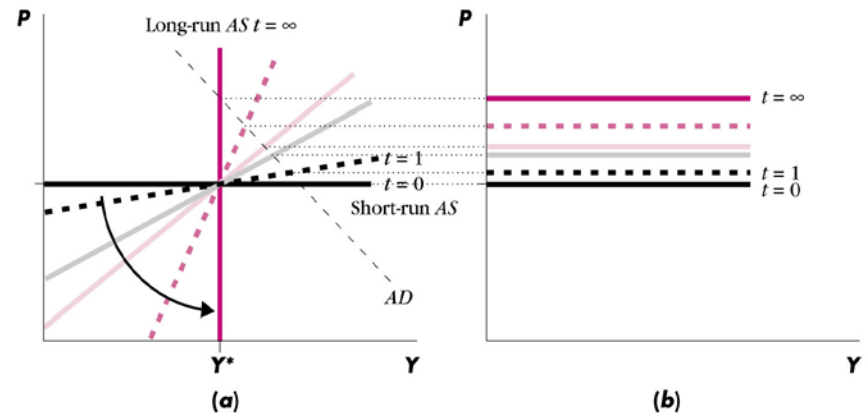
AS and the Price Adjustment Mechanism

$$P_{t+1} = P_t[1 + \lambda(Y - Y^*)] \quad (1)$$

- The upward shifting horizontal lines in Figure 5-6 (b) correspond to successive snapshots of equation (1)

- Beginning with the horizontal black line at time t=0, at $Y > Y^*$, price will be higher (AS shifting up) by t=1

- Process continues until $Y = Y^*$
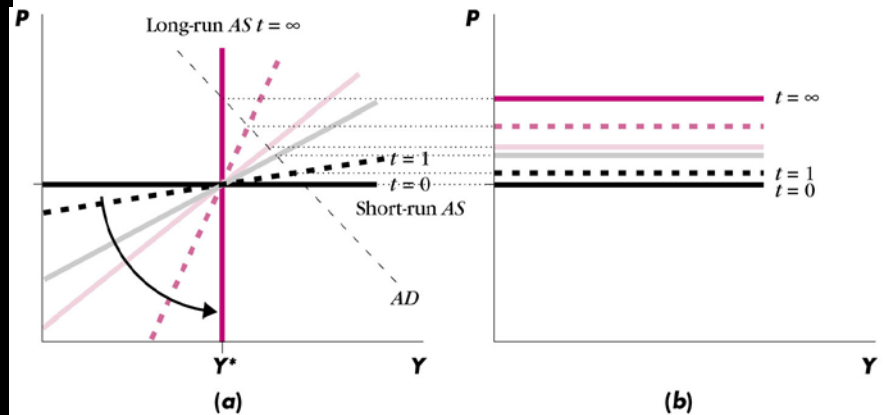
AS and the Price Adjustment Mechanism

$$P_{t+1} = P_t[1 + \lambda(Y - Y^*)] \quad (1)$$

- The speed of the price adjustment mechanism is controlled by the parameter λ
    - If λ is large, AS moves quickly (the counter clock-wise rotations in Figure 5-6 (a))
    - If λ is small, prices adjust slowly
- λ is of importance to policy makers:
    - If λ is large, the AS mechanism will return the economy to Y^* relatively quickly
    - If λ is small, might want to use AD policy to speed up the adjustment process

(a) (b)
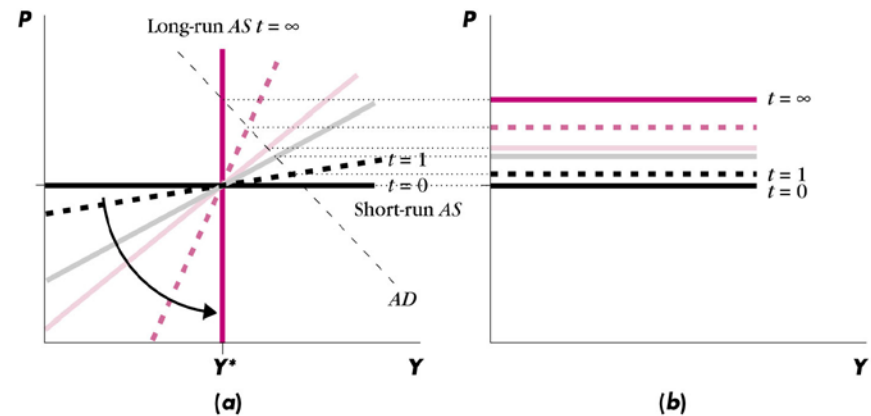
AD Curve and Shifts in AD

- AD shows the combination of the price level and level of output at which the goods and money markets are simultaneously in equilibrium

- Shifts in AD due to:

  1. Policy measures
     - Changes in G, T, and MS
  2. Consumer and investor confidence

Figure 5-8 shows an outward shift in AD resulting from an increase in the money supply.
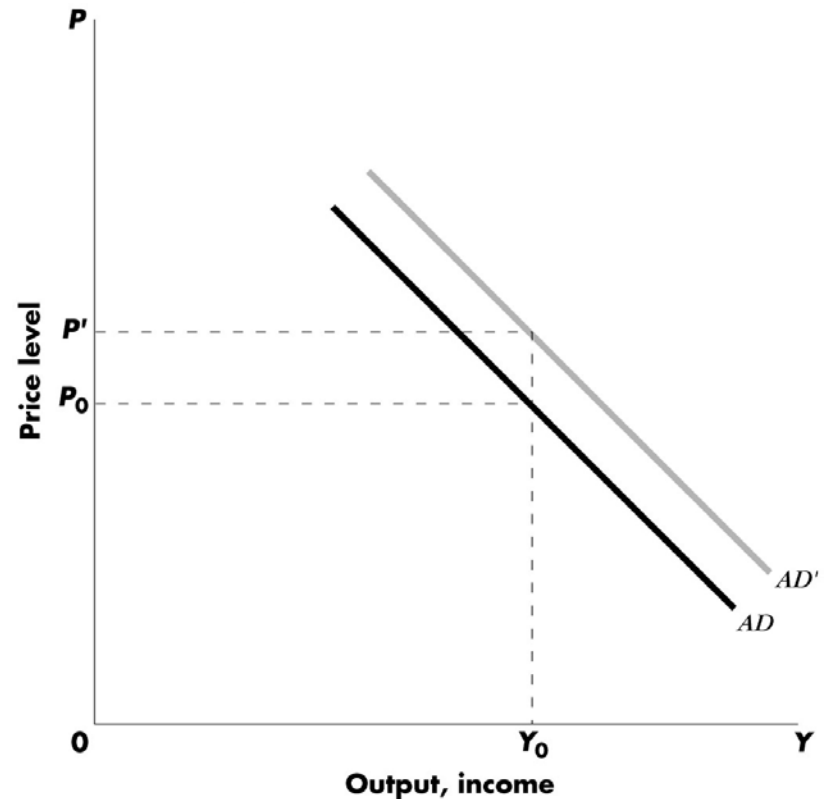
AD Relationship Between Output and Prices

- Key to the AD relationship between output and prices is the dependency of AD on <u>real money supply</u>

    - Real money supply = value of money provided by the central bank and the banking system

    - Real money supply is written as $\dfrac{\overline{M}}{P}$, where $\overline{M}$ is the nominal money supply, and P is the price level

    - $\uparrow \dfrac{\overline{M}}{P} \rightarrow \downarrow r \rightarrow \uparrow I \rightarrow \uparrow AD$ AND $\downarrow \dfrac{\overline{M}}{P} \rightarrow \uparrow r \rightarrow \downarrow I \rightarrow \downarrow AD$

- For a given level of $\overline{M}$, high prices result in low $\dfrac{\overline{M}}{P}$ OR high prices mean that the value of the number of available dollars is low and thus a high P = low level of AD

    Inverse relationship between P and Y $\rightarrow$ downward sloping AD curve

AD and the Money Market

- For the moment, ignore the goods market and focus on the money market and the determination of AD

- The quantity theory of money offers a simple explanation of the link between the money market and AD

  - The total number of dollars spent in a year, NGDP, is P*Y

  - The total number of times the average dollar changes hands in a year is the velocity of money, V

  - The central bank provides M dollars

  $\rightarrow$ The fundamental equation underlying the quantity theory of money is the quantity equation: $M \times V = P \times Y$ (2)

AD and the Money Market

$$M \times V = P \times Y \quad (2)$$

- If the velocity of money is assumed constant, equation (2) becomes $M \times \overline{V} = P \times Y$, and is an equation for the AD curve

- For a given level of M, an increase in Y must be offset by a decrease in P, and vice versa

  - Inverse relationship between Y and P as illustrated by downward sloping AD curve

- An increase in M shifts the AD curve upward for any value of Y

  - Illustrated in Figure 5-8

Changes in the Money Stock and AD

- An increase in the nominal money stock shifts the AD schedule up exactly in proportion to the increase in nominal money

  - Suppose $\overline{M}_0$ corresponds to AD and the economy is operating at P_0 and Y_0

  - If money stock increases by 10% to $\overline{M}' = 1.1\overline{M}_0$, AD shifts to AD' $\rightarrow$ the value of P corresponding to Y_0 must be P' = $1.1P_0$

  - Therefore $\dfrac{\overline{M}'}{P'} = \dfrac{1.1\overline{M}_0}{1.1P_0} = \dfrac{\overline{M}_0}{P_0} \rightarrow$ real money balances and Y are unchanged
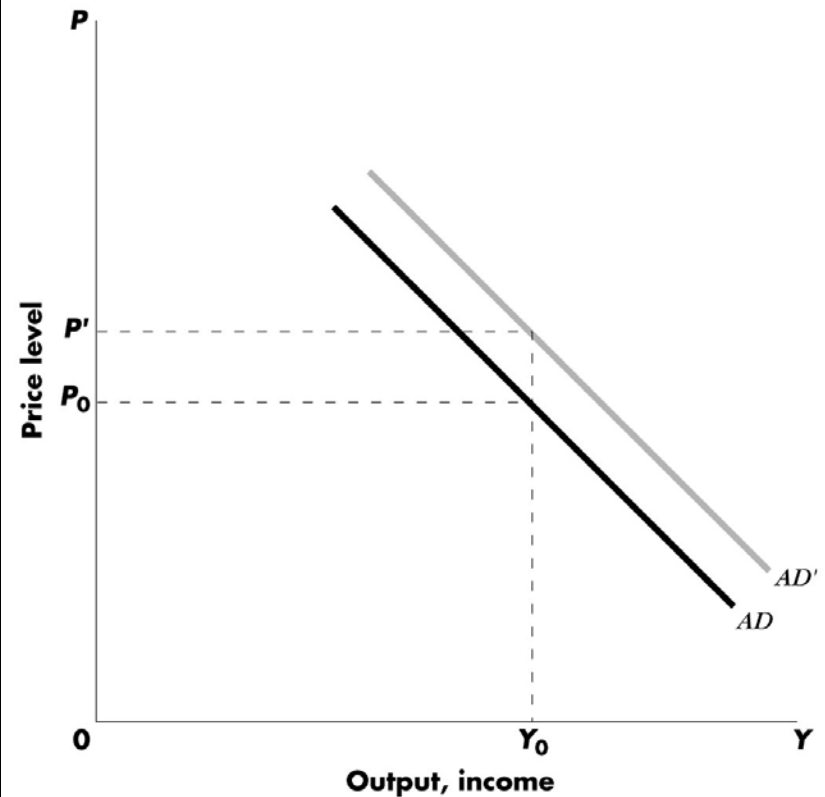
AD policy and the Keynesian Supply Curve

- Figure 5-9 shows the AD schedule and the Keynesian supply schedule
  - Initial equilibrium is at point E (AS = AD)
  - Suppose an aggregate demand policy increases AD $\left(\uparrow G, \downarrow T, \uparrow M^s\right)$ to AD'
    - The new equilibrium point, E', corresponds to the same price level, and a higher level of output (employment is also likely to increase)
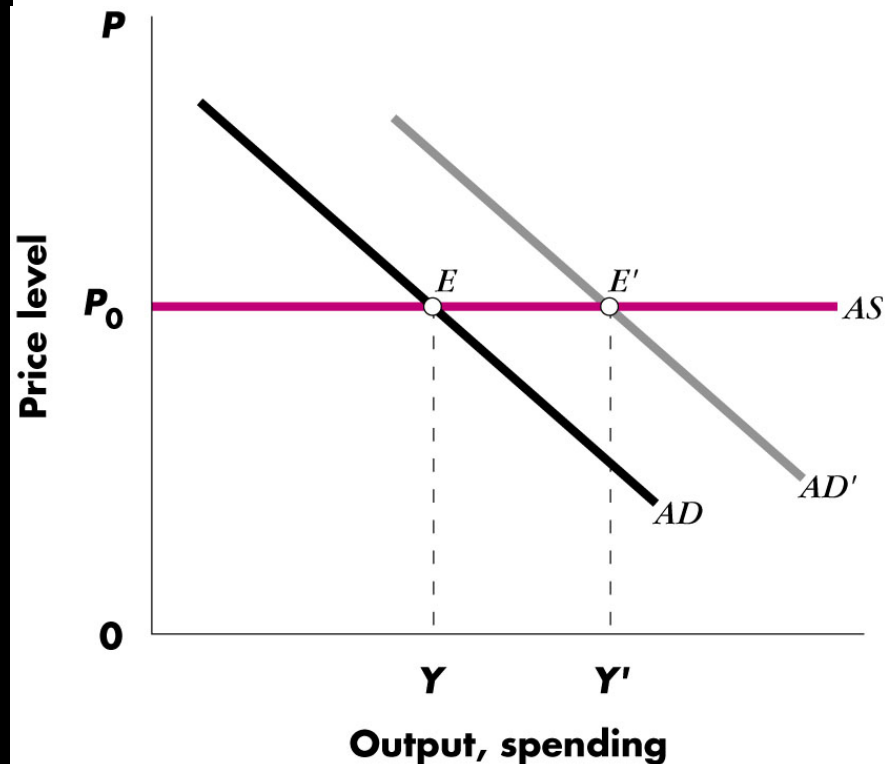
AD policy and the Classical Supply Curve

- In the classical case, AS schedule is vertical at FE level of output

  - Unlike the Keynesian case, the price level is not given, but depends upon the interaction between AS and AD

- Suppose AD increases to AD':

  - At the original price level, spending would increase to E' BUT firms can not obtain the N required to meet the increased demand

  - As firms hire more workers, wages and costs of production increase, and firms must charge higher price

  - Move up AS and AD curves to E'' where AS = AD'

    RESULT: Increase in AD results in higher prices, but not output
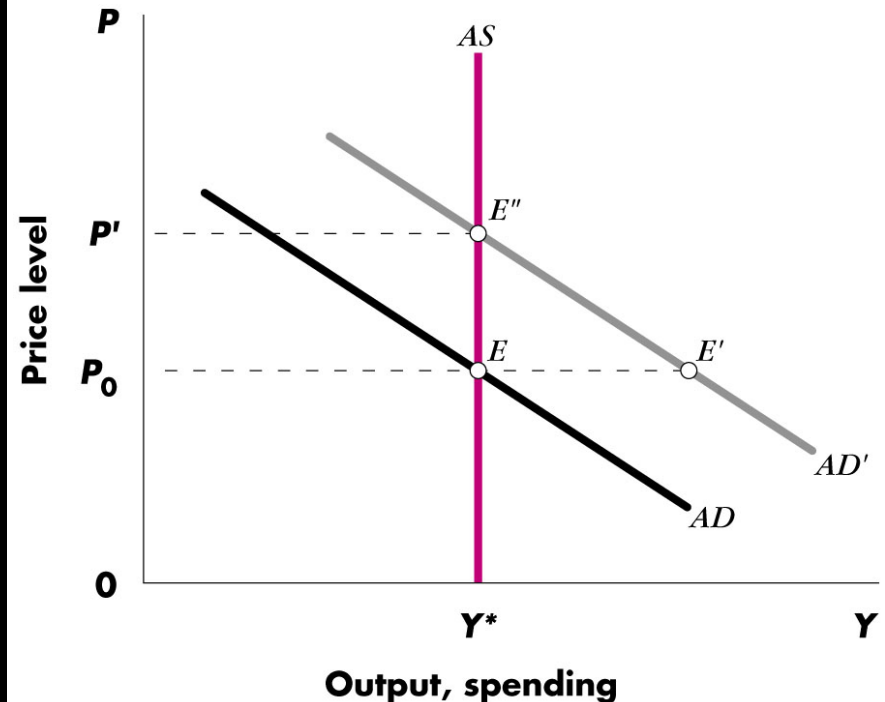
AD policy and the Classical Supply Curve

- The increase in price from the increase in AD reduces the real money stock, $\downarrow\left(\dfrac{\overline{M}}{\uparrow P}\right)$, and leads to a reduction in spending

  - The economy only moves up AD until prices have risen enough, and M/P has fallen enough, to reduce total spending to a level consistent with full employment $\rightarrow$ this is true at E'', where

    AD = AS
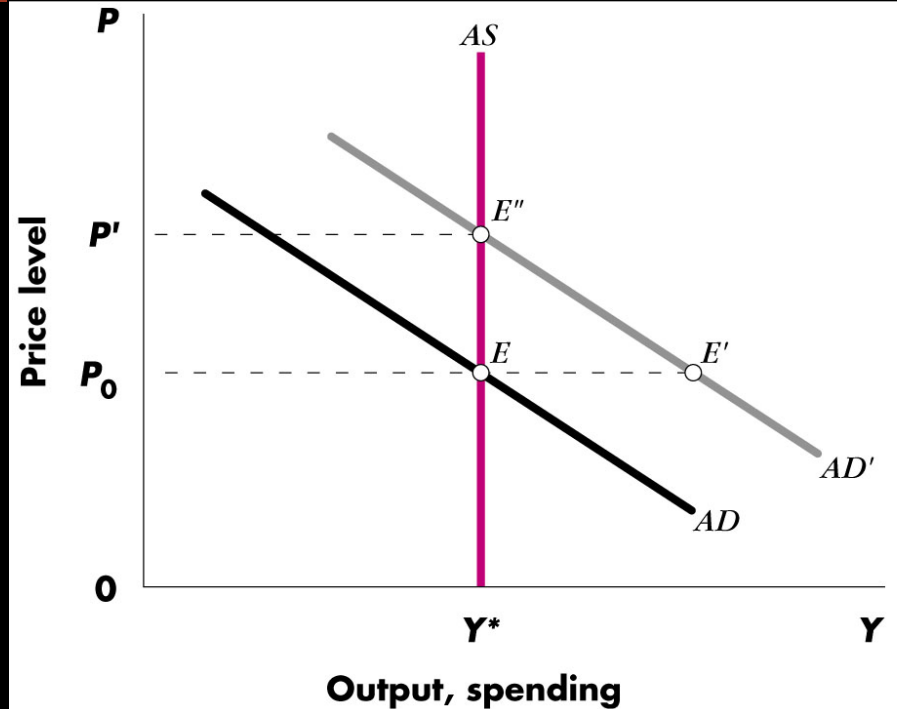
Supply Side Economics

- Supply side economics focuses on AS as the driver in the economy
- Supply side policies are those that encourage growth in potential output $\rightarrow$ shift AS to right
  - Such policy measures include:
    - Removing unnecessary regulation
    - Maintaining efficient legal system
    - Encouraging technological progress
- Politicians use the term supply side economics in reference to the idea that cutting taxes will increase AS enough that tax collections will actually increase, rather than fall

Supply Side Economics

- Cutting tax rates has an impact on both AS and AD
  - AD shifts to AD' due to increase in disposable income
    - Shift is relatively large compared to that of the AS
  - AS shifts to AS' as the incentive to work increases
- In short run, economy moves from E to E': GDP increases, tax revenues fall proportionately less than tax cut (AD effect)
- In the LR, economy moves to E'' as AS curve shifts to right: GDP is higher, but by a small amount, tax collections fall as the deficit rises
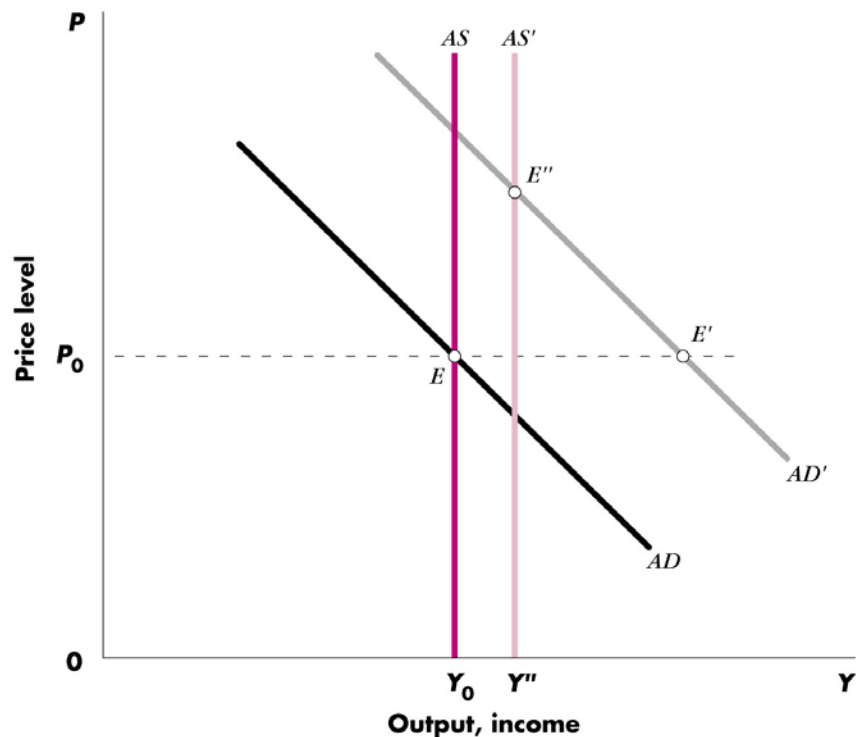
Supply Side Economics

- Supply side policies are useful, despite previous example
  - Only supply side policies can permanently increase output
  - Demand side policies are useful for short run results
- Many economists support cutting taxes for the incentive effect, but with a simultaneous reduction in government spending
  - tax collections fall, but the reduction in government spending minimizes the impact on the deficit

  The deficit is the excess of government expenditures over tax revenues.

AS and AD in the Long Run

- In the LR, AS curve moves to the right at a slow, but steady pace
- Movements in AD over long periods can be large or small, depending largely on movements in money supply
- Figure 5-12 shows a set of AS and AD curves for the period 1970-2000
  - Movements in AS slightly higher after 1990
  - Big shifts in AD between 1970 and 1980
  - Prices increase when AD moves out more than AS
  - Output determined by AS, while prices determined by the relative shifts in AS and AD
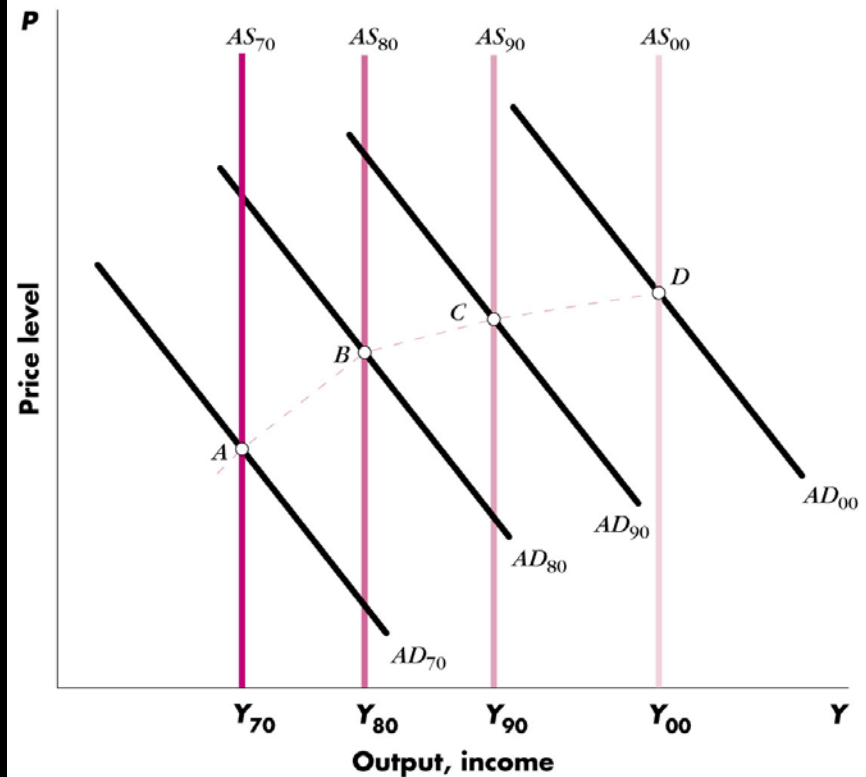
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MACROECONOMICS

Chapter 6

Aggregate Supply: Wages, Prices, and Unemployment

Introduction

- Further develop the AS side of the economy and examine the dynamic adjustment process that carries us from the short run to the long run
  - The price-output relationship is based upon links between wages, prices, employment, and output

    $\rightarrow$ link between unemployment and inflation = Phillips Curve
  - Translate between unemployment and output, inflation and price changes
- Introduce role of price and inflation expectations, and the "rational expectations revolution"
- NOTE: theory of AS is the least settled area in macro
  - Don't fully understand why W and P are slow to adjust, but offer several theories
  - All modern models differ in starting point, but reach the same conclusion: SRAS is flat, LRAS is vertical

Inflation and Unemployment

- Figure 6.1 shows U.S. unemployment from 1959 to 2005
  - Several periods of high unemployment: early 1960s, mid 1970's, early-mid 1980's, and early 1990s
  - Several periods of low unemployment: late 1960's, early 2000
- Phillips curve (PC) shows the relationship between unemployment and inflation
  - Although GDP is linked to unemployment, it is easier to work with the PC than the AS when discussing unemployment
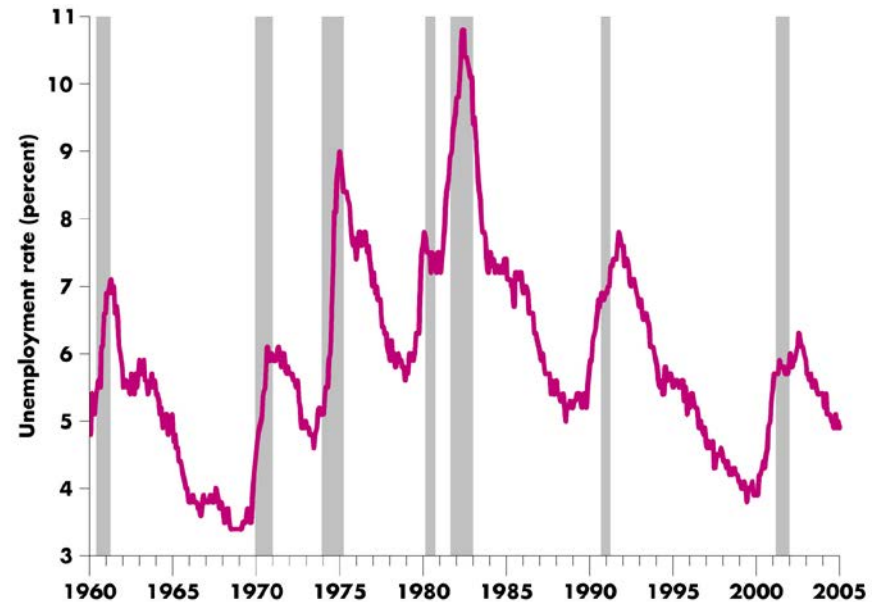
The Phillips Curve

- In 1958 A.W. Phillips published a study of wage behavior in the U.K. between 1861 and 1957
    - The main findings are summarized in Figure 6.2
    - → There is an inverse relationship between the rate of unemployment and the rate of increase in money wages
    - → From a policymaker's perspective, there is a tradeoff between wage inflation and unemployment
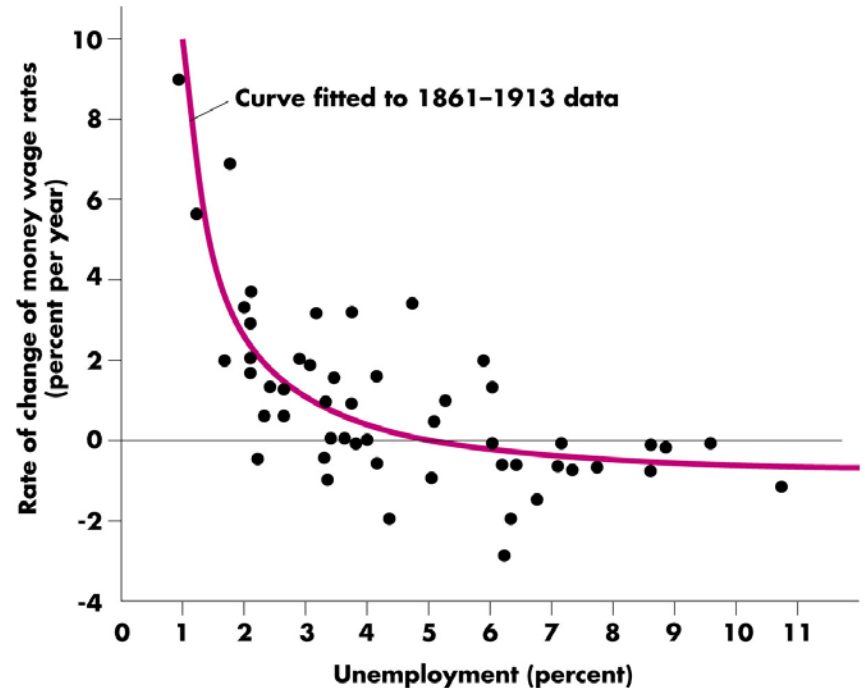
Phillips Curve

- The PC shows the rate of growth of wage inflation decreases with increases in unemployment
  - If W_t = wage this period

    W_{t+1} = wage next period

    g_w = rate of wage inflation, then $g_w = \dfrac{W_{t+1} - W_t}{W_t}$ (1)
- If μ^* represents the natural rate of unemployment, the simple PC is defined as: $g_w = -\varepsilon(\mu - \mu^*)$ (2) where ε measures the responsiveness of wages to unemployment
  - Wages are falling when $\mu > \mu^*$ and rising when $\mu < \mu^*$
  - $(\mu - \mu^*)$ is called the unemployment gap

Phillips Curve

- Suppose the economy is in equilibrium with prices stable and unemployment at the natural rate
  - If money supply increases by 10%, wages and prices both must increase by 10% for the economy to return to equilibrium
  - PC shows:
    - If wages increase by 10%, unemployment will have to fall
    - If wages increase, price will increase and the economy will return to the full employment level of output and unemployment

- To see why this is so, rewrite equation (1) in terms of current and past wage levels:

$$\frac{W_{t+1} - W_t}{W_t} = -\varepsilon(\mu - \mu^*)$$

$$W_{t+1} - W_t = W_t(-\varepsilon(\mu - \mu^*))$$

$$W_{t+1} = W_t(-\varepsilon(\mu - \mu^*)) + W_t$$

$$W_{t+1} = W_t[1 - \varepsilon(\mu - \mu^*)] \qquad (2a)$$

$\rightarrow$ For wages to rise above previous levels, u must fall below the natural rate

The Policy Tradeoff

- PC quickly became a cornerstone of macroeconomic policy analysis since it suggests that policy makers could choose different combinations of u and Π rates
  - Can choose low u if willing to accept high Π (late 1960's)
  - Can maintain low Π by having high u (early 1960's)
- In reality the tradeoff between u and Π is a short run phenomenon
  - In the LR the tradeoff disappears as AS becomes vertical
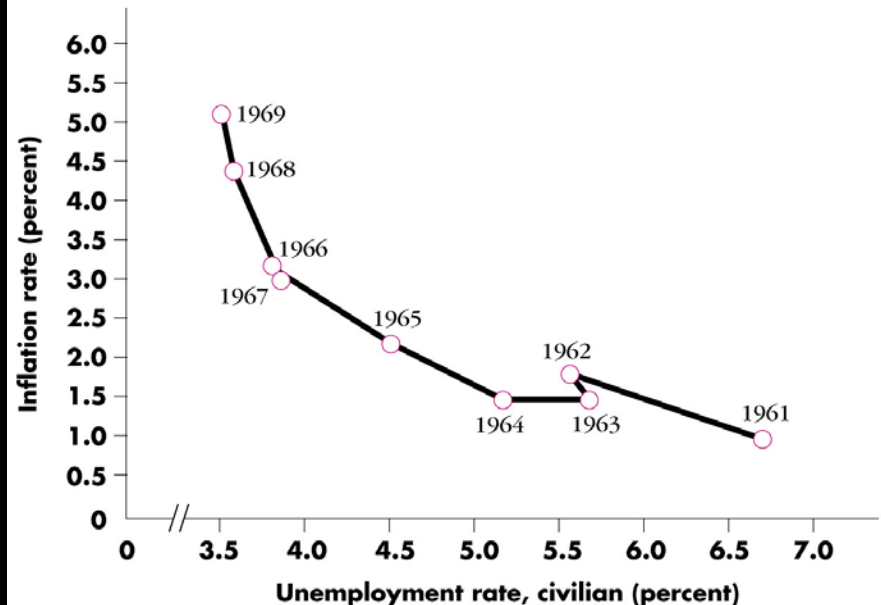
The Inflation Expectations-Augmented Phillips Curve

- Figure 6-4 shows the behavior of Π and u in the US since 1960 → does not fit the simple PC story
  - Individuals are concerned with standard of living, and compare wage growth to inflation
    - If wages to not "keep up" with inflation, standard of living falls
  - Individuals form expectations as to what Π will be over a particular period of time, and use in wage negotiations (Π^e)
- Rewrite (2) to reflect this as:

$$(g_w - \Pi^e) = -\varepsilon(\mu - \mu^*) \quad (3)$$
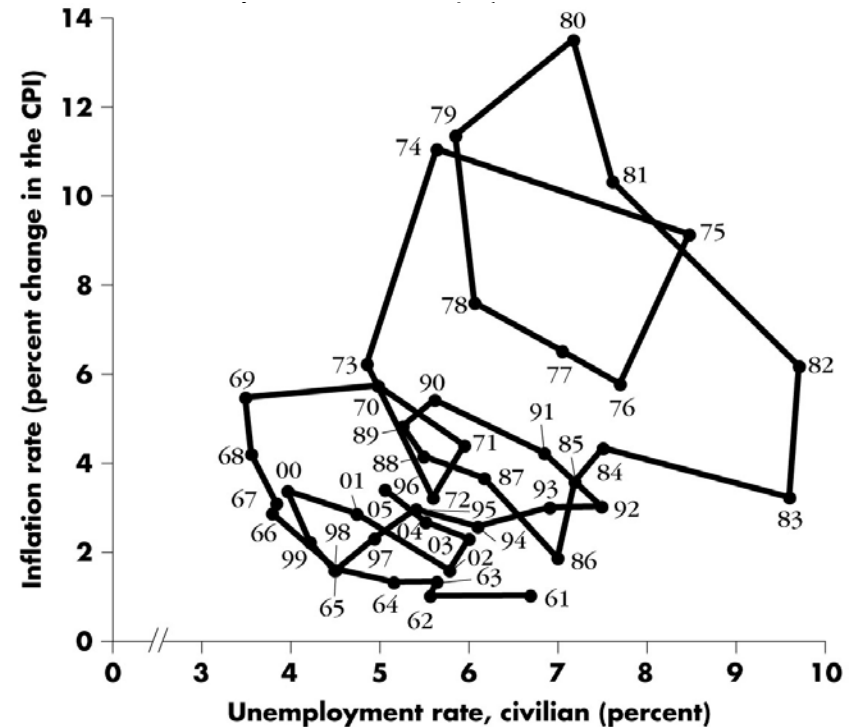
The Inflation Expectations-Augmented Phillips Curve

- If maintaining the assumption of a constant real wage, W/P, actual Π will equal wage inflation

  - The equation for the modern version of the PC, the expectations augmented PC, is:

$$(g_w - \Pi^e) = -\varepsilon(\mu - \mu^*) \Rightarrow$$
$$(\Pi - \Pi^e) = -\varepsilon(\mu - \mu^*),$$
$$\Pi = \Pi^e - \varepsilon(\mu - \mu^*) \qquad (4)$$

  NOTE:

  1. Π^e is passed one for one into actual Π
  2. $u = u^*$ when $\Pi^e = \Pi$

The Inflation Expectations-Augmented Phillips Curve

- The modern PC intersects the natural rate of u at the level of expected inflation
  - Figure 6-5 illustrates the inflation expectations-augmented Phillips curve for the 1980s and early 2000
- The height of the SRPC depends upon Π^e
- Changes in expectations shifts the curve up and down
  - The role of Π^e adds another automatic adjustment mechanism to the AS side of the economy
- When high AD moves the economy up and to the left along the SRPC, Π results → if persists, people adjust their expectations upwards, and move to higher SRPC
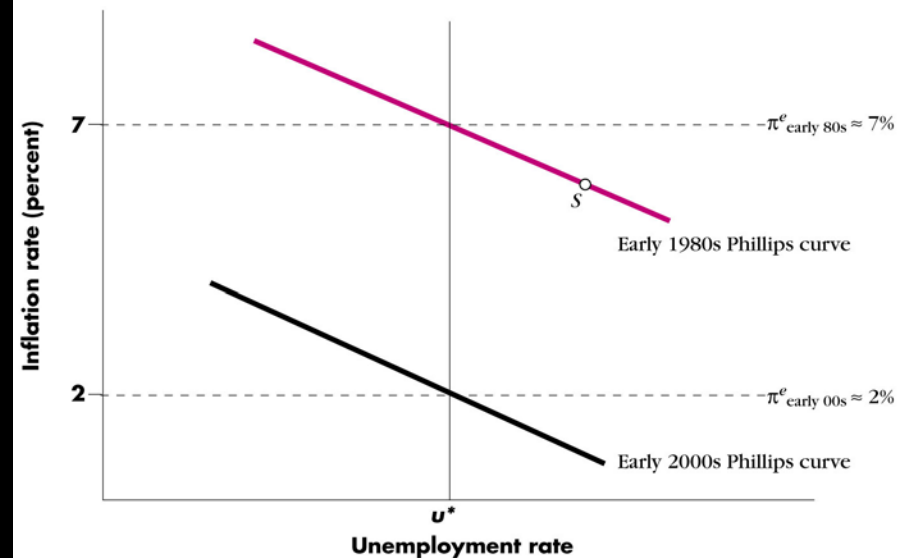
The Inflation Expectations-Augmented Phillips Curve

- After 1960, the original PC relationship broke down

How does the augmented PC hold up?

- To test the augmented PC, need a measure of $\Pi^e \rightarrow$ best estimate is last period's inflation, $\Pi^e = \Pi_{t-1}$

- Figure 6-6 illustrates the augmented PC using the equation:

$$\Pi - \Pi^e \approx \Pi - \Pi_{t-1} = -\varepsilon(u - u^*)$$

  - Appears to work well in most periods
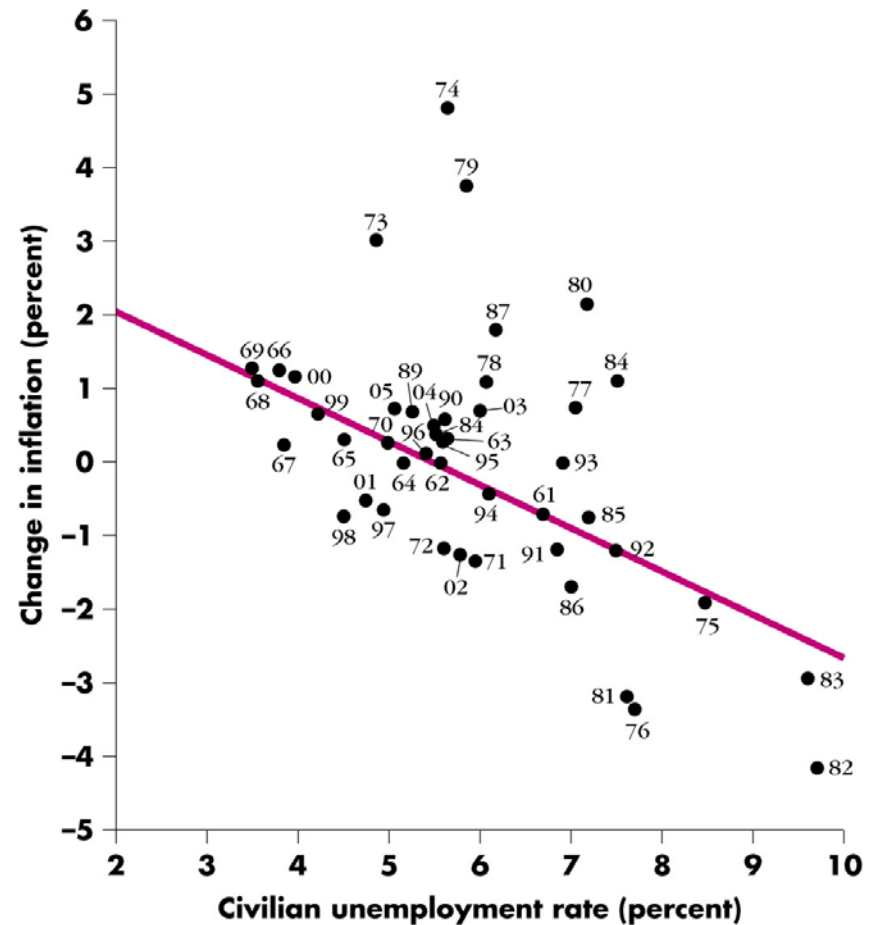
Rational Expectations

- The augmented PC predicts that actual Π will rise above Π^e when u $<$ u* $\rightarrow$ So why don't individuals quickly adjust their expectations to match the model's prediction?
  - The PC relationship relies on people being *WRONG* about Π in a very predictable way
  - If people learn to use (4) to predict Π, Π^e should always equal Π, and thus u $=$ u*
    - We predict u $=$ u* in the LR, but this refers to the SR
- Robert Lucas modified the model to allow for *mistakes*
  - He argued that a good economics model should not rely on the public making easily avoidable mistakes
  - So long as we are making predictions based on information available to the public, then the values we use for Π^e should be the same as the values the model predicts for Π
  - <u>Surprise</u> shifts in AD will change u, but <u>predictable</u> shifts will not

Rational Expectations

- The argument over rational expectations is as follows:
  - The usual macroeconomic model takes the height of the PC as being pegged in the SR by Π^e, where Π^e is set by historical experience
  - The rational expectations model has the SRPC floating up and down in response to available information about the near future
    - Individuals use new information to update their expectations
- Both models agree that if money growth were permanently increased, the PC would shift up in the LR, and Π would increase with no LR change in u
  - The RE model states that this change is instantaneous, while the traditional model argues that the shift is gradual

The Wage-Unemployment Relationship and Sticky Wages

- In neoclassical theory of supply, wages adjust instantly to ensure that output always at the full employment level, BUT output is <u>not</u> always at the full employment level, and the PC suggests that wages adjust slowly in response to changes in u

- The key question in the theory of AS is *"Why does the nominal wage adjust slowly to shifts in demand?"* OR *"Why are wages sticky?"*

- Wages are sticky when wages move slowly over time, rather than being flexible, allowing for economy to deviate from the full employment level

The Wage-Unemployment Relationship and Sticky Wages

- To clarify the assumptions about wage stickiness, translate (3) into a relationship between g_w and the level of employment:

    If $N^* =$ full employment level of employment

    $N =$ actual level of employment

    $u =$ share of N^* that is not employed, then

$$\mu - \mu^* = \frac{N^* - N}{N^*} \quad (5)$$

- Substitute (5) into (3) we have the PC relationship between E, Π^e, and g_w:

$$g_w - \Pi^e = \frac{W_{t+1} - W_t}{W_t} - \Pi^e = -\varepsilon\left(\frac{N^* - N}{N^*}\right) \quad (2b)$$

The Wage-Unemployment Relationship and Sticky Wages

$$g_w - \Pi^e = \frac{W_{t+1} - W_t}{W_t} - \Pi^e = -\varepsilon\left(\frac{N^* - N}{N^*}\right) \qquad \text{(2b)}$$

- The wage next period is equal to the wage that prevailed this period, but with an adjustment for the level of employment and π^e
  - At full employment, $N^* = N$, this period's wage equals last period's, plus an adjustment for π^e
  - If $N > N^*$, the wage next period increases above this period's by more than π^e since $g_w - \pi^e > 0$

The Wage-Unemployment Relationship and Sticky Wages

- Figure 6-7 illustrates the wage-employment relationship, WN
- The extent to which the wage responds to E depends on the parameter ε
  - If ε is large, u has large effects on wages and the WN line is steep
- The PC relationship also implies WN relationship shifts over time
  - If there is over-employment this period, WN shifts up to WN'
  - If there is less than full employment this period, WN curve shifts down to WN''
- <u>Result</u>: Changes in AD that alter the u this period will have effects on wages in subsequent periods
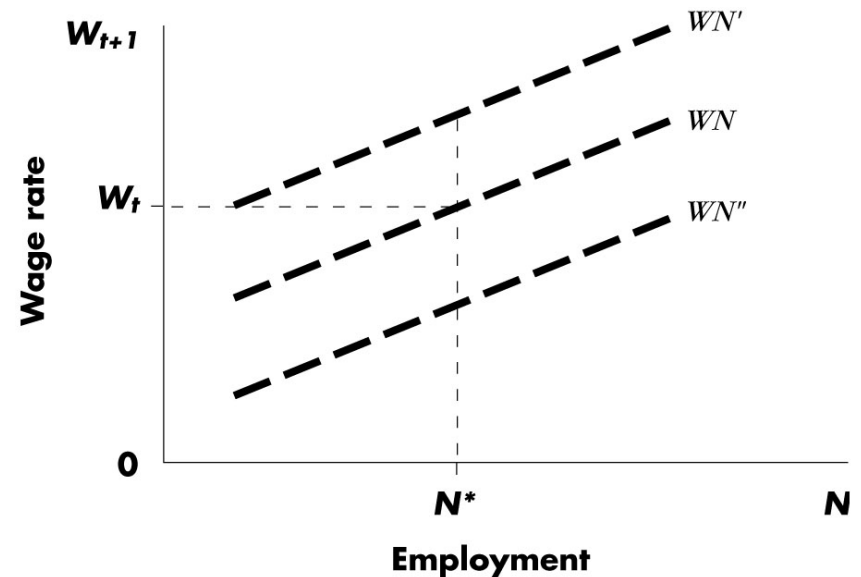
The Wage-Unemployment Relationship and Sticky Wages

- Each school of thought has to explain why there is a PC, or the reasons for wage and price stickiness
  - Explanations are not mutually exclusive
  - Examples of such explanations for wage and price stickiness include:
    1. Imperfect information
       - Friedman and Phelps
       - In the context of clearing markets
    2. Coordination problems
       - Focus on the process by which firms adjust their prices when demand changes
    3. Efficiency wages and costs of price changes
       - Focus on wage as a means of motivating labor

The Wage-Unemployment Relationship and Sticky Wages

- In developing an explanation of wage stickiness, build upon mentioned theories and one central element $\rightarrow$ the labor market involves long-term relationships between firms and workers
  - Working conditions, including the wage, are renegotiated periodically, but not frequently, due to the costs of doing so
- At any time, firms and workers agree on a wage schedule that is to be paid to currently employed workers
  - If demand for labor increases and firms increase hours of work, in the SR wages rise along the WN curve
  - With demand up, workers press for increased wages, but takes time to renegotiate all wages (staggered wage-setting dates)
  - During the adjustment process, firms also resetting P to cover increased cost of production
    - Process of W and P adjustment continues until economy back at full employment level of output

From the Phillips Curve to the AS Curve

- The transition from the PC to the AS curve requires four steps:

    1. Translate output to employment
    2. Link prices firms charge to costs
    3. Use Phillips curve relationship between W and E
    4. Combine 1-3 to derive upward sloping AS curve

Translate output to employment

- Close relationship between unemployment/employment and output in SR

- Okun's Law defines this relationship:

$$\frac{Y - Y^*}{Y^*} = -\omega(u - u^*) \quad (6)$$

- Estimate ω to be close to 2 $\rightarrow$ each point of u costs 2% points of GDP

From the Phillips Curve to the AS Curve

- The transition from the PC to the AS curve requires four steps:
  1. Translate output to employment
  2. Link prices firms charge to costs
  3. Use Phillips curve relationship between W and E
  4. Combine 1-3 to derive upward sloping AS curve

<u>Link prices to costs</u>

- Firms supply output at a price that at least covers costs of production

  - Assuming N is the only cost of production, if each unit of N produces a units of output, the labor costs of production per unit is W/a

  - Firms set price as a markup, z, on labor costs:

$$P = \frac{(1+z)W}{a} \quad (7)$$

From the Phillips Curve to the AS Curve

The transition from the PC to the AS curve requires four steps:

1. Translate output to employment
2. Link prices firms charge to costs
3. Use Phillips curve relationship between W and E
4. Combine 1-3 to derive upward sloping AS curve

PC, wages and employment

- PC in equation 2(b) gives wage increases as a function of π^e and $(u - u^*)$

$$g_w = \Pi^e - \varepsilon\left(\frac{N^* - N}{N^*}\right)$$

where $\dfrac{N^* - N}{N^*} = (\mu - \mu^*)$

From the Phillips Curve to the AS Curve

- The transition from the PC to the AS curve requires four steps:

  1. Translate output to employment
  2. Link prices firms charge to costs
  3. Use Phillips curve relationship between W and E
  4. Combine 1-3 to derive upward sloping AS curve

The Aggregate Supply curve

- Combining (2b), (6), and (7) yields:

$$P_{t+1} = P_{t+1}^e + P_t \frac{\varepsilon}{\omega}\left(\frac{Y - Y^*}{Y^*}\right) \quad (8)$$

- Often replace (8) with an approximate version:

$$P_{t+1} = P_{t+1}^e\left[1 + \lambda(Y - Y^*)\right] \quad (9)$$

which is the equation for the aggregate supply curve

From the Phillips Curve to the AS Curve

$$P_{t+1} = P^e_{t+1}\left[1 + \lambda(Y - Y^*)\right]$$

- Figure 6-8 shows AS curve implied by equation (9)
  - If $Y > Y^*$, next period the AS curve will shift up to AS'
  - If $Y < Y^*$, next period AS will shift down to AS''

  NOTE: These are the same properties as the WN curve
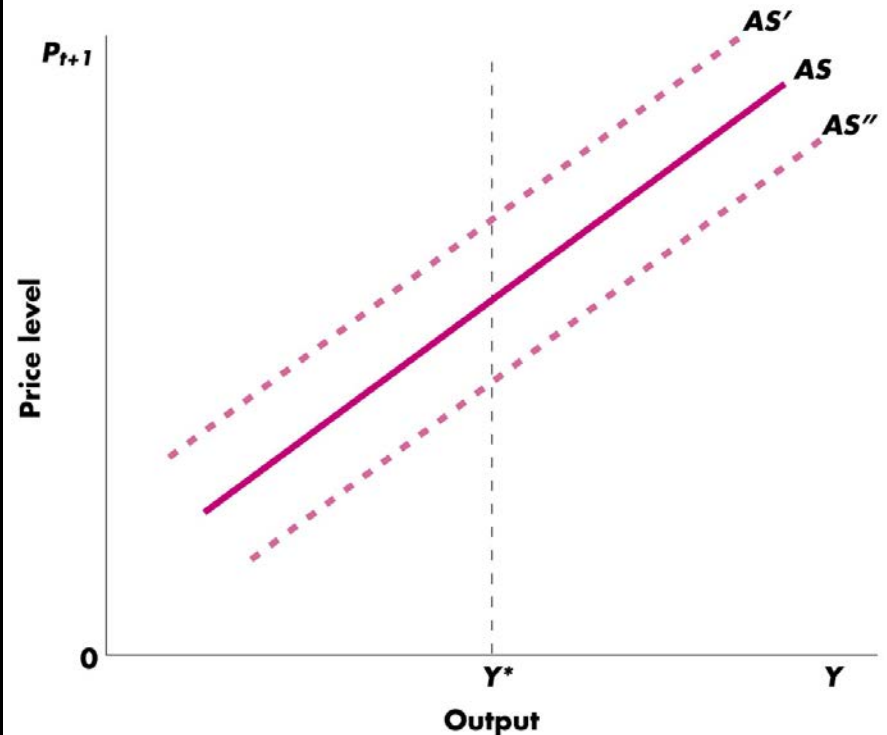
Supply Shocks

- A supply shock is a disturbance in the economy whose first impact is a shift in the AS curve
  - An adverse supply shock is one that shifts AS inwards (as in Figure 6-10)
  - As AS shifts to AS', equilibrium shifts from E to E' and prices increase while output falls
  - The u at E' forces wages and prices down until return to E, but process is slow
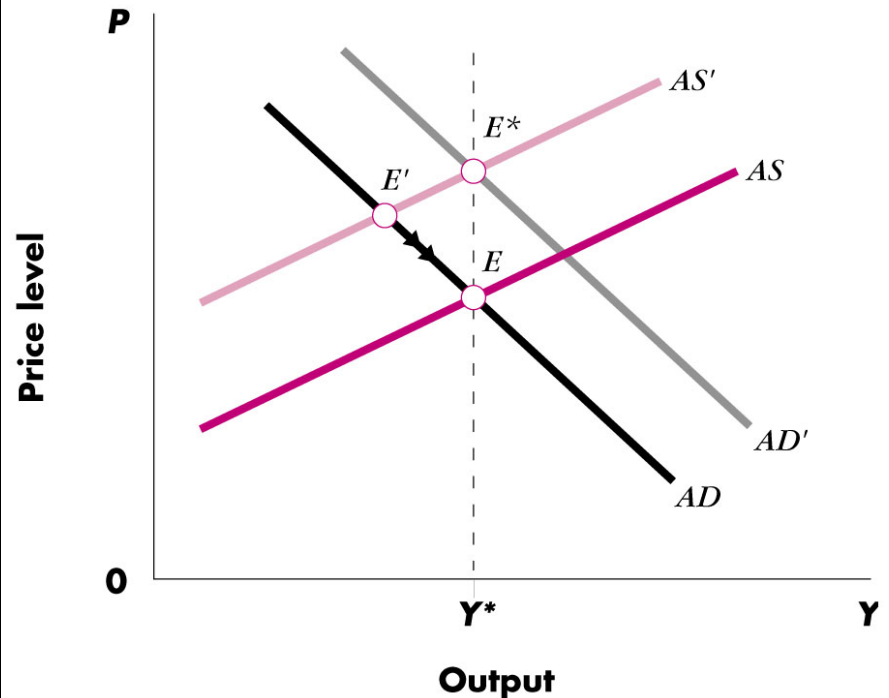
Supply Shocks

- After the shock:
  - Economy returns to the full employment level of employment
  - Price level is the same as it was before the shock
  - Nominal wages are <u>LOWER</u> due to the increased u at the onset of the shock
  - Real wages must also fall

  $$\downarrow w = \frac{\downarrow W}{\overline{P}}$$ where w is the real wage and W is the nominal wage
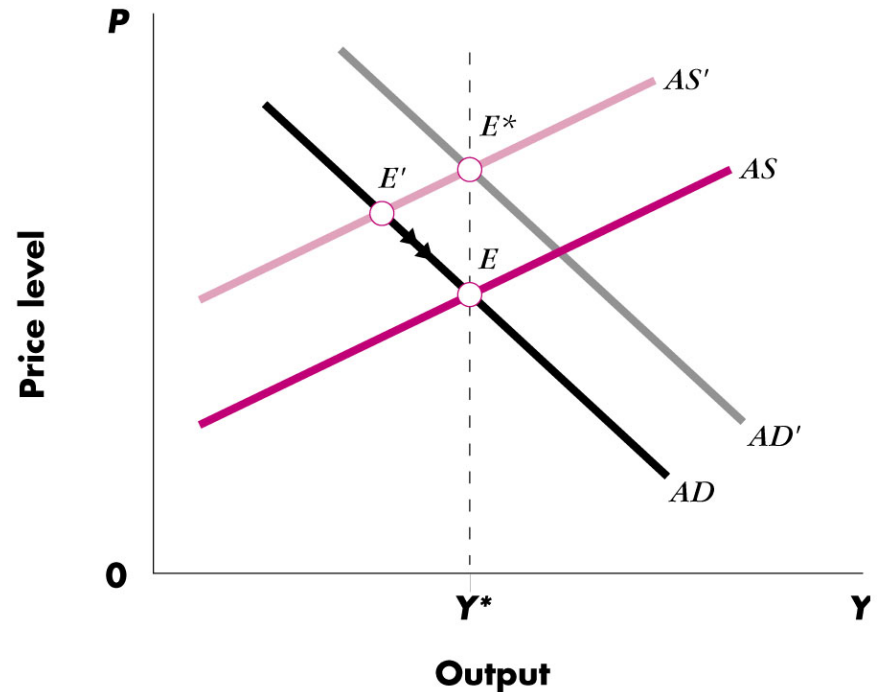
Supply Shocks

- Figure 6-10 also shows the impact of AD policy after an adverse supply shock
  - Suppose G increases (to AD'):
    - Economy could move to E^* if increase enough
    - Such shifts are "accommodating policies" since accommodate the fall in the real wage at the existing nominal wage
    - Added inflation, although reduce u from AS shock
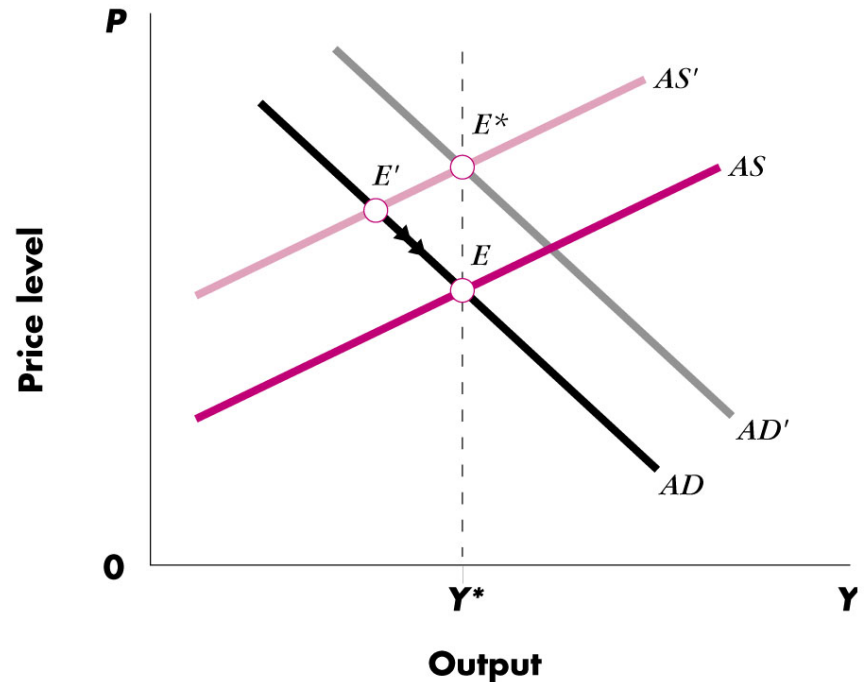
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MACROECONOMICS

The Anatomy of Inflation and Unemployment

Introduction

- So far have focused on how various economic factors determine output, prices, unemployment, and inflation $\rightarrow$ now examine the consequences of inflation and unemployment and the tradeoff between them

- What are the "big picture" costs of moderate inflation and unemployment rates?

  - There are two major costs of unemployment:
    1. Lost production
    2. Undesirable effects on the distribution of income

  - The costs of inflation depend on the type:
    - $\rightarrow$ Unanticipated inflation creates significant redistribution of wealth
    - $\rightarrow$ Impact of anticipated inflation, especially of moderate levels, is small

Unemployment

- The greatest single cost of unemployment is lost production → people who can't work don't produce
  - This cost is large: a recession can easily cost 3-5% of GDP and hundreds of billions of dollars
  - Okun's law states that 1 extra point of unemployment costs 2% of GDP [See Figure 7-1]
- Costs are borne unevenly, and largely by those who lose their jobs
  - Workers just entering the labor force and teenagers are amongst the hardest hit
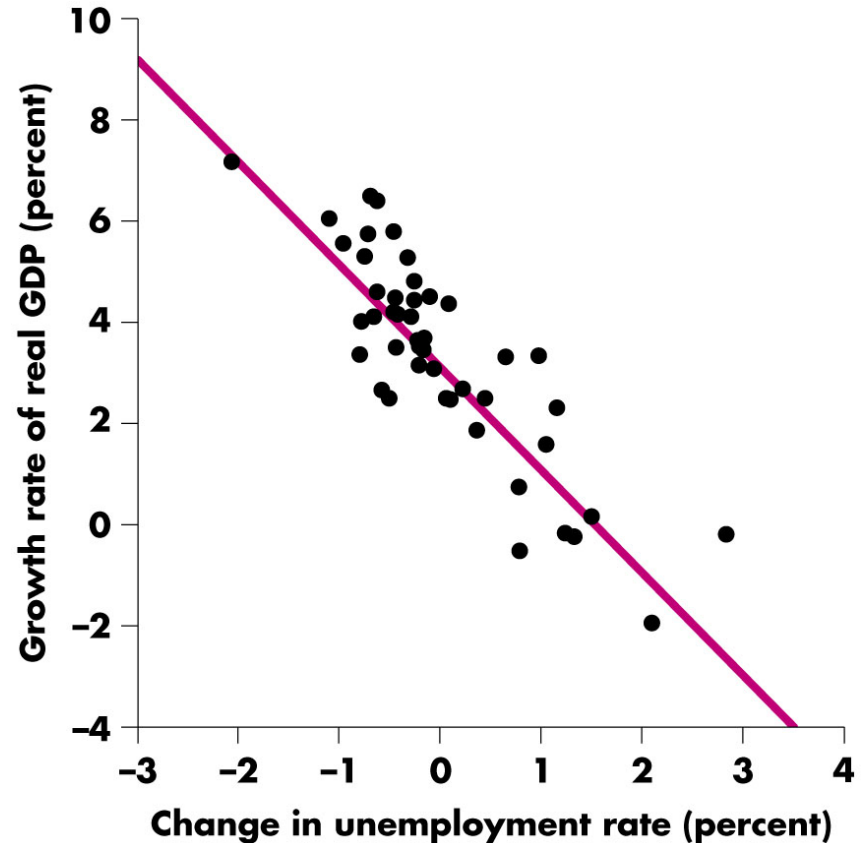
Inflation

- Costs of extremely high inflation are easy to see
  - M lubricates the economy $\rightarrow$ if P increase dramatically:
    - money is no longer a useful medium of exchange
    - output can drop substantially
- Costs of low, single-digit inflation are more difficult to identify
- Unanticipated inflation has a distributional cost:
  - debtors benefit by repaying in cheaper dollars
  - creditors suffer by being repaid in cheaper dollars

The Anatomy of Unemployment

- Research has revealed five key characteristics of unemployment in the U.S.

  1. There are large variations in unemployment rates across groups defined by age, race, or experience.

  2. There is high turnover in the labor market. Flows into and out of employment and unemployment are high relative to the numbers of employed or unemployed.

  3. A significant part of this turnover is cyclical: Layoffs and separations are high during recessions, and voluntary quits are high during booms.

  4. Most people who become unemployed in any given month remain unemployed for only a short time.

  5. Much of the U.S. unemployment consists of people who will be unemployed for quite a long time.

The Anatomy of Unemployment

- The size of the labor force is determined from surveys by the BLS

  - Labor force = unemployed (U) + employed (E)

- Unemployed is one who is out of work <u>and</u> who either

  1. Has actively looked for work during the previous 4 weeks <u>OR</u>
  2. Is waiting to be recalled to a job after having been laid off

TABLE 7-2   U.S. Labor Force and Unemployment, 2005
(Millions of Persons 16 Years and Over)

Working-age population	226.1
Labor force	149.3
Employed	141.7
Unemployed	7.6
Not in labor force	76.8

Source: Bureau of Labor Statistics.

The Anatomy of Unemployment

- The size of the labor force is determined from surveys by the BLS
  - Labor force = unemployed (U) + employed (E)
- Employed person is one who during the reference week:
  1. Did at least one hour of work for pay in the last week
  2. Worked at least 15 hours as an unpaid worker for an enterprise owned by a family member OR
  3. Was not working, but only temporarily absent from work (ex. vacation or maturity leave)

TABLE 7-2   U.S. Labor Force and Unemployment, 2005
(Millions of Persons 16 Years and Over)

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Labor force	149.3
Employed	141.7
Unemployed	7.6
Not in labor force	76.8

Source: Bureau of Labor Statistics.

The Unemployment Pool

- At any point in time there is a given number, or pool, of unemployed people, and there are flows in and out of the unemployment pool.

- A person can become unemployed for one of four reasons:

  1. He/she may be a new entrant or reentrant into the LF
  2. The person may quit a job in order to look for other employment and may register as unemployed while searching
  3. The person may be laid off
  4. The worker may lose a job (fired or firm closes)

The Unemployment Pool

- At any point in time there is a given number, or pool, of unemployed people, and there are flows in and out of the unemployment pool.

- There are three ways of moving out of the unemployment pool:
    1. A person may be hired into a new job
    2. Someone laid off may be recalled
    3. An unemployed person may stop looking for a job, and thus move out of the labor force

- Unemployment is rising when more people are entering the pool than leaving
    - Job losses account for half of new unemployment; voluntary separations, new entrants, and reentrants into the LF account for the other half

Variation in Unemployment Across Groups

- The aggregate unemployment rate tells us the share of the labor force that is unemployed
  - The aggregate number conceals wide variations across various segments of the population
    - Teenagers have much higher unemployment rates than older workers
    - Black unemployment is higher than that of their white cohorts
    - Female unemployment was higher than male unemployment through the 1970s, but currently approximately equal
- The relationship between the aggregate unemployment rate, u, and that of groups is: $u = w_1 u_1 + w_2 u_2 + ... + w_n u_n$ (1), where w_i are the fraction of the civilian LF that falls within a specific group

Variation in Unemployment Across Groups

Total civilian labor force, age 16+
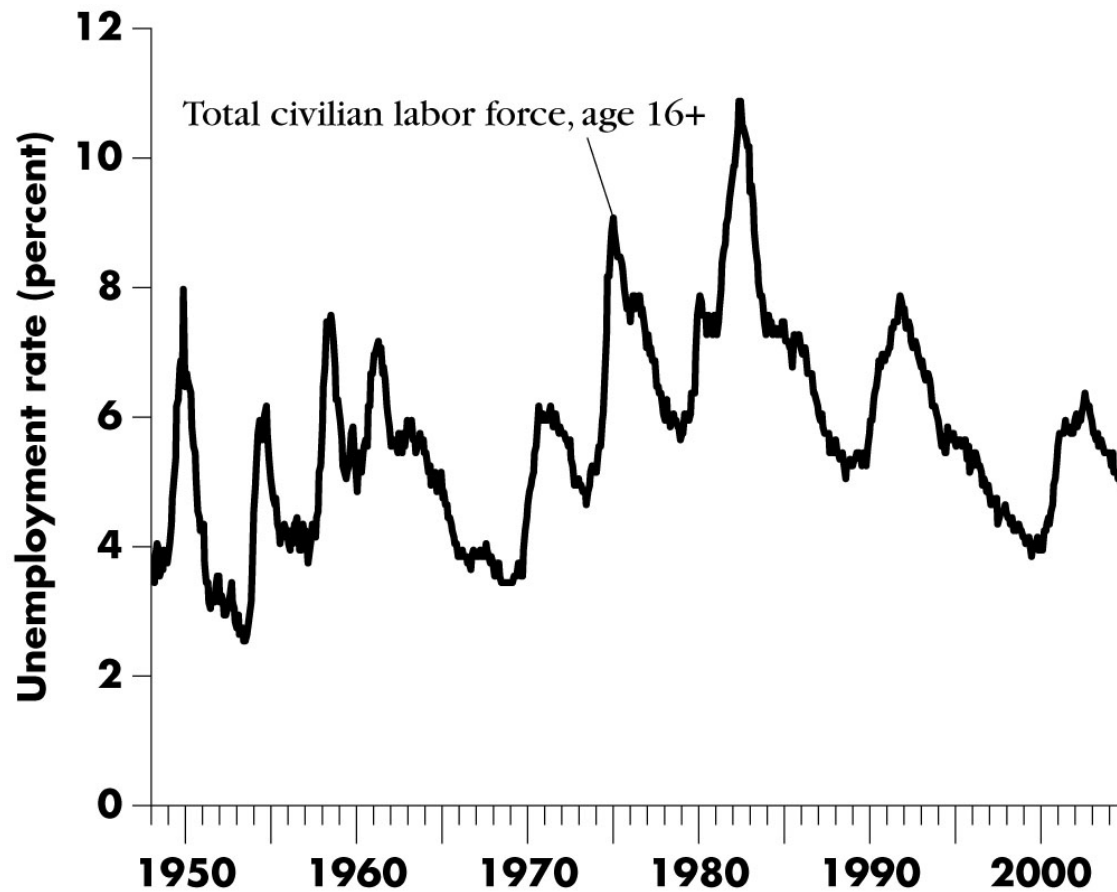
Cyclical and Frictional Unemployment

- <u>Frictional unemployment</u> is the unemployment that exists when the economy is at full employment
  - Results from the structure of the labor market, including:
    - ➤ The nature of jobs in the economy
    - ➤ Social habits
    - ➤ Labor market institutions
    - → *Frictional unemployment rate = natural rate of unemployment*
- <u>Cyclical unemployment</u> is unemployment in excess of frictional unemployment
  - Occurs when output is below the full employment level
  - The presence of cyclical unemployment indicates a downturn in the economy

Labor Market Flows

- Labor market turnover, flows into and out of unemployment and employment and between jobs, is large

- Table 7-3 shows the average of monthly flows in 2005 into and out of employment within the manufacturing sector

  ➢ Added 2.4 individuals per 100 employees to payrolls

  ➢ Removed 2.6 individuals per 100 employees from payrolls

People are taking and leaving jobs.

TABLE 7-3   Labor Turnover Rates in Manufacturing, 2005
(Per 100 Employees; Average of Monthly Data)

ACCESSIONS	SEPARATIONS			
HIRES	QUITS	LAYOFFS*	OTHER	TOTAL
2.4	1.3	1.0	0.3	2.6

*Includes involuntary separations.

Source: Bureau of Labor Statistics, Job Openings and Labor Turnover Survey.

Duration of Unemployment

- Another issue to consider when examining unemployment is the duration of unemployment spells
  - A spell of unemployment is a period in which an individual remains continuously unemployed
  - The duration of unemployment is the average length of time a person remains unemployed
- Table 7-4 shows the duration of unemployment for 2000 and 2003

TABLE 7-4   Unemployment by Duration

LENGTH OF UNEMPLOYMENT, WEEKS	PERCENT OF UNEMPLOYED	
	2000	2003
Less than 5	44.9	31.7
5–14	31.9	29.8
15–26	11.8	16.4
27 and over	11.4	22.1
Mean number of weeks	12.6 wk.	19.2 wk.
Unemployment rate	4.0	6.0

Source: Bureau of Labor Statistics.

Determinants of the Natural Rate

- The determinants of the natural rate of unemployment, u^*, can be thought of in terms of the <u>duration</u> and <u>frequency</u> of unemployment
  - The duration of unemployment depends on cyclical factors and on the following structural characteristics of the labor market:
    - The organization of the labor market, including the presence or absence of employment agencies, youth employment services, etc.
    - The demographic makeup of the labor force
    - The ability and desire of the unemployed to keep looking for a better job, which depends in part on the availability of unemployment benefits

Determinants of the Natural Rate

- The determinants of the natural rate of unemployment, u^*, can be thought of in terms of the <u>duration</u> and <u>frequency</u> of unemployment
  - The frequency of unemployment is the average number of times per period that workers become unemployed
    - There are two basic determinants of the frequency of unemployment:
      - ➢ Variability of the demand for labor across different firms in the economy
      - ➢ The rate at which new workers enter the labor force, since new potential workers begin as unemployed workers
- The three determinants of duration and the two determinants of frequency of unemployment are the basic determinants of the natural rate of unemployment

Estimates of the Natural Rate

- The equation for the natural rate of unemployment is similar to equation (1): $u^* = w_1 u_1^* + w_2 u_2^* + ... + w_n u_n^*$ (2)
  - Equation (2) says that the natural rate is the weighted average of the natural rates of unemployment of the subgroups in the LF
    - Several adjustments are needed to account for:
      ➤ Changing composition of the LF, including increasing share of teenagers
      ➤ Changes in the fundamental determinants of the natural rate, including unemployment benefits
- The Congressional Budget Office (CBO) provides an official full-employment-unemployment rate estimate
  - If actual unemployment rate is above natural rate, $u > u^*$, $Y < Y^*$
  - If actual unemployment rate is below natural rate, $u < u^*$, $Y > Y^*$

Estimates of the Natural Rate
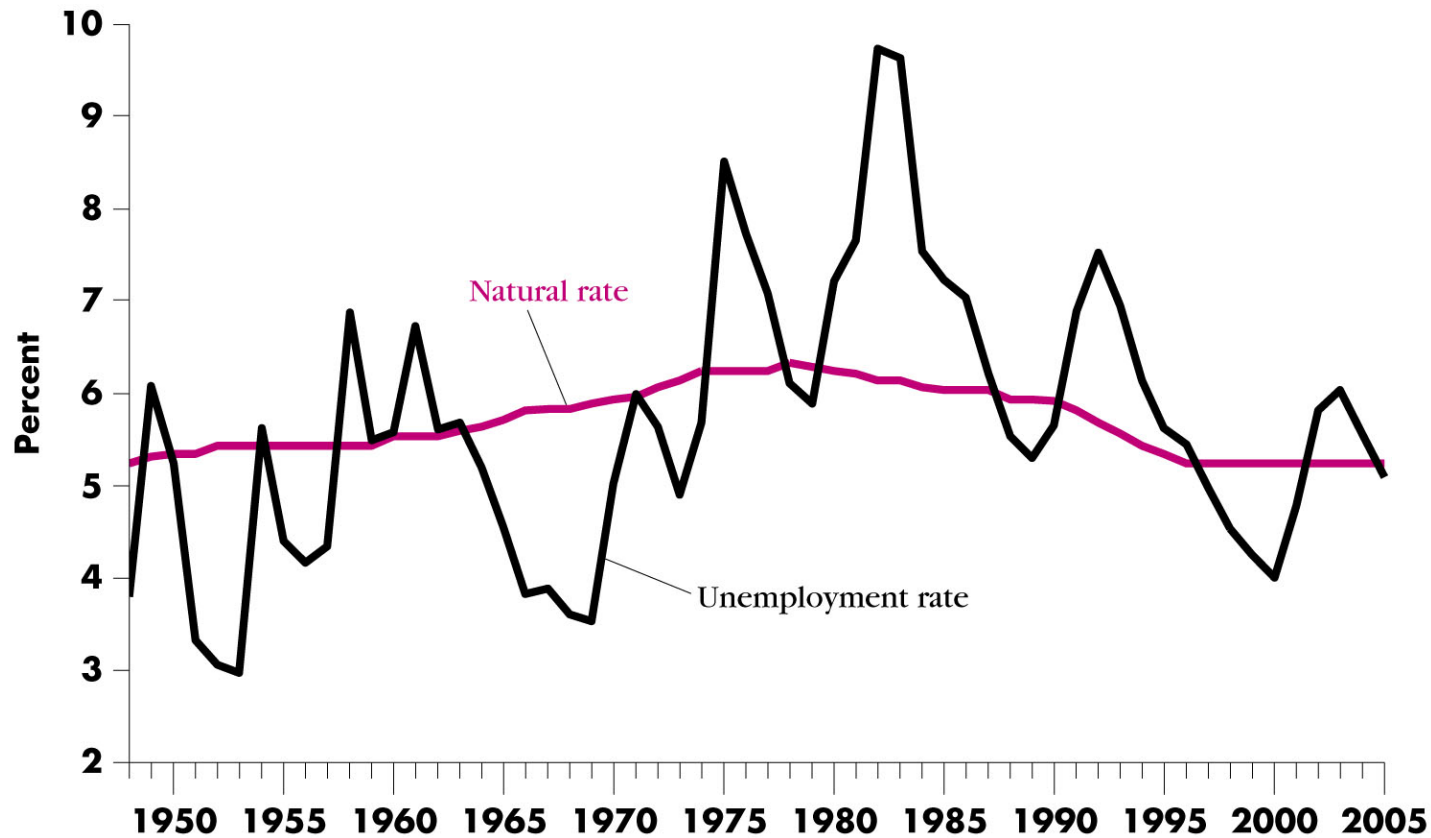
Hysteresis and the Rising Natural Rate of Unemployment

- Between 1973 and 1988 the U.S. unemployment rate stayed well above the natural rate estimated using the demographic adjustment method
  - Some economists argue that the unemployment rate over long periods cannot move too far from the natural rate $\rightarrow$ the natural rate must have increased over this time period

WHY?

- One explanation is <u>unemployment hysteresis</u>: extended periods of high unemployment raise the natural rate
  - Unemployed might become accustomed to not working
  - Unemployed could become discouraged and not vigorously seek work
  - Long unemployment spells might signal to firms that a worker is undesirable, and the firms might avoid hiring such workers

Unemployment Benefits

- Unemployment benefits increase the rate of unemployment in two ways:
    1. Unemployment benefits allow for longer job searches
    2. Lessens the severity of being in and out of jobs

- Unemployment benefits increase the measured unemployment rate through <u>reporting effects</u>

    ➤ In order to collect unemployment insurance, a person must be considered "in the labor force," or actively seeking work → some seek work even if they do not really want the job to be counted as unemployed

    → One estimate suggests that reporting effects raise the unemployment rate by about half a percentage point

The Costs of Unemployment

- Unemployed persons suffer both from their income loss and from the related social problems that long periods of unemployment cause
  - <u>Costs of cyclical unemployment</u>:
    - ➢ Okun's law tells us that every 1 point increase in unemployment reduces output by 2 % points
    - ➢ Distributional impact of unemployment may be more dire for some groups than others (Ex. Teenagers vs. older workers)
    - ➢ In addition to lost output from unemployment, there is reduced tax revenues
  - <u>Social costs of unemployment</u>:
    - ➢ include increased divorce rates, suicide rates, and depression

The Costs of Inflation

- Perfectly anticipated inflation: Suppose an economy has been experiencing inflation of 5% and the anticipated rate of inflation is also 5%, then all contracts will build in the expected 5% inflation
  - Nominal interest rates account for the inflation
  - Long term labor contracts account for the inflation
  - Tax brackets are typically adjusted to account for the inflation
  - →Inflation has no real costs, except for two qualifications:
    - ➢ The costs of holding currency rise along with the rate of inflation, and the demand for currency decreases
    - ➢ Menu costs of inflation

The Costs of Inflation

- <u>Imperfectly anticipated inflation</u>: full adjustment to inflation does not describe economies in the real world → imperfectly anticipated

- Most contracts are written in nominal terms

    - If inflation is unexpectedly high, debtors repay loans in cheaper dollars

    - If inflation in unexpectedly low, debtors repay loans in more valuable dollars (take a loss)

    → The possibility of unexpected inflation introduces an element of risk, which might prevent some from making some exchanges they otherwise would undertake

    → Unanticipated inflation redistributes wealth and income

Inflation and Indexation

- In counties where inflation rates are high and uncertain, long-term borrowing using nominal debt becomes impossible: lenders are simply too uncertain about the real value of the repayments they will receive
  - In such countries governments issue *indexed debt*: a bond is indexed to the the price level when either the interest rate or the principle or both are adjusted for inflation
    - The holder of the indexed bond will typically receive interest equal to the stated real rate plus the actual inflation rate $\rightarrow$ risk reducing
- Some formal labor contracts include cost of living adjustment (COLA) provisions
  - Link increases in money wages to increases in the price level

Inflation and Indexation

- Suppose real material prices increase, and firms pass these cost increases on as higher prices of final goods
  - Consumer prices will increase
  - Under a system of wage indexation, wages will also rise $\rightarrow$ this leads to further price, materials-cost, and wage increases
  - $\rightarrow$ Indexation in this example feeds an inflation spiral
- Need to differentiate between supply and demand shocks to understand the consequences of wage indexation
  - In the case of a demand shock, there is a "pure" inflation disturbance and firms can afford to pay the same real wages and will not be affected by indexation
  - In the case of a supply shock, real wages fall, and full indexation prevents this from happening
  - $\rightarrow$ Wage indexation complicates the adjustment of an economy to supply shocks

Inflation and Indexation

- Many have argued that the government should adopt indexation on a broad scale, including bonds and the tax system because:
  - ➢ Inflation would be easier to live with
  - ➢ Costs of unanticipated inflation would disappear
- Governments have been reluctant to index for three reasons:
  1. Indexing makes it harder for the economy to adjust to shocks whenever changes in relative prices are needed
  2. Indexing adds another layer of calculation to most contracts
  3. Indexation will weaken the political will to fight inflation, lead to higher inflation, and perhaps make the economy worse off

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MACROECONOMICS

Chapter 8

Policy Preview

Introduction

- Focus of this chapter is monetary policy

  - Examine how the central bank sets interest rates in order to control aggregate demand

- Begin with a "media level" description of the operation of central bank policy (*who, what, why, when, and how*)

  - Fundamentally, the central bank moves interest rates in response to deviations of output and inflation from desired levels $\rightarrow$ a notion that is summarized by the Taylor rule

- Finally, discuss how the central bank decides how much to move interest rates

The "Who" of Policy

- Although both fiscal and monetary policy can be used to fine tune the economy, as a practical matter, most short-run fine tuning is done with monetary policy

- The "who" of stabilization policy = central bank

  - In the U.S., the central bank is the Federal Reserve Bank

  - Formally, U.S. monetary policy is established by vote of the Fed's Open Market Committee (FOMC)

    - The chair (currently Ben Bernanke) can typically swing that vote

    - In other countries, the formal decision making authority is vested solely in the governor of the central bank

The "What" of Policy

- What the Fed actually does is set a key interest rate in the economy – the federal funds rate
  - Raising interest rates tends to cool off the economy
  - Lowering interest rates tends to heat up the economy
- Lower interest rates encourage greater investment spending and greater spending on some consumption goods, thus increasing AD
  - Monetary policy works through AD
  - Monetary policy has little influence on AS

The "Why" of Policy

- Central banks choose short-run policy with two goals in mind:
    1. Maintain high economic activity
    2. Maintain low inflation rates

  $\rightarrow$ An obvious conflict between these goals

- Additional conflict between central bank's preferences and capabilities

    - Except at high inflation rates, boosting economic activity does much more to enhance economic welfare than does controlling inflation $\rightarrow$ Due to the different slopes of the SRAS and LRAS

        - Central banks focus on stabilizing economic activity around a sustainable goal (Y^*) and have moved toward *inflation targeting*

"When" Policy Is Made

- FOMC meets every six weeks and sets the federal funds rate

- Fed tries not to "surprise" markets
  - Sends advance signals of the likely future path of interest rates
    - At each meeting appropriate language is chosen to describe the Fed's thinking about the near future
    - Markets listen to these words closely and react to the signals that they send

- Current Fed chair Ben Bernanke has emphasized the need to increase such *transparency*

"How" Policy Is Implemented

- Fed "sets" the interest rate by buying or selling Treasury bills to lower or raise the interest rate
- The Fed buys Treasury bills with money it prints (electronically)
  - Lowering interest rates means increasing the money supply
  - The increased money supply results, eventually, in increased prices
- In chapter 10 we will see how the increased money supply moves out the LM curve

Policy as a Rule

- When central bank sets the interest rate, makes a decision on the current economic situation

  - Useful to set that decision within the overall framework of a *monetary policy rule*

  - A general format of a monetary policy rule is:

$$i_t = r^* + \Pi_t + \alpha(\Pi_t - \Pi^*) + \beta\left(100 \times \frac{Y_t - Y_t^*}{Y_t^*}\right) \quad (1)$$

  $\rightarrow r^*$ is the real, "natural" rate of interest, corresponding to the real interest rate we would observe if the economy operating at the full employment level of output

  $\rightarrow \Pi^*$ is the Fed's target rate of inflation

Policy as a Rule

$$i_t = r^* + \Pi_t + \alpha(\Pi_t - \Pi^*) + \beta\left(100 \times \frac{Y_t - Y_t^*}{Y_t^*}\right)$$

- If α and β are large, then the monetary rule dictates aggressive responses to excess inflation and to economic booms

- If α is large relative to β, then the monetary authority will respond much more aggressively to inflation than it will to the level of economic activity

- The case of β=0 corresponds to pure inflation targeting

Equation (1) is the Taylor rule

Interest Rates and Aggregate Demand

- Higher interest rates raise the opportunity cost of purchasing goods for investment and consumption → reducing demand

- Ignoring all other elements that affect aggregate demand, we can write:

$$Y = C(i) + I(i) + G + NX = AD(i) \quad (2)$$

  ➢ If the Fed raises interest rates, the AD curve shifts to the left, as shown in Figure 8-1

    ➢ Higher interest rates lower prices, but also reduce economic activity
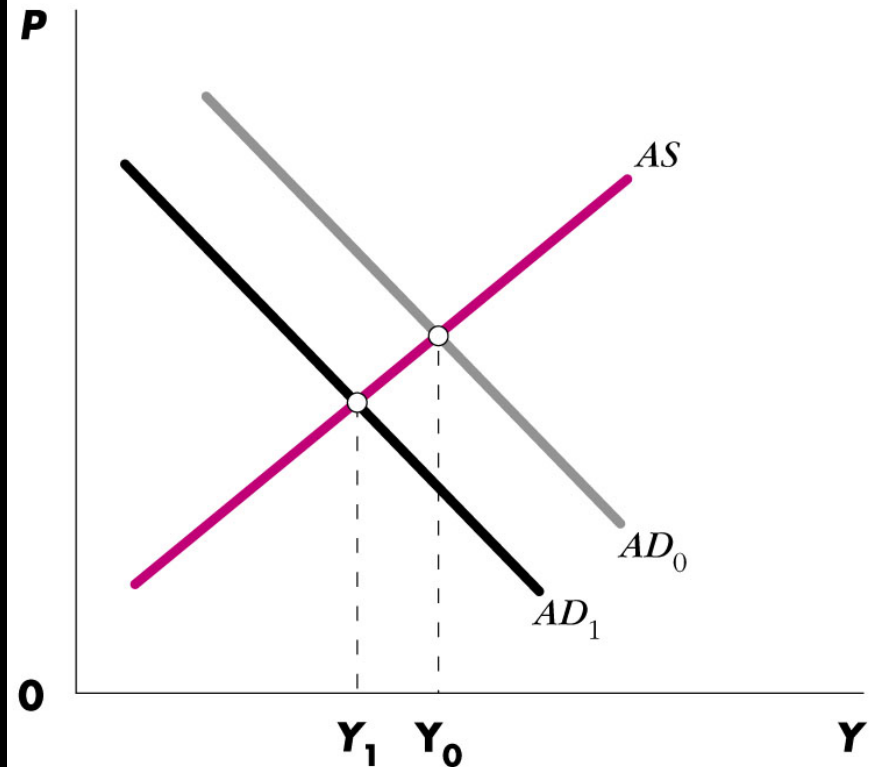
Calculating How to Hit the Target

- Steps taken by a policy maker are:
  - Determining where output and the price level should be (or employment and inflation)
  - Determining how much they need to shift AD or AS to hit those targets
  - Determining how large a policy change is required to move the AD or AS the necessary distance
- Box 8-3 works out an example of this sort of policy formulation

Calculating How to Hit the Target

BOX 8-1 Central Banks

In some countries, the national government has a good deal of influence—sometimes officially and sometimes behind closed doors—on the decisions of the central bank. The trend has been toward greater central bank independence (see Section 17-7), which means that the personal histories and future plans of individual central bankers matter.*

Interestingly, at this writing the central banks of the United States, Israel, Chile, and Italy are all headed by economics PhDs. And the heads of the U.S. and Israeli central banks have each co-authored well-known intermediate macro texts!

*See Chris Adolph's *The Dilemma of Discretion: Career Ambitions and the Politics of Central Banking*, Harvard University dissertation, 2005.

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MACROECONOMICS

Income and Spending

Introduction

- One of the central questions in macroeconomics is why output fluctuates around its potential level

  - In business cycle booms and recessions, output rises and falls relative to the trend of potential output

- This chapter offers a first theory of these fluctuations in real output relative to trend

  - Cornerstone of this model is the mutual interaction between output and spending: spending determines output and income, but output and income also determine spending

- The Keynesian model of income determination develops the theory of AD

  - Assume that prices do not change at all and that firms are willing to sell any amount of output at the given level of prices $\rightarrow$ AS curve is flat

AD and Equilibrium Output

- AD is the total amount of goods demanded in the economy: $AD = C + I + G + NX$ (1)

- Output is at its equilibrium level when the quantity of output produced is equal to the quantity demanded, or $Y = AD = C + I + G + NX$ (2)

- When AD is not equal to output there is unplanned inventory investment or disinvestment: $IU = Y - AD$ (3), where IU is unplanned additions to inventory

  - If IU > 0, firms cut back on production until output and AD are again in equilibrium

The Consumption Function

- Consumption is the largest component of AD
  - Consumption is not constant, but increases with income $\rightarrow$ the relationship between between consumption and income is described by the <u>consumption function</u>
  - If C is consumption and Y is income, the consumption function is $C = \overline{C} + cY$ (4), where $\overline{C} > 0$ and $0 < c < 1$
  - The intercept of equation (4) is the level of consumption when income is zero $\rightarrow$ this is greater than zero since there is a subsistence level of consumption
  - The slope of equation (4) is known as the marginal propensity to consume (MPC) $\rightarrow$ the increase in consumption per unit increase in income

The Consumption Function
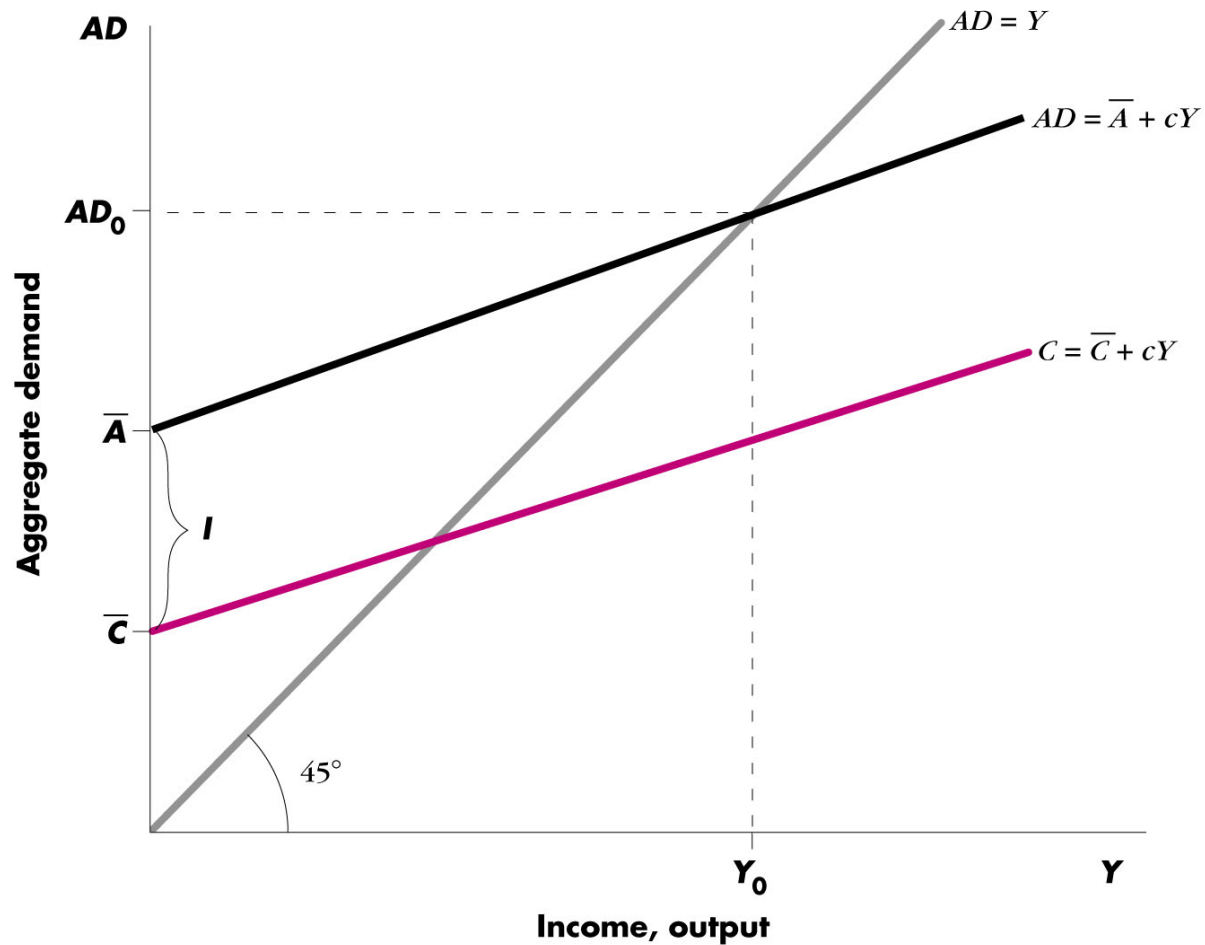
Consumption and Savings

- Income is either spent or saved $\rightarrow$ a theory that explains consumption is equivalently explaining the behavior of saving

  - More formally, $S \equiv Y - C$ (5) $\rightarrow$ a budget constraint

- Combining (4) and (5) yields the savings function:

$$S \equiv Y - C = Y - \overline{C} - cY = -\overline{C} + (1-c)Y \quad (6)$$

  - Saving is an increasing function of the level of income because the marginal propensity to save (MPS), s = 1-c, is positive

    - Savings increases as income rises

    - Ex. If MPS is 0.1, for every extra dollar of income, savings increases by $0.10 <u>OR</u> consumers save 10% of an extra dollar of income

Consumption, AD, and Autonomous Spending

- Now we incorporate the other components of AD: G, I, taxes, and foreign trade (assume autonomous)
  - Consumption now depends on disposable income,
  $$YD = Y - TA + TR \quad \text{(7)} \quad \text{and} \quad C = \overline{C} + cYD = \overline{C} + c(Y + TR - TA) \quad \text{(8)}$$
- AD then becomes
$$
\begin{aligned}
AD &= C + I + G + NX \\
&= \overline{C} + c(Y - TA + TR) + I + G + NX \\
&= \left[\overline{C} - c(TA - TR) + I + G + NX \right] + cY \\
&= \overline{A} + cY
\end{aligned}
\quad \text{(9)}
$$

where A is independent of the level of income, or autonomous

Consumption, AD, and Autonomous Spending
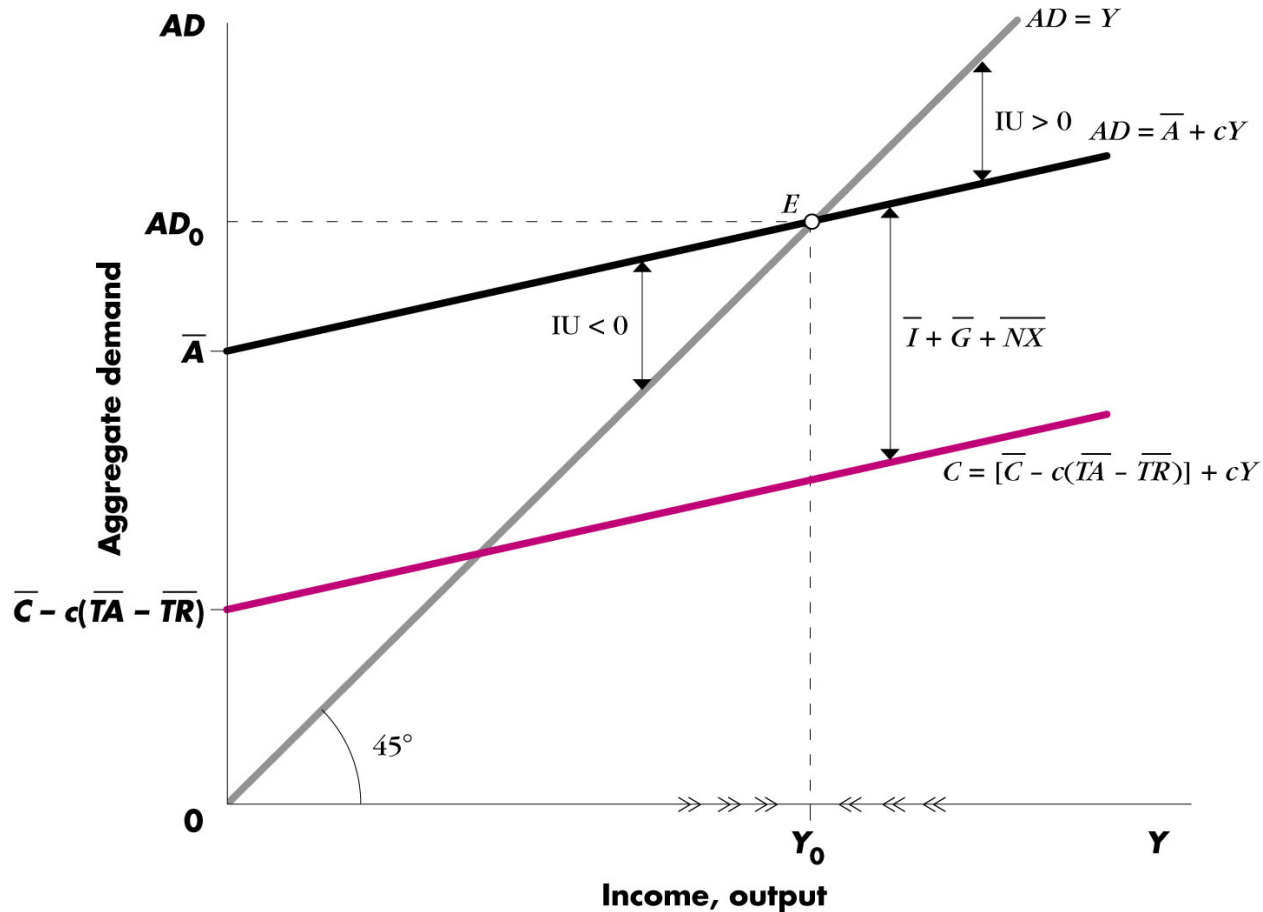
Equilibrium Income and Output

- Equilibrium occurs where Y=AD, which is illustrated by the 45° line in Figure 9-2 → point E

- The arrows in Figure 9-2 show how the economy reaches equilibrium

  - At any level of output below Y_0, firms' inventories decline, and they increase production

  - At any level of output above Y_0, firms' inventories increase, and they decrease production

  Process continues until reach Y_0
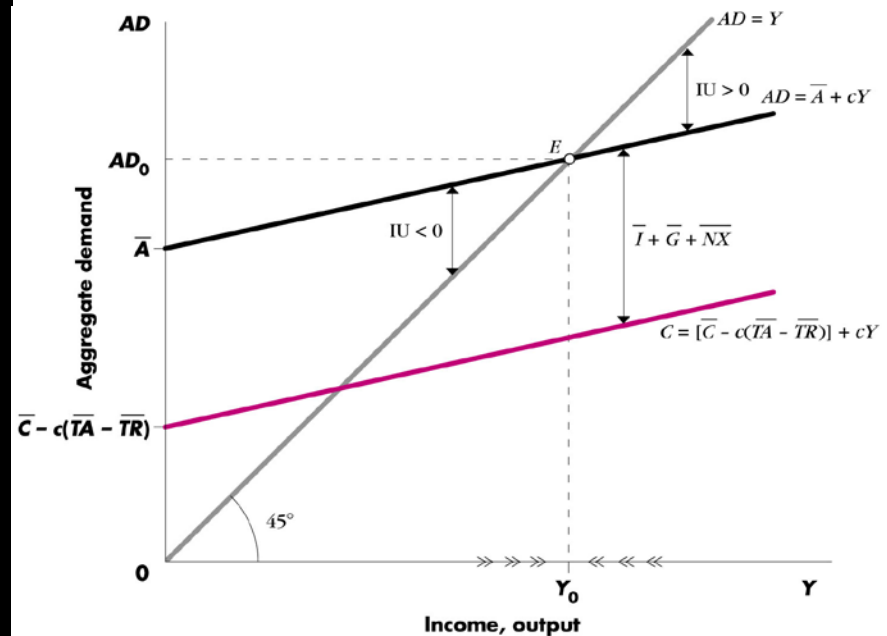
The Formula for Equilibrium Output

- Can solve for the equilibrium level of output, Y_0, algebraically:
  - The equilibrium condition is $Y = AD$ (10)
  - Substituting (9) into (10) yields $Y = \overline{A} + cY$ (11)
  - Solve for Y to find the equilibrium level of output:

$$Y - cY = \overline{A}$$

$$Y(1-c) = \overline{A} \qquad (12)$$

$$Y_0 = \frac{1}{(1-c)}\overline{A}$$

  The equilibrium level of output is higher the larger the MPC and the higher the level of autonomous spending.

The Formula for Equilibrium Output

- Equation (12) shows the level of output as a function of the MPC and A
  - Frequently we are interested in knowing how a *change* in some component of autonomous spending would *change* output
  - Relate changes in output to changes in autonomous spending through $\Delta Y = \dfrac{1}{(1-c)} \Delta A$ (13)
    - Ex. If the MPC = 0.9, then 1/(1-c) = 10 → an increase in government spending by $1 billion results in an increase in output by $10 billion
      - Recipients of increased government spending increase their own spending, the recipients of that spending increase their spending and so on

Saving and Investment

- In equilibrium, planned investment equals saving in an economy with no government or trade

  - In figure 9-2, the vertical distance between the AD and consumption schedules is equal to planned investment spending, I

  - The vertical distance between the consumption schedule and the 45° line measures saving at each level of income

    $\rightarrow$ at Y_0 the two vertical distances are equal and S = I
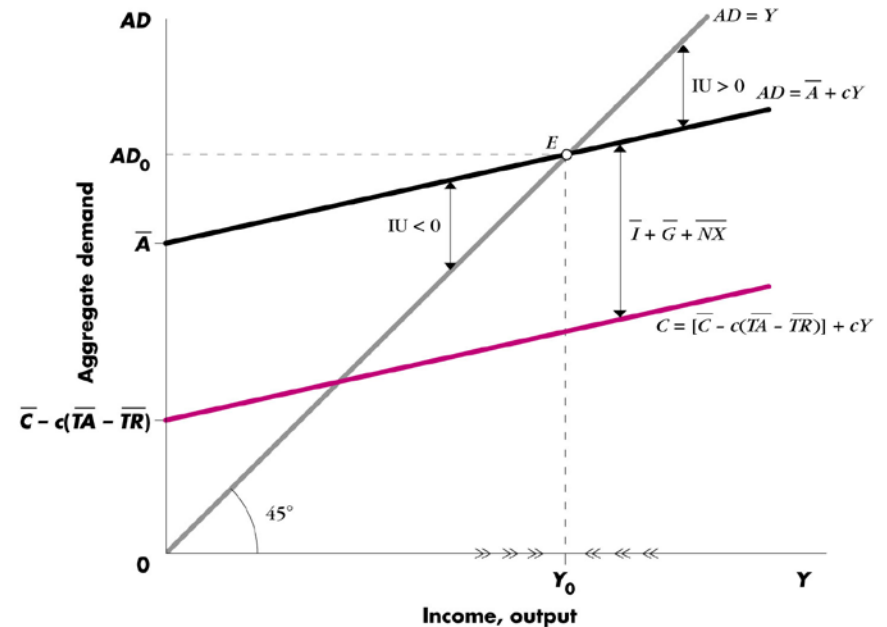
Saving and Investment

- The equality between planned investment and saving can be seen directly from national income accounting
  - Income is either spent or saved: $Y = C + S$
  - Without G or trade, $Y = C + I$
  - Putting the two together: $C + S = C + I$

  $$S = I$$

- With government and foreign trade in the model:
  - Income is either spent, saved, or paid in taxes: $Y = C + S + TA - TR$
  - Complete aggregate demand is $AD = C + I + G + NX$
  - Putting the two together: $C + I + G + NX = C + S + TA - TR$

  $$I = S + (TA - TR - G) - NX \qquad (14)$$

The Multiplier

- By how much does a $1 increase in autonomous spending raise the equilibrium level of income? $\rightarrow$ The answer is <u>not</u> $1

  - Out of an additional dollar in income, $c is consumed

  - Output increases to meet this increased expenditure, making the total change in output $(1+c)$

  - The expansion in output and income, will result in further increases $\rightarrow$ process continues

  <u>The steps in the process are shown in Table 9-1.</u>

TABLE 9-1	The Multiplier		
	INCREASE IN DEMAND	INCREASE IN PRODUCTION	TOTAL INCREASE IN INCOME
ROUND	THIS ROUND	THIS ROUND	(ALL ROUNDS)
1	$\Delta \overline{A}$	$\Delta \overline{A}$	$\Delta \overline{A}$
2	$c\Delta \overline{A}$	$c\Delta \overline{A}$	$(1 + c)\Delta \overline{A}$
3	$c^2\Delta \overline{A}$	$c^2\Delta \overline{A}$	$(1 + c + c^2)\Delta \overline{A}$
4	$c^3\Delta \overline{A}$	$c^3\Delta \overline{A}$	$(1 + c + c^2 + c^3)\Delta \overline{A}$
. . .	. . .	. . .	. . .
. . .	. . .	. . .	. . .
. . .	. . .	. . .	$\frac{1}{1 - c}\Delta \overline{A}$

The Multiplier

- If we write out the successive rounds of increased spending, starting with the initial increase in autonomous demand, we have: $\Delta AD = \Delta \overline{A} + c\Delta \overline{A} + c^2\Delta \overline{A} + c^3\Delta \overline{A} + ...$ (15)

$$= \Delta \overline{A}(1 + c + c^2 + c^3 + ...)$$

- This is a geometric series, where c < 1, that simplifies to:

$$\Delta AD = \frac{1}{(1-c)}\Delta \overline{A} = \Delta Y_0 \quad (16)$$

- The multiple 1/(1-c) is the multiplier
- The multiplier = amount by which equilibrium output changes when autonomous aggregate demand increases by 1 unit

- The general definition of the multiplier is $\dfrac{\Delta Y}{\Delta A} = \alpha = \dfrac{1}{(1-c)}$ (17)

The Multiplier

- Figure 9-3 provides a graphical interpretation of the effects of an increase in autonomous spending on the equilibrium level of output

  - The initial equilibrium is at point E, with income at Y_0

  - If autonomous spending increases, the AD curve shifts up by $\Delta \overline{A}$, and income increases to Y'

  - The new equilibrium is at E' with income at
    $$\Delta Y_0 = Y_0{}' - Y_0$$
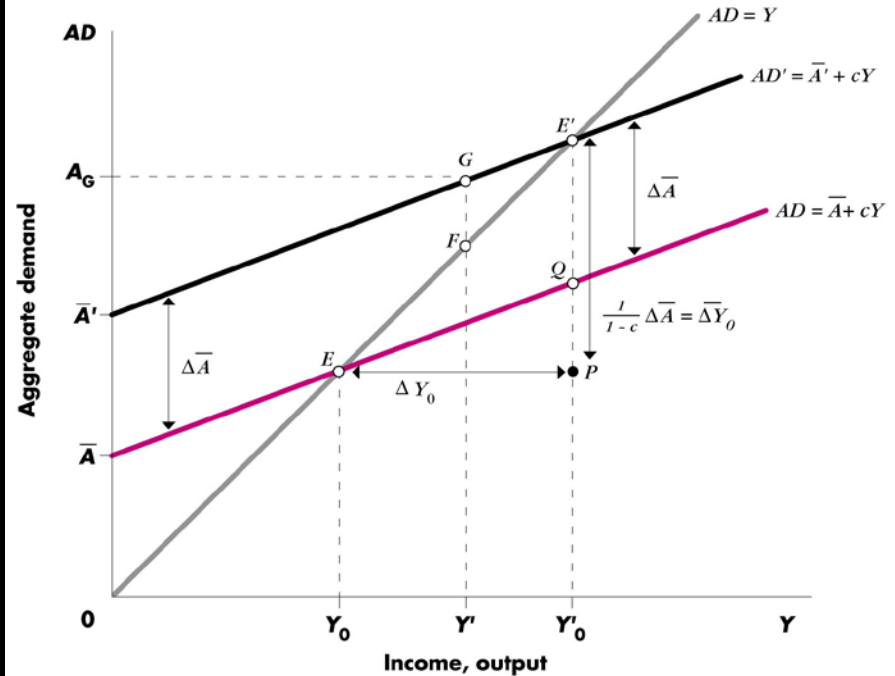
The Government Sector

- The government affects the level of equilibrium output in two ways:
  1. Government expenditures (component of AD)
  2. Taxes and transfers

- Fiscal policy is the policy of the government with regards to G, TR, and TA
  - Assume G and TR are constant, and that there is a proportional income tax (t)
  - The consumption function becomes:

$$C = \overline{C} + c(Y + TR - tY)$$
$$= \overline{C} + cTR + c(1-t)Y \quad (19)$$

The MPC out of income becomes c(1-t)

The Government Sector

- Combining (19) with AD:
$$AD = C + I + G + NX$$
$$= \left[\overline{C} + cTR + c(1-t)Y\right] + I + G + NX \quad (20)$$
$$= A + c(1-t)Y$$

- Using the equilibrium condition, Y=AD, and equation (19), the equilibrium level of output is:
$$Y = \overline{A} + c(1-t)Y$$
$$Y - c(1-t)Y = \overline{A}$$
$$Y[1 - c(1-t)] = \overline{A} \quad (21)$$
$$Y_0 = \frac{\overline{A}}{1 - c(1-t)}$$

- The presence of the government sector flattens the AD curve and reduces the multiplier to $\dfrac{1}{(1 - c(1-t))}$

# Income Taxes as an Automatic Stabilizer

- Automatic stabilizer is any mechanism in the economy that automatically (without case-by-case government intervention) reduces the amount by which output changes in response to a change in autonomous demand
  - One explanation of the business cycle is that it is caused by shifts in autonomous demand, especially investment
  - Swings in investment demand have a smaller effect on output when automatic stabilizers are in place (ex. Proportional income tax)
    - Unemployment benefits are another example of an automatic stabilizer $\rightarrow$ enables unemployed to continue consuming even though they do not have a job

Effects of a Change in Fiscal Policy

- Suppose government expenditures increase

  - Results in a change in autonomous spending and shifts the AD schedule upward by the amount of that change

  - At the initial level of output, Y_0, the demand for goods > output, and firms increase production until reach new equilibrium (E')

- How much does income expand? The change in equilibrium income is

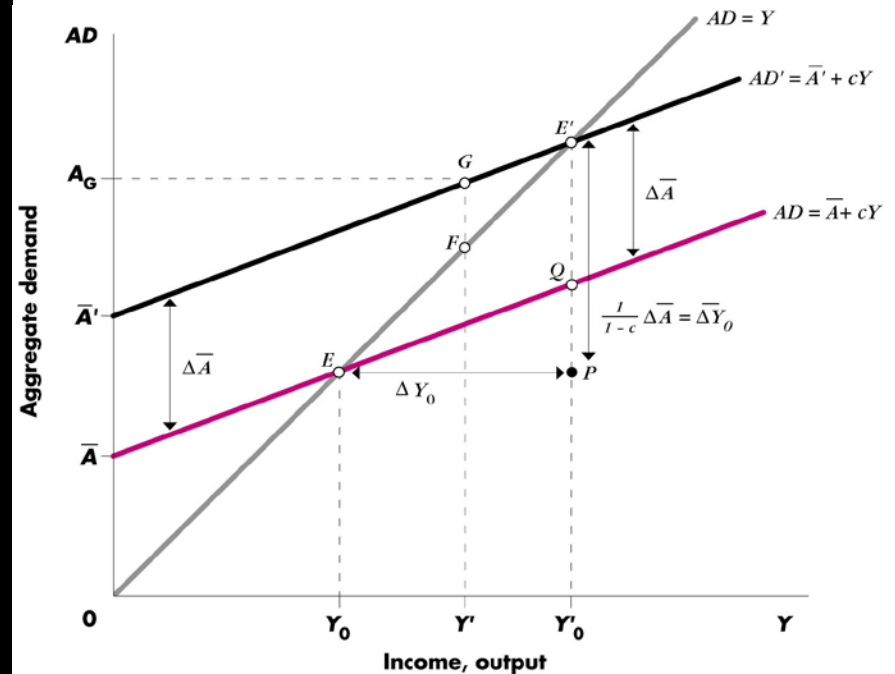$$\Delta Y_0 = \frac{1}{1 - c(1 - t)} \Delta \overline{G} = \alpha_G \Delta \overline{G} \text{ (22)}$$
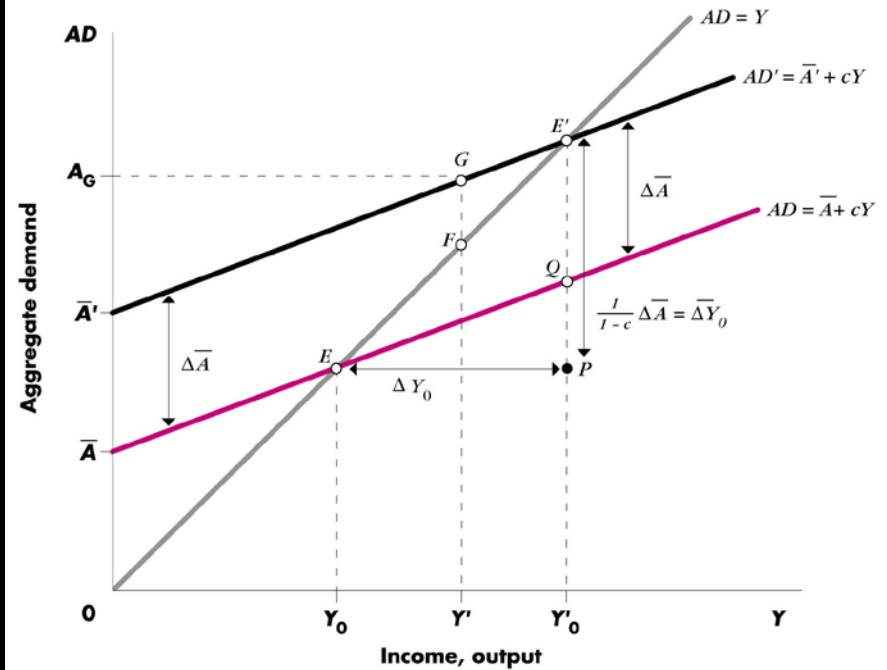
Effects of a Change in Fiscal Policy

$$\Delta Y_0 = \frac{1}{1-c(1-t)} \Delta \overline{G} = \alpha_G \Delta \overline{G} \qquad (22)$$

- A $1 increase in G will lead to an increase in income in excess of a dollar

  - If c = 0.80 and t = 0.25, the multiplier is 2.5

  → A $1 increase in G results in an increase in equilibrium income of $2.50

  → ΔG and ΔY shown in Figure 9-3

**Expansionary fiscal policy measure**

Effects of a Change in Fiscal Policy

- Suppose government increases TR instead
  - Autonomous spending would increase by only $c\Delta TR$, so output would increase by $\alpha_G \, c\Delta TR$
  - The multiplier for transfer payments is smaller than that for G by a factor of c
    - Part of any increase in TR is saved (since considered income)
- If the government increases marginal tax rates, two things happen:
  - The direct effect is that AD is reduced since disposable income decreases, and thus consumption falls
  - The multiplier is smaller, and the shock will have a smaller effect on AD

The Budget

- Government budget deficits have been the norm in the U.S. since the 1960s
- Is there a reason for concern over a budget deficit?
  - The fear is that the government's borrowing makes it difficult for private firms to borrow and invest $\rightarrow$ slows economic growth
- The budget surplus is the excess of the government's revenues, TA, over its initial expenditures consisting of purchases of goods and services and TR: $BS \equiv TA - G - TR$ (24)
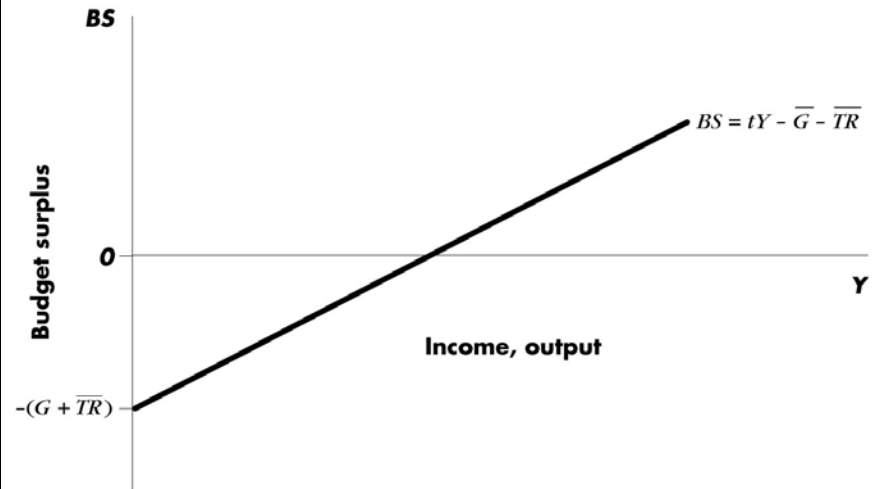 - A negative budget surplus is a budget deficit
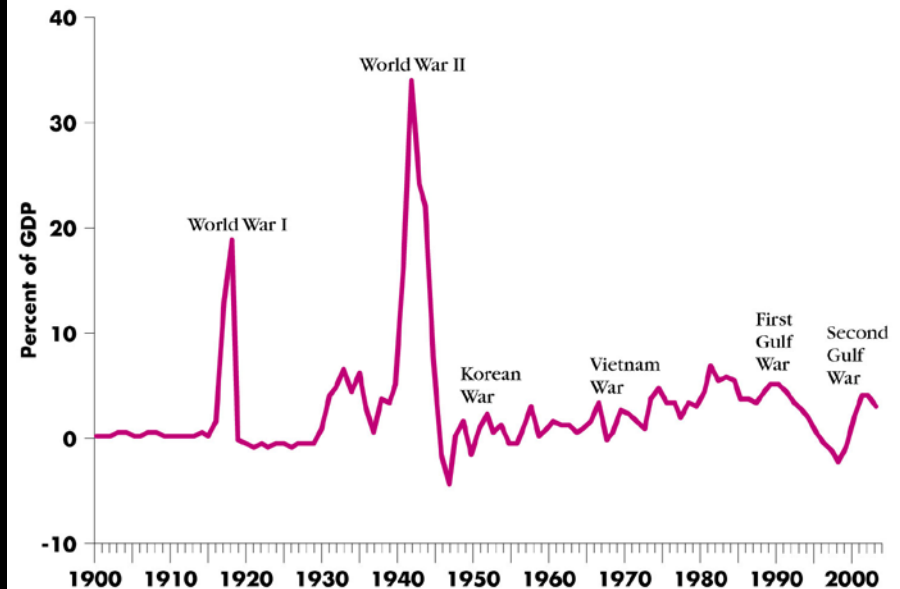
The Budget

- If TA = tY, the budget surplus is defined as:

$$BS \equiv tY - G - TR \quad (24a)$$

- Figure 9-6 plots the BS as a function of the level of income for given G, TR, and t
  - At low levels of income, the budget is in deficit since spends more than it receives in income
  - At high levels of income, the budget is in surplus since the government receives more in income than it spends
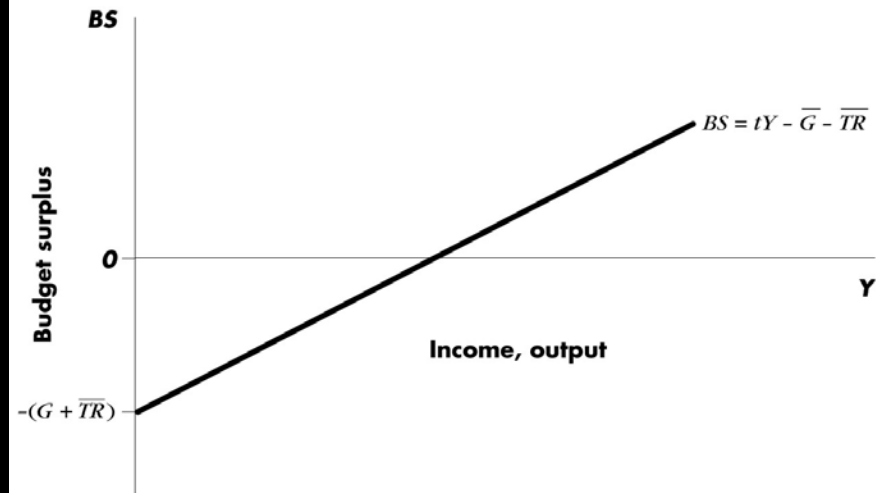
The Budget

- If TA = tY, the budget surplus is defined as:
$$BS \equiv tY - G - TR \quad \text{(24a)}$$

- Figure 9-6 shows that the budget deficit depends not only on the government's policy choices (G, t, and TR), but also on anything else that shifts the level of income
  - Ex. Suppose that there is an increase in I demand that increases the level of output $\rightarrow$ budget deficit will fall as tax revenues increase

Effects of Government Purchases and Tax Changes on the BS

- How do changes in fiscal policy affect the budget? <u>OR</u> Must an increase in G reduce the BS?

  - An increase in G reduces the surplus, but also increases income, and thus tax revenues

  $\rightarrow$ Possibility that increased tax collections > increase in G

- The change in income due to increased G is equal to

  $\Delta Y_0 \equiv \alpha_G \Delta G$, a fraction of which is collected in taxes

  - Tax revenues increases by $t\alpha_G \Delta G$

  - The change in BS is $\Delta BS = \Delta TA - \Delta G$

  $$= t\alpha_G \Delta G - \Delta G \qquad (25)$$

  $$= -\frac{(1-c)(1-t)}{1-c(1-t)}\Delta G$$

  The change is
  $\Rightarrow$ **negative <u>OR</u> reduces the surplus**

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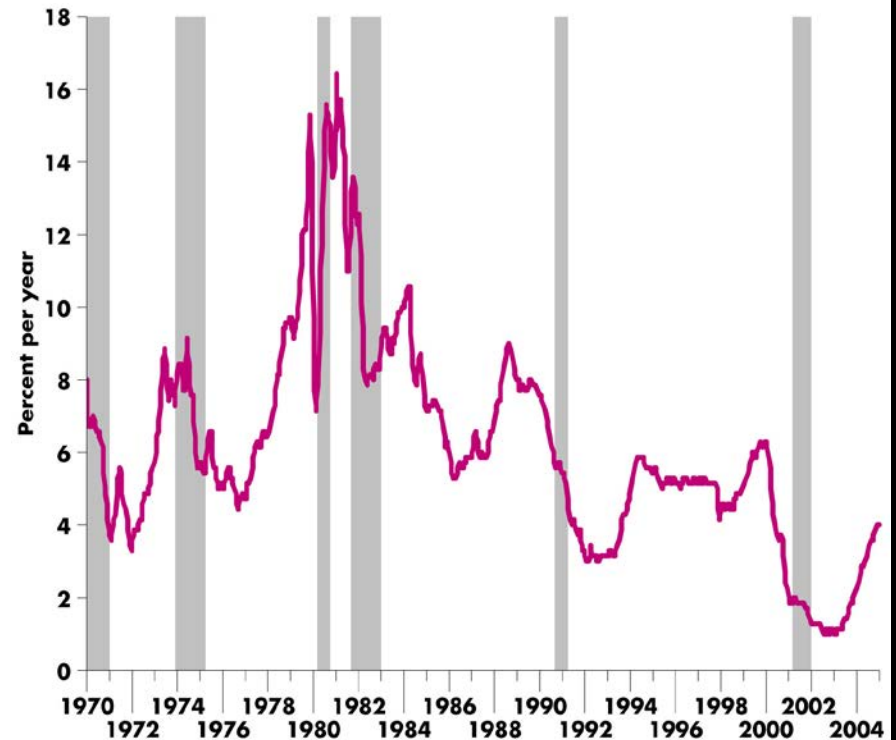
MACROECONOMICS

Chapter 10

Money, Interest, and Income

Introduction

- Money plays a central role in the determination of income and employment
  - Interest rates are a significant determinant of aggregate spending $\rightarrow$ Fed controls the money supply in the United States
  - The stock of money, interest rates, and the Fed were noticeably absent from the model developed in the last chapter
- This chapter:
  - introduces money and monetary policy
  - builds an explicit framework of analysis within which to study the interaction of goods markets and assets market
    - ✓ What determines interest rates?
   - ✓ What is the role of interest rates in the business cycle?

Introduction

- Figure 10-1 shows the interest rate on Treasury bills = the payment received by someone who lends to the U.S. government
  - Ex. At an interest rate of 5%, a $100 loan to the government will earn $5 in interest
  - Figure 10-1 shows that interest rates:
    - ➤ Are high just before a recession
    - ➤ Drop during the recession
   - ➤ Rise during the recovery

Introduction

- Figure 10-2 shows the strong link between money and output growth
  - This chapter explores the link from money to interest rates to output
- IS-LM model is the core of short-run macroeconomics
  - Maintains the details of earlier model, but adds the interest rate as an additional determinant of aggregate demand
  - Includes the goods market and the money market, and their link through interest rates and income
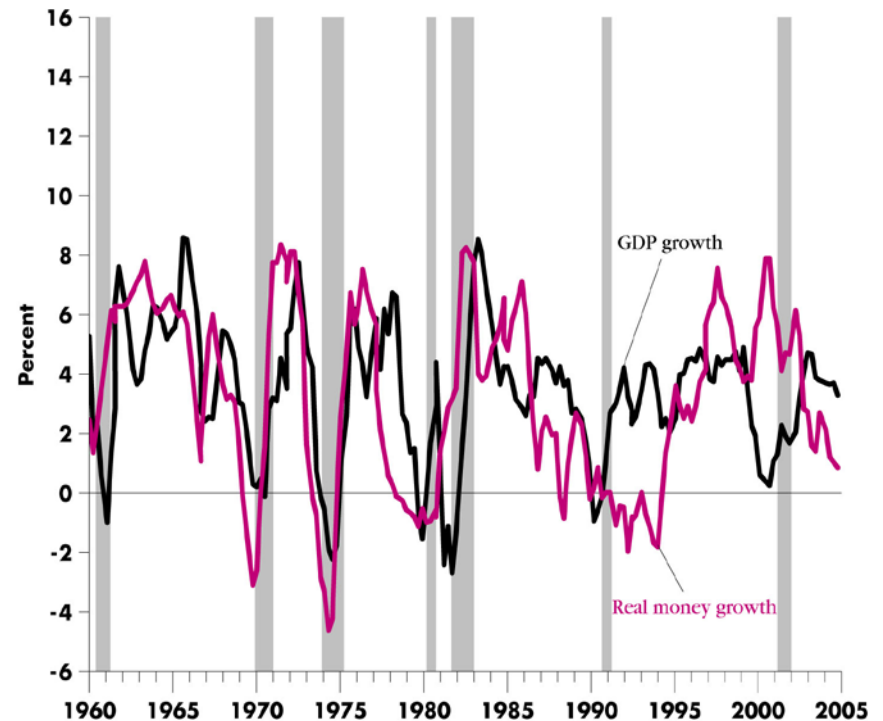
Introduction
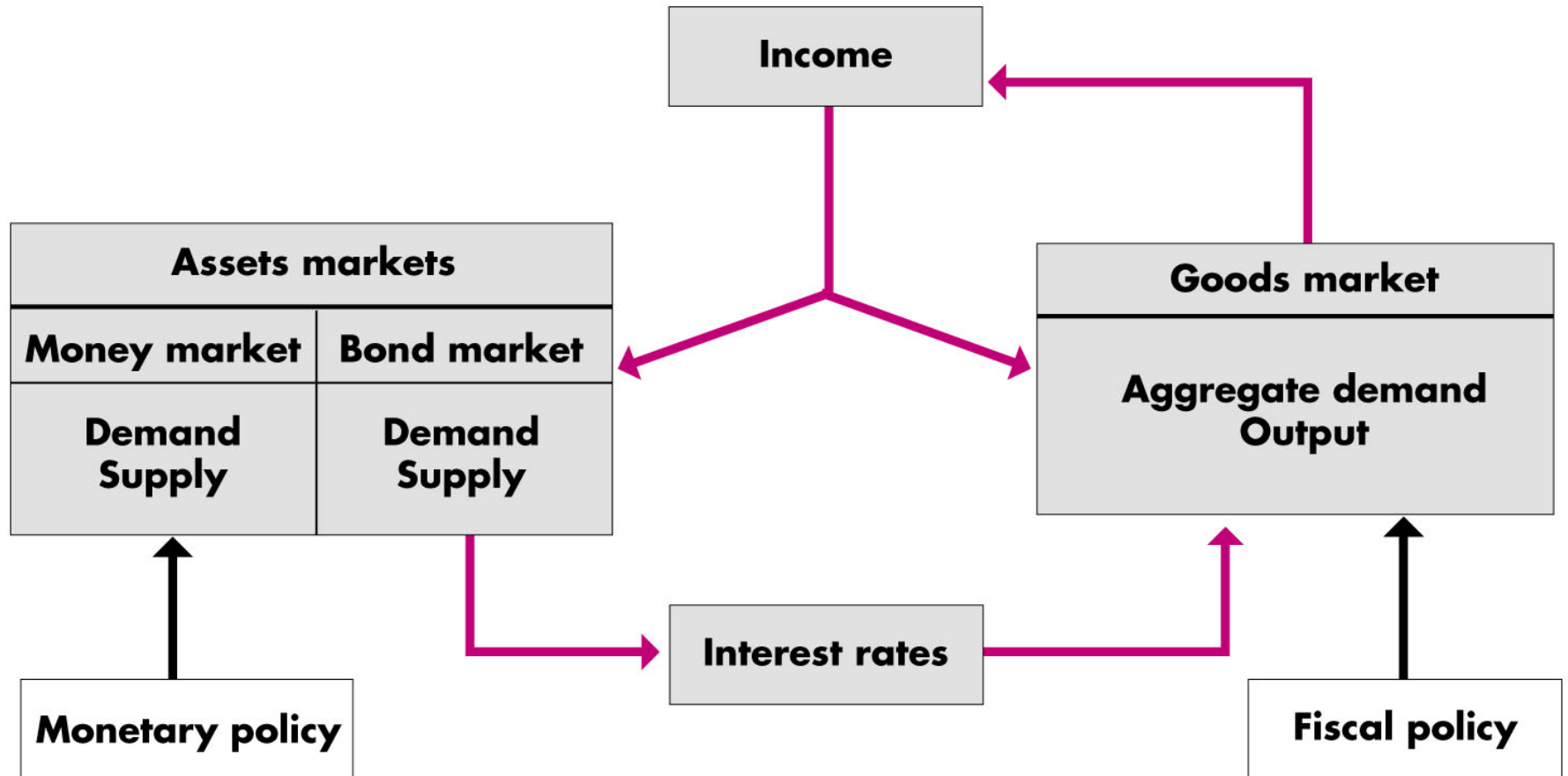
The Goods Market and the IS Curve

- The IS curve shows combinations of interest rates and levels of output such that planned spending equals income
  - Derived in two steps:
    1. Link between interest rates and investment
    2. Link between investment demand and AD
- Investment is no longer treated as exogenous, but dependent upon interest rates (endogenous)
  - Investment demand is lower the higher are interest rates
    - Interest rates are the cost of borrowing money
    - Increased interest rates raise the price to firms of borrowing for capital equipment $\rightarrow$ reduce the quantity of investment demand

Investment and the Interest Rate

- The investment spending function can be specified as:

  $I = \bar{I} - bi$ where b > 0 (1)

  - i = rate of interest
  - b = the responsiveness of investment spending to the interest rate
  - $\bar{I}$ = autonomous investment spending

- Figure 10-4 illustrates the investment schedule of equation (1)

  - Negative slope reflects assumption that a reduction in i increases the quantity of I
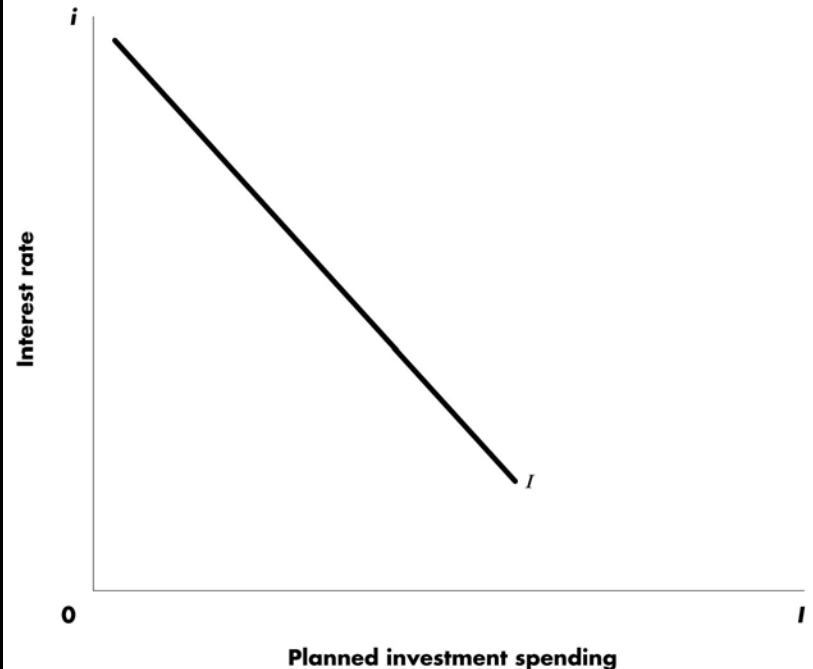
Investment and the Interest Rate

$$I = \bar{I} - bi \quad (1)$$

- The position of the I schedule is determined by:
  - The slope, b
    - ➢ If investment is highly responsive to i, the investment schedule is almost flat
    - ➢ If investment responds little to i, the investment schedule is close to vertical
  - Level of autonomous spending
    - ➢ An increase in $\bar{I}$ shifts the investment schedule out
    - ➢ A decrease in $\bar{I}$ shifts the investment schedule in

Interest rate — i

Planned investment spending — I
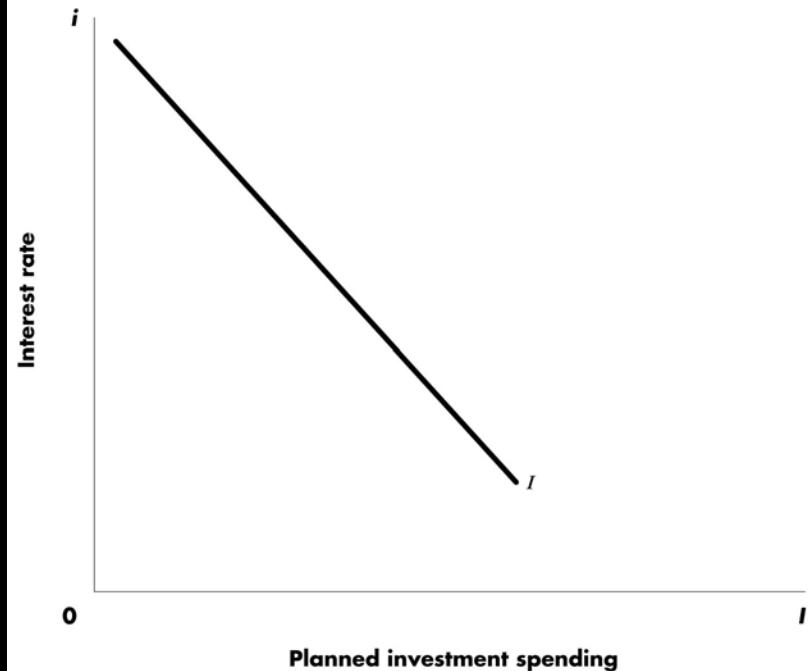
The Interest Rate and AD: The IS Curve

- Need to modify the AD function of the last chapter to reflect the new planned investment spending schedule

$$AD = C + I + G + NX$$

$$= \left[\overline{C} + c\overline{TR} + c(1-t)Y\right] + (\overline{I} - bi) + \overline{G} + \overline{NX}$$

$$= \overline{A} + c(1-t)Y - bi \qquad\qquad (2)$$

  ➤ An increase in i reduces AD for a given level of income

  ➤ At any given level of i, can determine the equilibrium level of income and output as in Chapter 9

    ➤ A change in i will change the equilibrium

The Interest Rate and AD: The IS Curve

$$AD = \overline{A} + c(1-t)Y - bi \quad (2)$$

- Derive the IS curve using figure 10-5

  - For a given interest rate, i_1, the last term in equation (2) is constant → can draw the AD function with an intercept of $\overline{A} - bi_1$

    - The equilibrium level of income is Y_1 at point E_1

  - Plot the pair (i_1, Y_1) in the bottom panel as point E_1 → a point on the IS curve

    - Combination of i and Y that clears the goods market
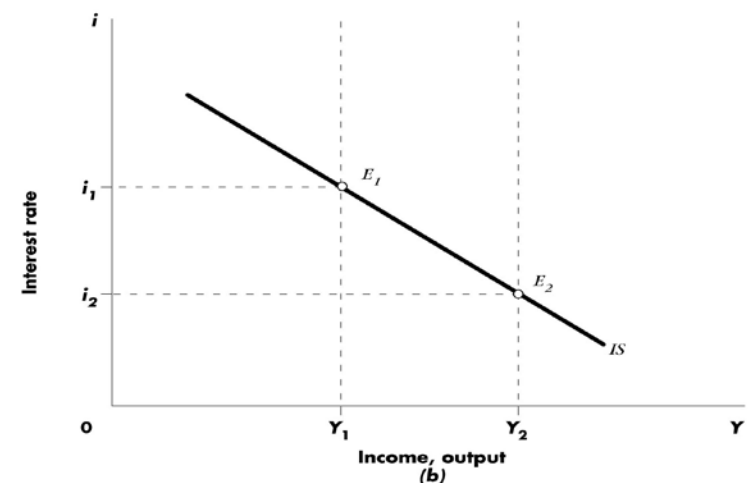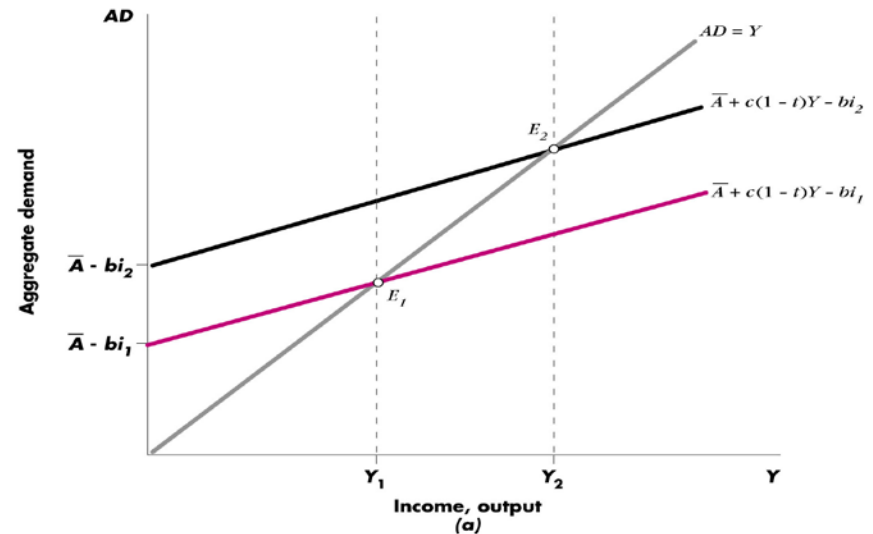
The Interest Rate and AD: The IS Curve

$$AD = \overline{A} + c(1-t)Y - bi \quad (2)$$

- Derive the IS curve using figure 10-5

  - Consider a lower interest rate, i_2

  - Shifts the AD curve upward to AD' with an intercept of
    $$\overline{A} - bi_2$$

  - Given the increase in AD, the equilibrium shifts to point E_2, with an associated income level of Y_2

  - Plot the pair (i_2, Y_2) in panel (b) for another point on the IS curve
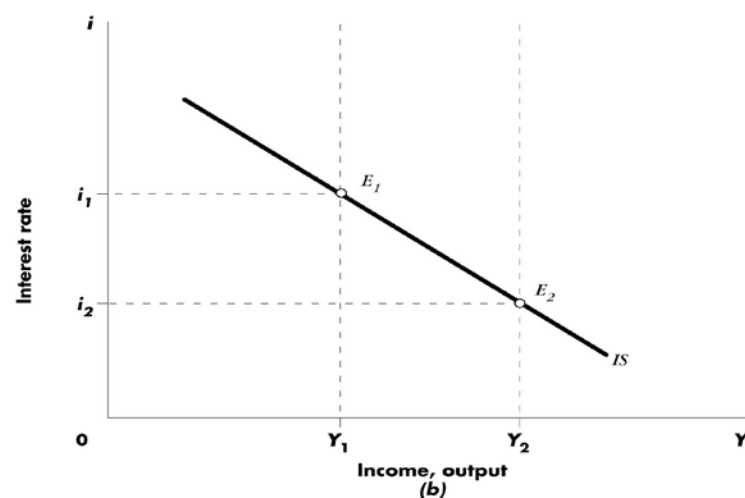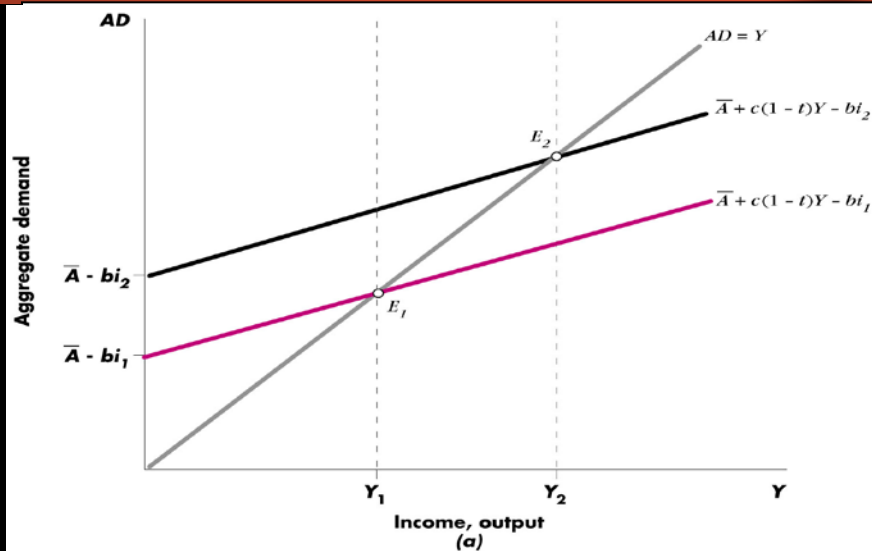
The Interest Rate and AD: The IS Curve

- We can apply the same procedure to all levels of i to generate additional points on the IS curve
  - All points on the IS curve represent combinations of i and income at which the goods market clears → *goods market equilibrium schedule*
- Figure 10-5 shows the negative relationship between i and Y
  - Downward sloping IS curve
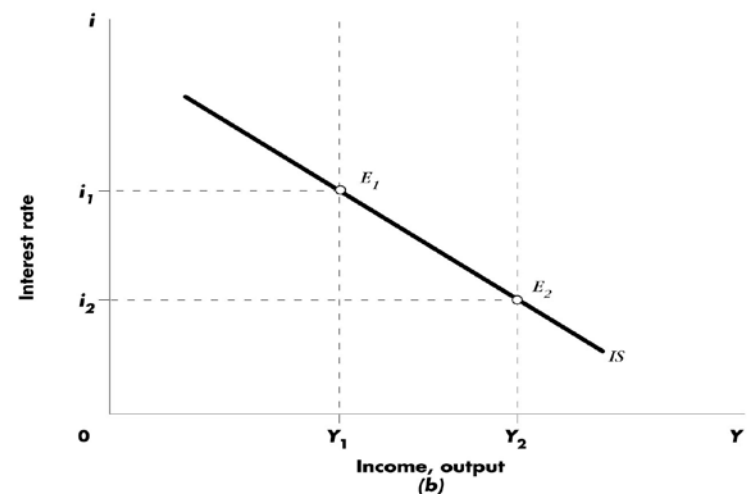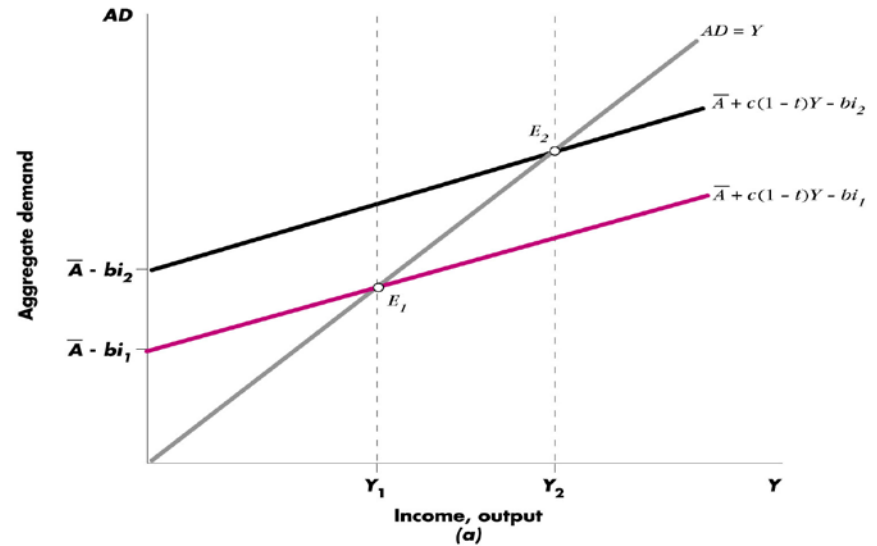
The Interest Rate and AD: The IS Curve

- We can also derive the IS curve using the goods market equilibrium condition:

$$Y = AD = \overline{A} + c(1-t)Y - bi \Rightarrow \quad (4)$$

$$Y - c(1-t)Y = \overline{A} - bi$$

$$Y(1 - c(1-t)) = \overline{A} - bi$$

$$Y = \alpha_G(\overline{A} - bi) \qquad (5)$$

where $\alpha_G = \dfrac{1}{(1 - c(1-t))}$, the multiplier from Chapter 9

Equation (5) is the equation for the IS curve.

The Slope of the IS Curve

- The steepness of the IS curve depends on:
  - How sensitive investment spending is to changes in i
  - The multiplier, α_G
- Suppose investment spending is very sensitive to i $\rightarrow$ the slope, b, is large
  - A given change in i produces a large change in AD (large shift)
  - A large shift in AD produces a large change in Y
  - A large change in Y resulting from a given change in i $\rightarrow$ IS curve is relatively flat
- If investment spending is not very sensitive to i, the IS curve is relatively steep

The Role of the Multiplier

- Figure 10-6 shows the AD curves corresponding to different multipliers
  - The coefficient c on the solid black AD curve is smaller than that on the dashed AD curve → multiplier larger on the dashed AD curves
- A given reduction in i to i_2 raises the intercept of the AD curves by the same vertical distance
  - Because of the different multipliers, income rises to Y'_2 on the dashed line and Y_2 on the solid line
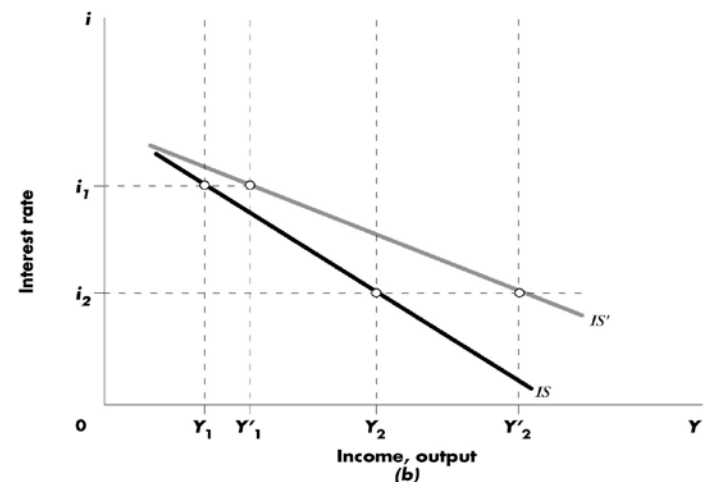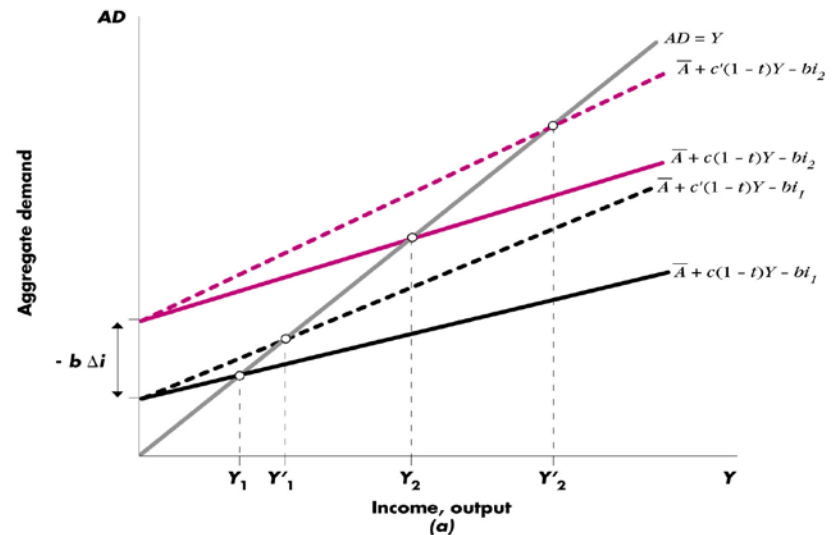
The Role of the Multiplier

- The smaller the sensitivity of investment spending to the interest rate AND the smaller the multiplier, the steeper the IS curve
  - This can be seen in equation (5): $Y = \alpha_G(\overline{A} - bi)$
- We can solve equation (5) for i: $Y = \alpha_G(\overline{A} - bi)$

For a given change in Y, the associated change in i will be larger in size as b is smaller and as the multiplier is smaller.
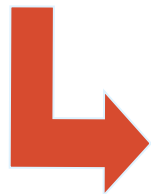
$$Y - \alpha_G\overline{A} = -\alpha_G bi$$

$$i = \frac{Y - \alpha_G\overline{A}}{-\alpha_G b}$$

$$= \frac{A}{b} - \frac{Y}{\alpha_G b}$$

The Position of the IS Curve

- Figure 10-7 shows two different IS curves → differ by levels of autonomous spending
  - Initial AD with $\overline{A}$ and i_1 → corresponding point E_1 on IS curve in Figure 10-7 (b)
  - If autonomous spending increases to $\overline{A}'$, equilibrium level of income increases at i_1 → point E_2 in panel 10-7 (b), shifting out IS
- The change in income as a result from a change in autonomous spending is $\Delta Y = \alpha_G \Delta \overline{A}$
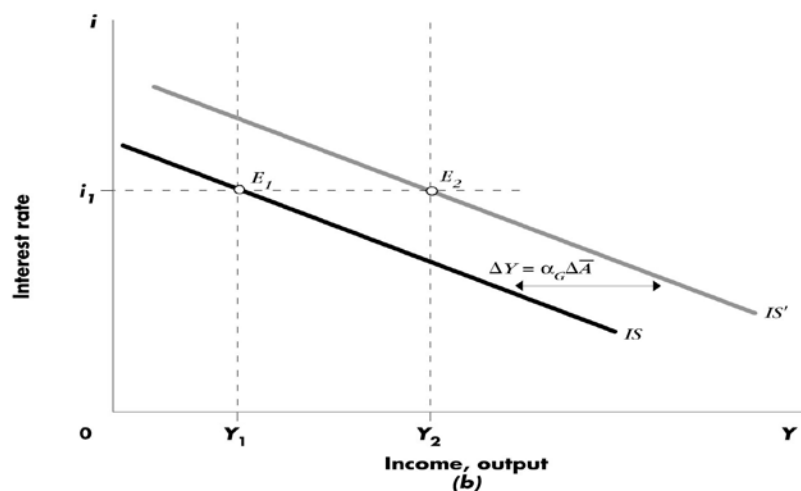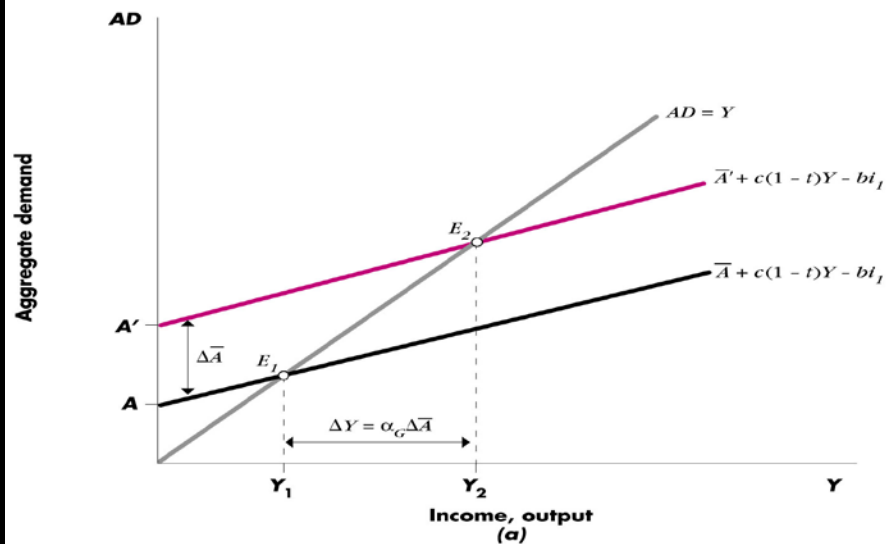
The Money Market and the LM Curve

- The LM curve shows combinations of interest rates and levels of output such that money demand equals money supply $\rightarrow$ equilibrium in the money market

- The LM curve is derived in two steps:

  1. Explain why money demand depends on interest rates and income
     - Theory of real money balances, rather than nominal

  2. Equate money demand with money supply, and find combinations of income and interest rates that maintain equilibrium in the money market
     - (i, Y) pairs meeting this criteria are points on a given LM curve

Demand for Money

- The demand for money, is a demand for real money balances

  - People are concerned with how much their money can buy, rather than the number of dollars in their pockets

- The demand for real balances depends on:

  - Real income: people hold money to pay for their purchases, which, in turn, depend on income

  - Interest rate: the cost of holding money

    - The higher the interest rate, the more expensive it is to hold money, and the less cash will be held at each level of income

- The demand for money is defined as: $L = kY - hi$ (6)

Demand for Money

$$L = kY - hi \quad (6)$$

- The parameters k and h reflect the sensitivity of the demand for real balances to the level of Y and i

- The demand function for real balances implies that for a given level of income, the quantity demanded is a decreasing function of i

  - Figure 10-8 illustrates the inverse relationship between money demand and i → *money demand curve*
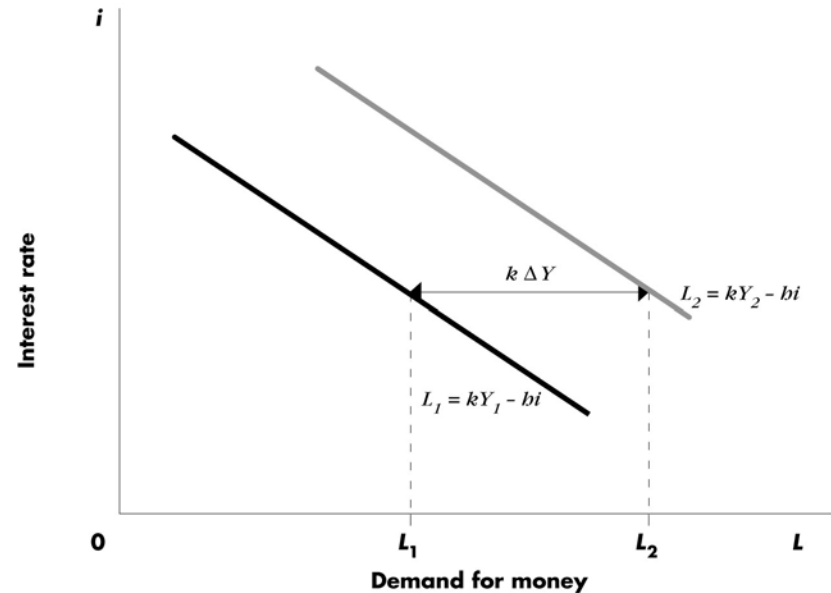
The Supply of Money, Money Market Equilibrium, and the LM Curve

- The nominal quantity of money supplied, M, is controlled by the central bank
  - Real money supply is $\dfrac{\overline{M}}{\overline{P}}$, where M and P are assumed fixed
- Figure 10-9 shows combinations of i and Y such that the demand for real money balances exactly matches the available supply
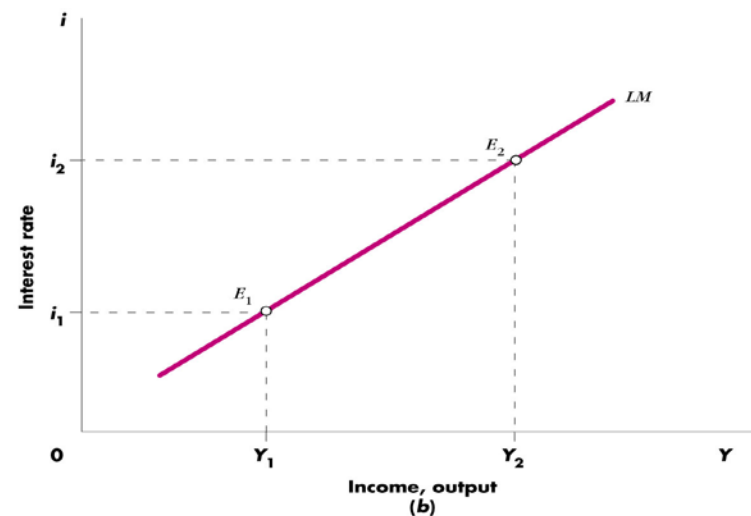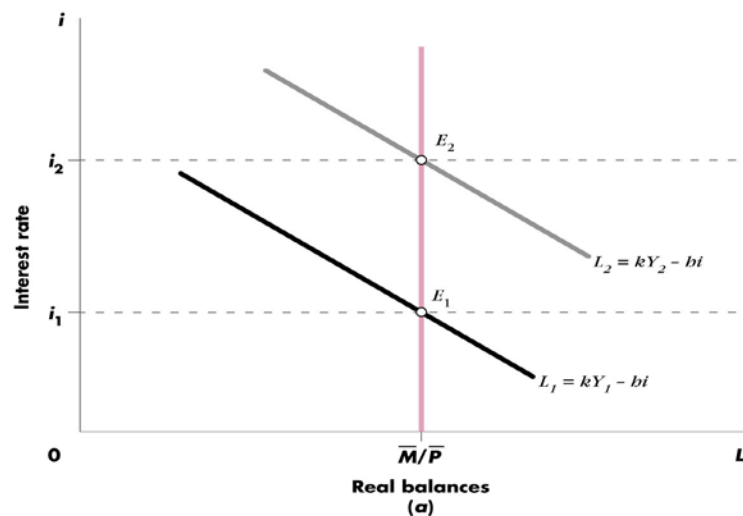
The Supply of Money, Money Market Equilibrium, and the LM Curve

- Starting at Y_1, the corresponding demand curve for real balances is $L_1 \rightarrow$ shown in panel (a)

  - Point E_1 is the equilibrium point in the money market

- Point E_1 is recorded in panel (b) as a point on the money market equilibrium schedule, or the LM curve

  - (i_1, Y_1) pair is a point on LM curve
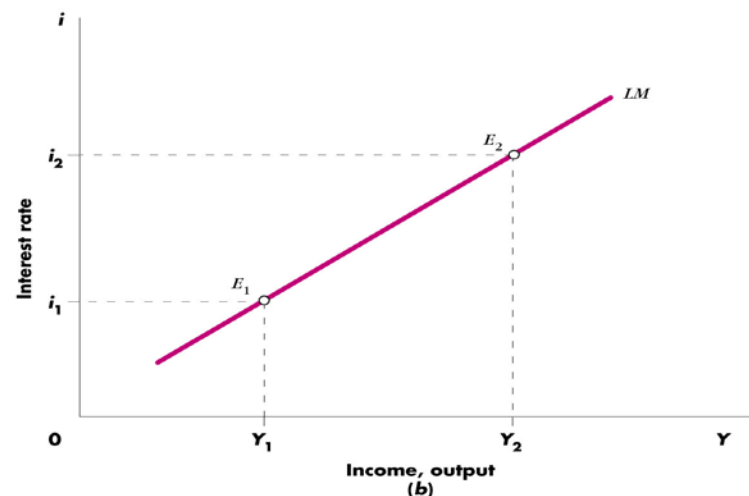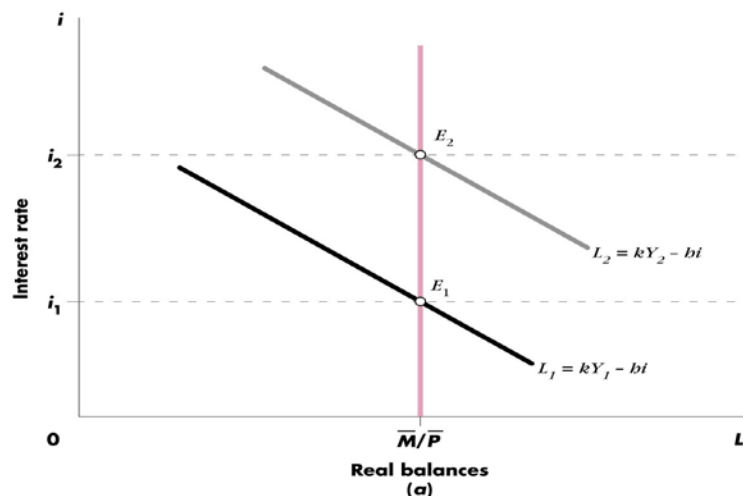
The Supply of Money, Money Market Equilibrium, and the LM Curve

- If income increases to Y_2, real money balances increase to be higher at every level of i $\rightarrow$ money demand shifts to L_2
  - The interest rate increases to i_2 to maintain equilibrium in the money market
  - The new equilibrium is at point E_2
- Record E_2 in panel (b) as another point on the LM curve
  - Pair (i_2, Y_2) is higher up the given LM curve
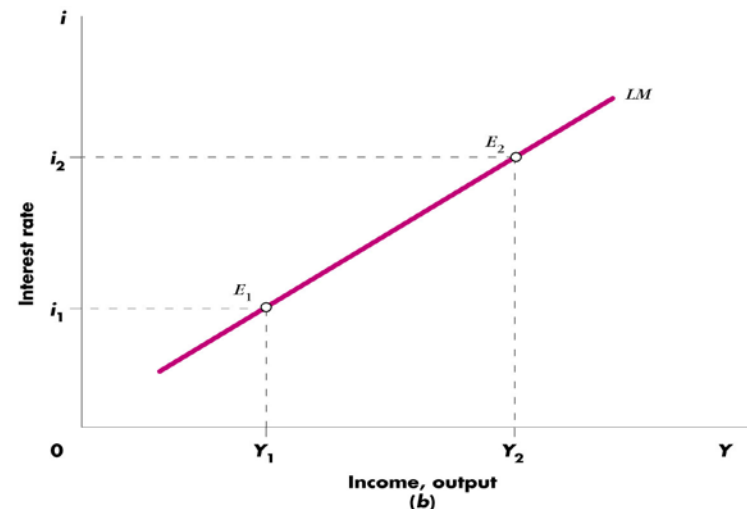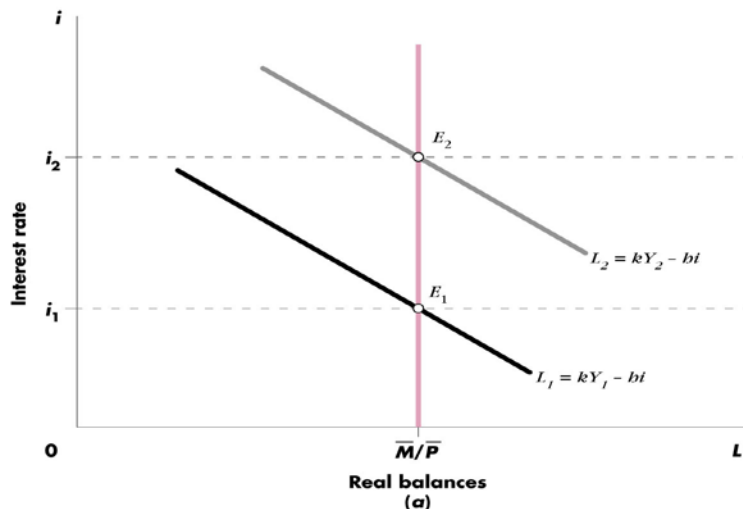
The Supply of Money, Money Market Equilibrium, and the LM Curve

- The LM schedule shows all combinations of interest rates and levels of income such that the demand for real balances is equal to the supply → money market is in equilibrium

  - LM curve is positively sloped:

    - An increase in the interest rate reduces the demand for real balances

    - To maintain the demand for real money balances equal to the fixed supply, the level of income has to rise

  Money market equilibrium implies that an increase in the interest rate is accompanied by an increase in the level of income.

The Supply of Money, Money Market Equilibrium, and the LM Curve

- The LM curve can be obtained directly by combining the demand curve for real balances and the fixed supply of real balances

  - For the money market to be in equilibrium, supply must equal demand: $\dfrac{\overline{M}}{\overline{P}} = kY - hi$ (7)

  - Solving for i: $i = \dfrac{1}{h}\left(kY - \dfrac{\overline{M}}{\overline{P}} \right)$ (7a)

  The relationship (7a) is the LM curve.

The Slope of the LM Curve

- The steeper the LM curve:

  - The greater the responsiveness of the demand for money to income, as measured by k

  - The lower the responsiveness of the demand for money to the interest rate, h

  → These points can be confirmed by experimenting with Figure 10-9 or examining equation (7a),

$$i = \frac{1}{h}\left(kY - \frac{\overline{M}}{\overline{P}} \right)$$

  → A given change in income has a larger effect on i, the larger is k and the smaller is h

The Position of the LM Curve

- The real money supply is held constant along the LM curve $\rightarrow$ a change in the real money supply will shift the LM curve
  - Figure 10-10 shows the effect of an increase in money supply
    - Panel (a) shows the demand for real money balances for income level Y_1
    - Equilibrium occurs at point E_1 with interest rate $i_1 \rightarrow$ corresponding point E_1 on the LM curve
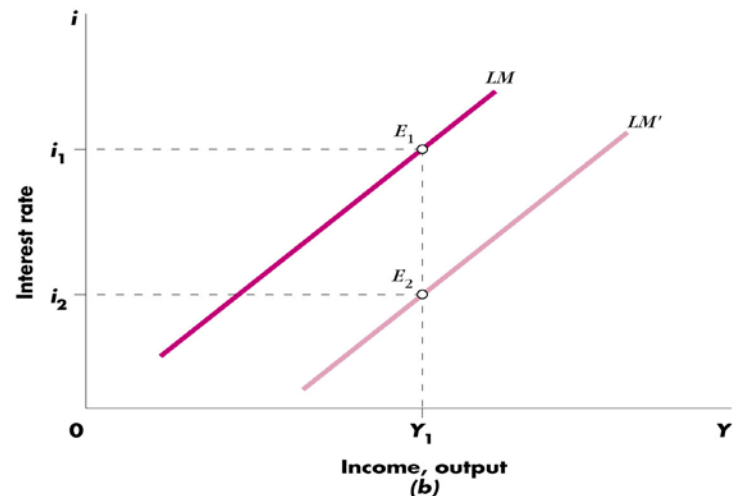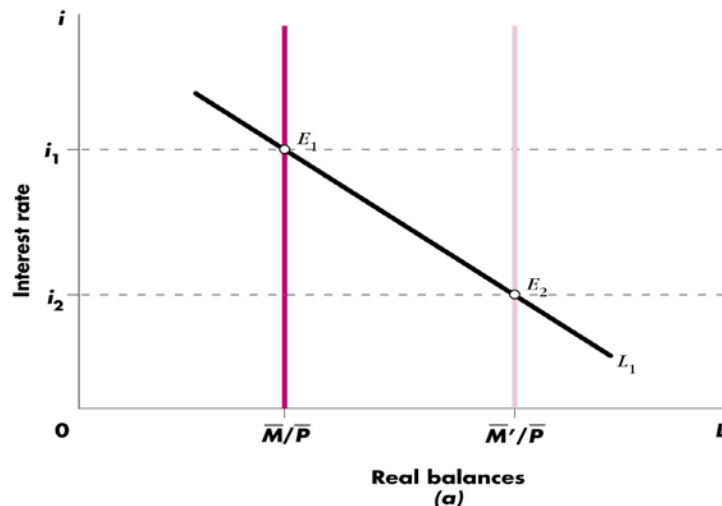
The Position of the LM Curve

- If real money balances increases, the money supply curve shifts to the right
  - To restore equilibrium at the income level Y_1, the i must decrease to i_2
    - The new equilibrium is at point E_2
  - In panel (b), the LM curve shifts to the down and to the right
    - At each level of income, the equilibrium interest rate has to be lower to induce people to hold the larger real quantity of money
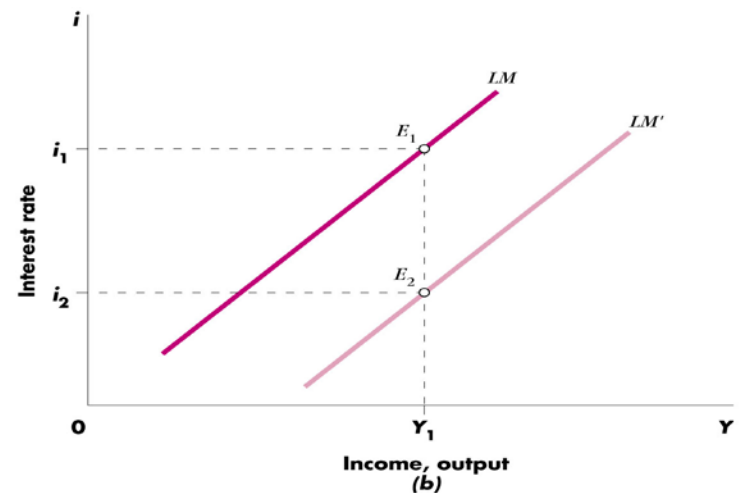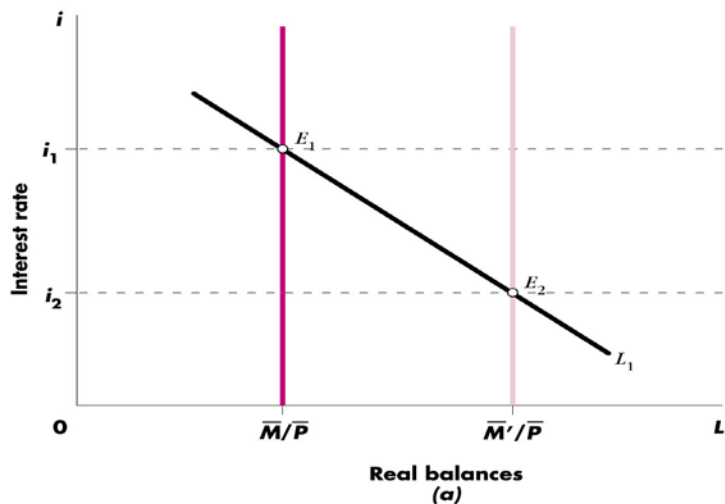
Equilibrium and the Goods and Money Market

- The IS and LM schedules summarize the conditions that have to be satisfied for the goods and money markets to the in equilibrium
  - *How are they brought into simultaneous equilibrium?*
    - ➢ Satisfied at point E in Figure 10-11, corresponding to the pair (i_0, Y_0)
- Assumptions:
  - Price level is constant
  - Firms willing to supply whatever amount of output is demanded at that price level
    - **Flat SRAS curve**
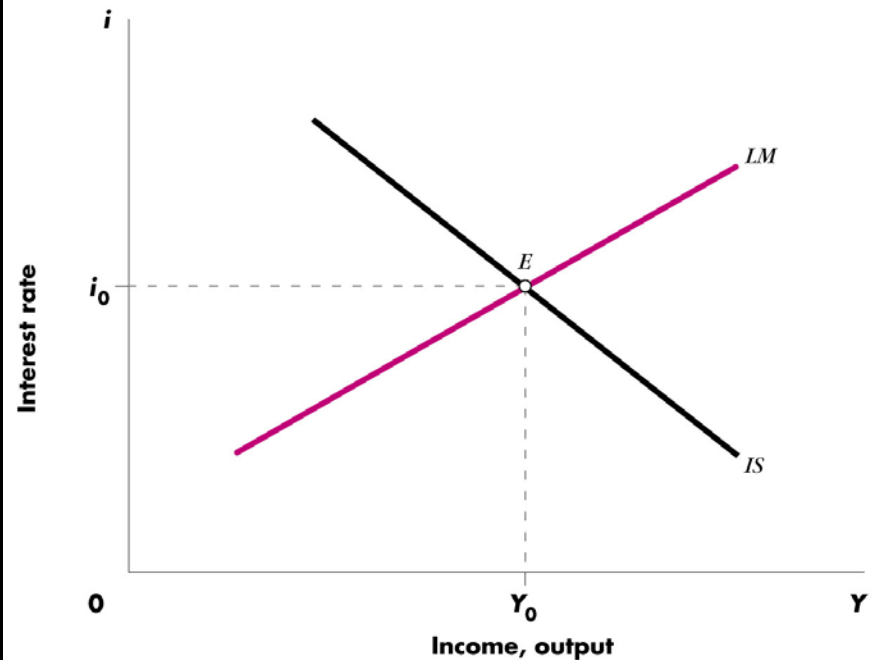
Changes in the Equilibrium Levels of Income and the Interest Rate

- The equilibrium levels of income and the interest rate change when either the IS or the LM curve shifts

  - Figure 10-12 shows the effects of an increase in autonomous spending on equilibrium i and Y

    - Shifts IS curve out by $\alpha_G \Delta I$ if autonomous investment is the source of increased spending

    - The resulting change in Y is smaller than the change in autonomous spending $\rightarrow$ due to slope of LM curve
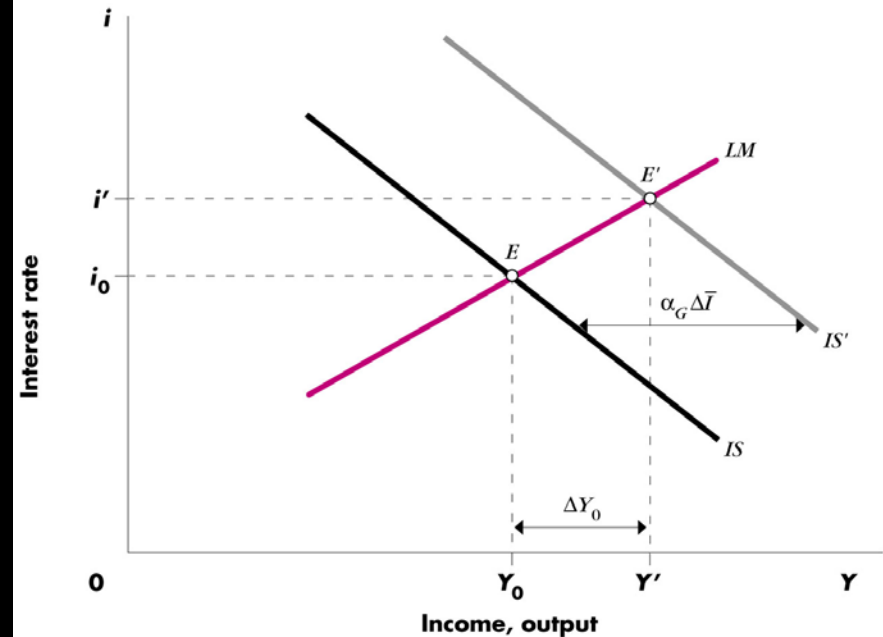
Deriving the AD Schedule

- The AD schedule maps out the IS-LM equilibrium holding autonomous spending and the nominal money supply constant and allowing prices to vary
  - Suppose prices increase from P_1 to P_2
    - M/P decrease from M/P_1 to $M/P_2 \to$ LM decreases from LM_1 to LM_2
    - Interest rates increase from i_1 to i_2, and decreased output from Y_1 to Y_2
    - Corresponds to lower AD
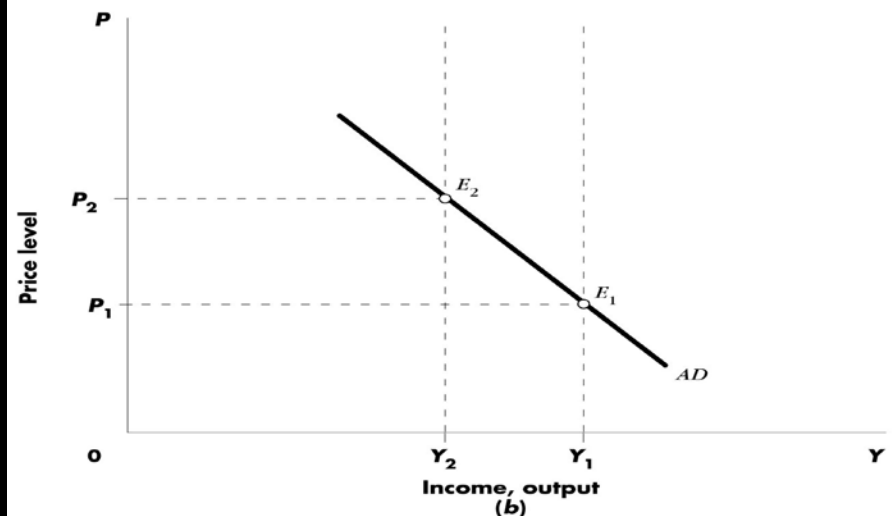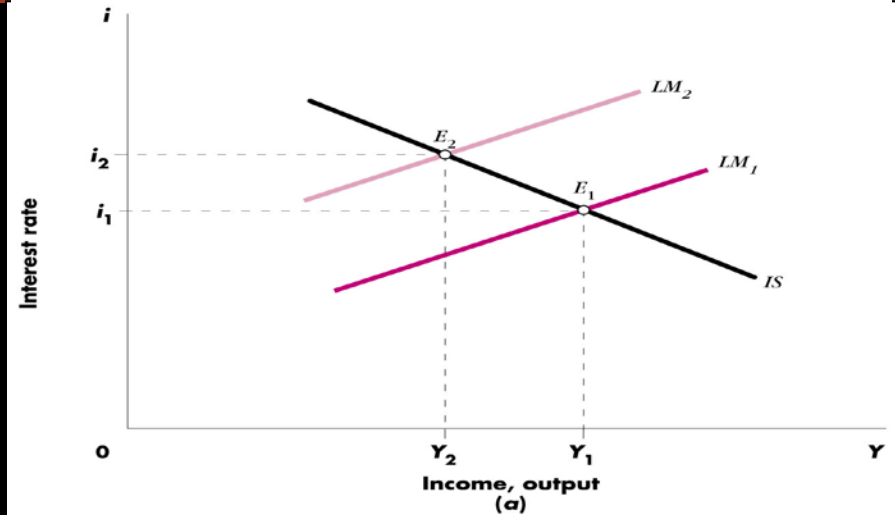
Deriving the AD Schedule

- Derive the equation for the AD curve using the equations for the IS-LM curves: $IS : Y = \alpha_G(\overline{A} - bi)$

$$LM : i = \frac{1}{h}\left(kY - \frac{\overline{M}}{\overline{P}} \right)$$

- Substituting LM equation into the IS equation:

$$Y = \alpha_G\left[\overline{A} - \frac{b}{h}\left(kY - \frac{\overline{M}}{\overline{P}} \right) \right]$$

$$= \frac{h\alpha_G}{h + kb\alpha_G}\overline{A} + \frac{b\alpha_G}{h + kb\alpha_G}\frac{\overline{M}}{\overline{P}} \quad (8)$$

$$= \gamma\overline{A} + \gamma\frac{b}{h}\frac{\overline{M}}{\overline{P}} \quad\quad\quad (8a)$$

Deriving the AD Schedule

$$Y = \frac{h\alpha_G}{h + kb\alpha_G}\overline{A} + \frac{b\alpha_G}{h + kb\alpha_G}\frac{\overline{M}}{\overline{P}}$$

- Equation (8) shows that AD depends upon:
    1. Autonomous spending
    2. Real money stock
- Equilibrium income is:
    - Higher the higher the level of autonomous spending
    - Higher the higher the stock of real balances
- Equation (8) is the AD schedule
    - It summarizes the IS-LM relation, relating Y and P for given levels of autonomous spending and nominal balances
    - Since P is in the denominator, AD is downward sloping

RUDIGER DORNBUSCH

STANLEY FISCHER

RICHARD STARTZ

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MACROECONOMICS

Chapter 11

Monetary and Fiscal Policy

Introduction

- In this chapter we use the IS-LM model developed in Chapter 10 to show how monetary and fiscal policy work
  - Fiscal policy has its initial impact in the goods market
  - Monetary policy has its initial impact mainly in the assets markets
  - →Because the goods and assets markets are interconnected, both fiscal and monetary policies have effects on both the level of output and interest rates
  - →Expansionary/contractionary monetary policy moves the LM curve to the right/left
  - →Expansionary/contractionary fiscal policy moves the IS curve to the right/left

Monetary Policy

- The Federal Reserve is responsible for monetary policy in the U.S. $\rightarrow$ conducted mainly through *open market operations*

  - *Open market operations:* buying and selling of government bonds

    - ➢ Fed buys bonds in exchange for money $\rightarrow$ increases the stock of money (Fig. 11-3)

    - ➢ Fed sells bonds in exchange for money paid by purchasers of the bonds $\rightarrow$ reducing the money stock
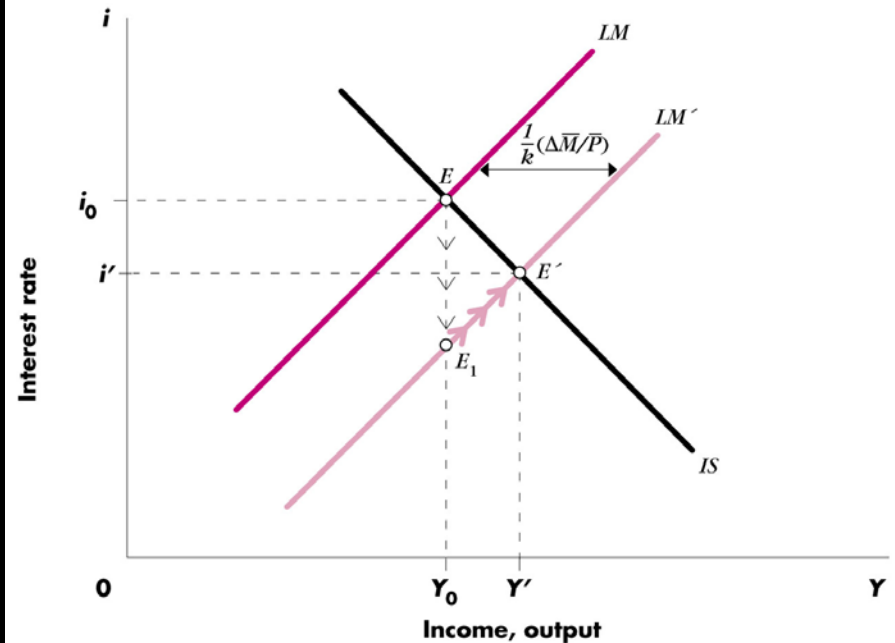
Monetary Policy

- Consider the process of adjustment to the monetary expansion
  - At the initial equilibrium, E, the increase in money supply creates an excess supply of money
  - The public adjusts by trying to buy other assets
  - Asset prices increase, and yields decrease → move to point E_1
    - Money market clears, with lower interest rate
  - Decline in interest rate results in excess demand for goods
    - Output expands and move up LM' schedule
  - Final position is at E'
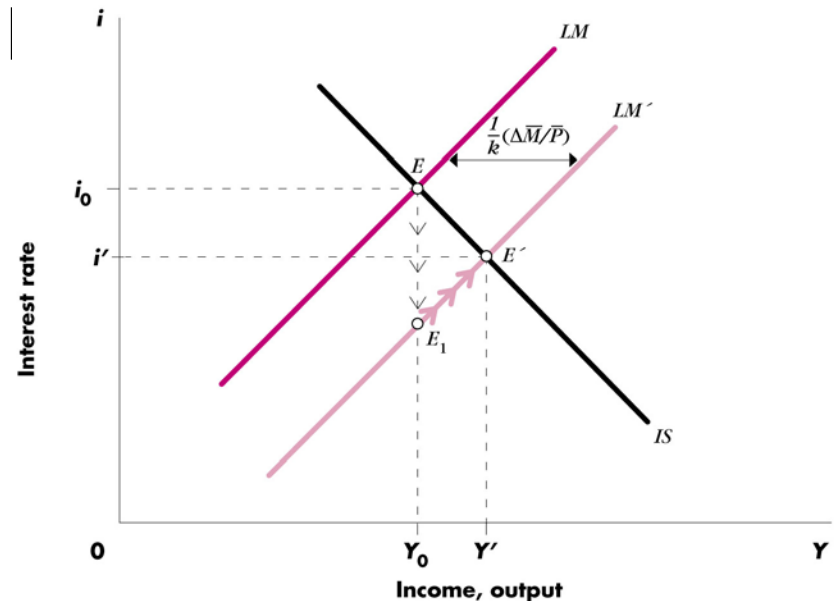
Transition Mechanism

- Two steps in the transmission mechanism (the process by which changes in monetary policy affect AD):

    1. An increase in real balances generates a <u>portfolio disequilibrium</u>
        - At the prevailing interest rate and level of income, people are holding more money than they want
        - Portfolio holders attempt to reduce their money holdings by buying other assets → changes asset prices and yields
        - The change in money supply changes interest rates
    2. A change in interest rates affects AD
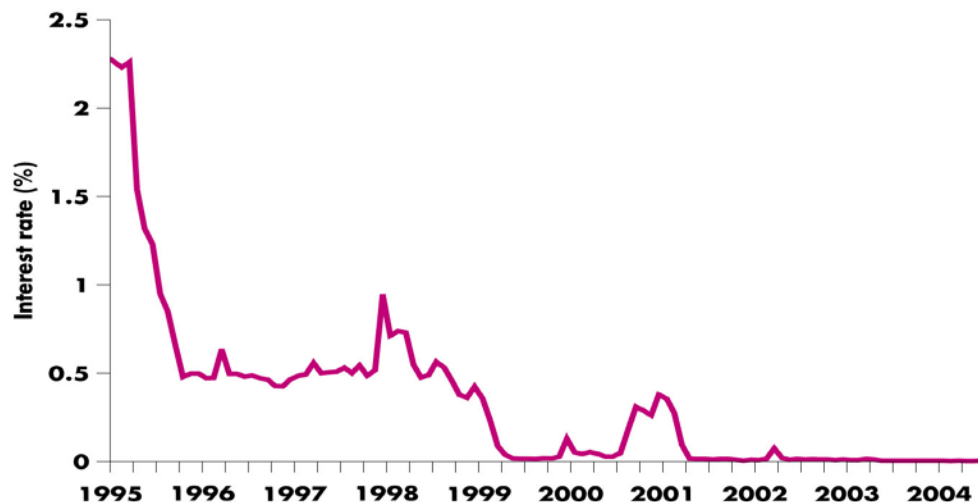
The Liquidity Trap

- Two extreme cases arise when discussing the effects of monetary policy on the economy → first is the *liquidity trap*

  - Liquidity trap = a situation in which the public is prepared, at a given interest rate, to hold whatever amount of money is supplied

  - Implies the LM curve is horizontal → changes in the quantity of money do not shift it

    - Monetary policy has no impact on either the interest rate or the level of income → monetary policy is powerless

    - Possibility of a liquidity trap at low interest rates is a notion that grew out of the theories of English economist John Maynard Keynes

Banks' Reluctance to Lend

- Two extreme cases arise when discussing the effects of monetary policy on the economy → second is the *reluctance of banks to lend*

  - Another situation in which monetary policy is powerless to alter the economy → break down in the transmission mechanism

  - Despite lower interest rates and increased demand for investment, banks may be unwilling to make the loans necessary for the investment purchases

    - If banks made prior bad loans that are not repaid, may become reluctant to make more, despite demand → prefer instead to lend to the government (safer)

The Classical Case

- The opposite of the horizontal LM curve (implies that monetary policy cannot affect the level of income) is the vertical LM curve

  - If LM is vertical = demand for money is entirely unresponsive to the interest rate

  - Recall, the equation for the LM curve is $\dfrac{\overline{M}}{P} = kY - hi$ (1)

    - If h is zero, then there is a unique level of income corresponding to a given real money supply $\rightarrow$ *VERTICAL LM CURVE*

- The vertical LM curve is called the classical case

  - Rewrite equation (1), with h = 0: $\overline{M} = k(P \times Y)$ (2)

    - Implies that NGDP depends only on the quantity of money $\rightarrow$ *quantity theory of money*

The Classical Case

- When the LM curve is vertical
    1. A given change in the quantity of money has a maximal effect on the level of income
    2. Shifts in the IS curve do not affect the level of income

    When the LM curve is vertical, monetary policy has a maximal effect on the level of income, and fiscal policy has no effect on income.

- Vertical LM curve implies the comparative effectiveness of monetary policy over fiscal policy
    - "Only money matters" for the determination of output
    - Requires that the demand for money be irresponsive to i $\rightarrow$ important issue in determining the effectiveness of alternative policies

Fiscal Policy and Crowding Out

- The equation for the IS curve is: $Y = \alpha_G(\overline{A} - bi)$ (3)
  - The fiscal policy variables, G and t, are within this definition
    - G is a part of A
    - t is a part of the multiplier
    - →Fiscal policy actions, changes in G and t, affect the IS curve
- Suppose G increases
  - At unchanged interest rates, AD increases
  - To meet increased demand, output must increase
  - At each level of the interest rate, equilibrium income must rise by $\alpha_G \Delta G$

Fiscal Policy and Crowding Out

- If the economy is initially in equilibrium at E, if government expenditures increases, equilibrium moves to E"
  - The goods market is in equilibrium at E", but the money market is not:
    - Because Y has increased, the demand for money also increases → interest rate increases
    - Firms' planned investment spending declines at higher interest rates and AD falls off → move up the LM curve to E'
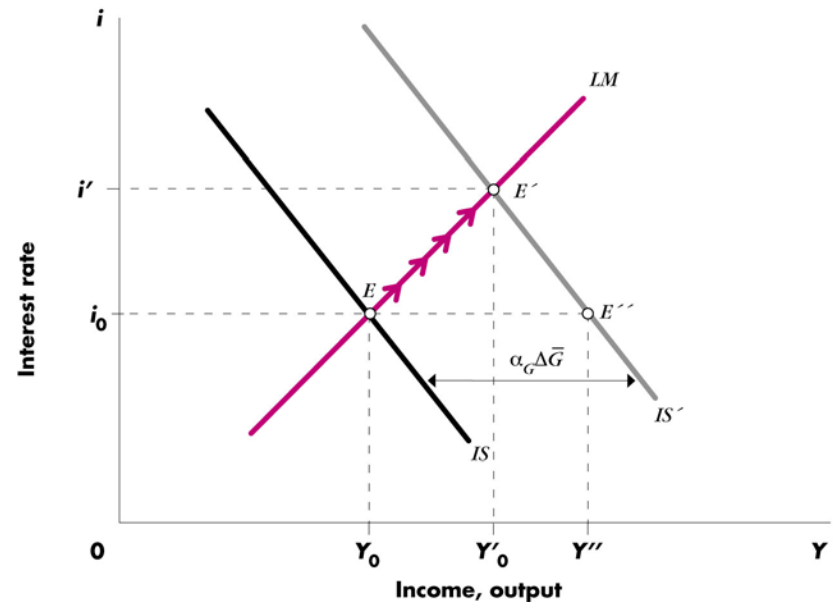
Fiscal Policy and Crowding Out

- <u>Comparing E to E'</u>: increased government spending increases income and the interest rate

- <u>Comparing E' to E''</u>: adjustment of interest rates and their impact on AD dampen expansionary effect of increased G

  - Income increases to Y'_0 instead of Y''

Increase in government expenditures crowds out investment spending.
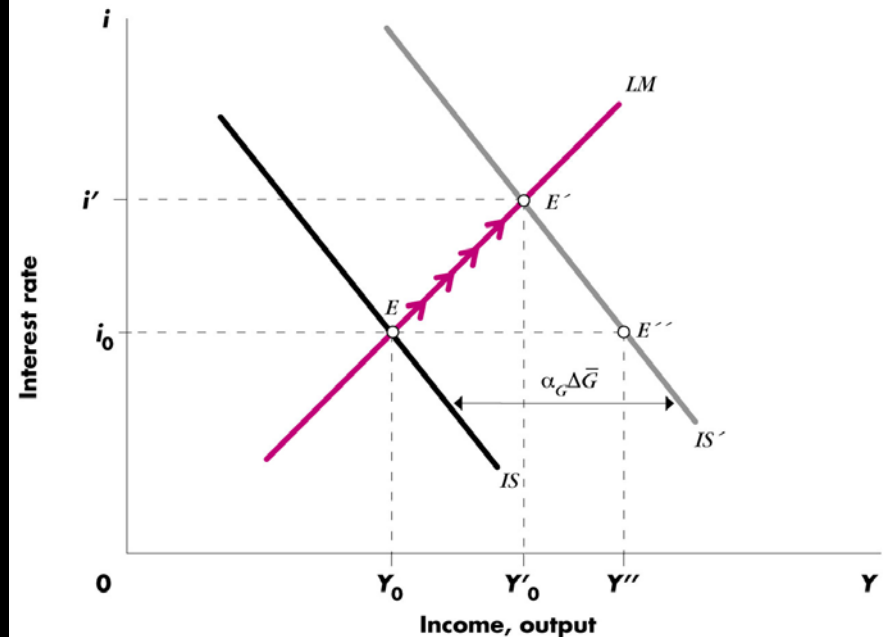
The Composition of Output and the Policy Mix

- Table 11-2 summarizes our analysis of the effects of expansionary monetary and fiscal policy on output and the interest rate (assuming not in a liquidity trap or in the classical case)
- Monetary policy operates by stimulating interest-responsive components of AD
- Fiscal policy operates through G and t → impact depends upon what goods the government buys and what taxes and transfers it changes
  - Increase in G → increases C along with G; reduction in income taxes increases C

TABLE 11-2 Policy Effects on Income and Interest Rates

POLICY	EQUILIBRIUM INCOME	EQUILIBRIUM INTEREST RATES
Monetary expansion	+	−
Fiscal expansion	+	+

The Composition of Output and the Policy Mix

- Figure 11-8 shows the policy problem of reaching full employment output, Y^*, for an economy that is initially at point E, with unemployment
  - Should a policy maker choose:
    - ➢ Fiscal policy expansion, moving to point E_1, with higher income and higher interest rates
    - ➢ Monetary policy expansion, resulting in full employment with lower interest rates at point E_2
    - ➢ A mix of fiscal expansion and accommodating monetary policy resulting in an intermediate position
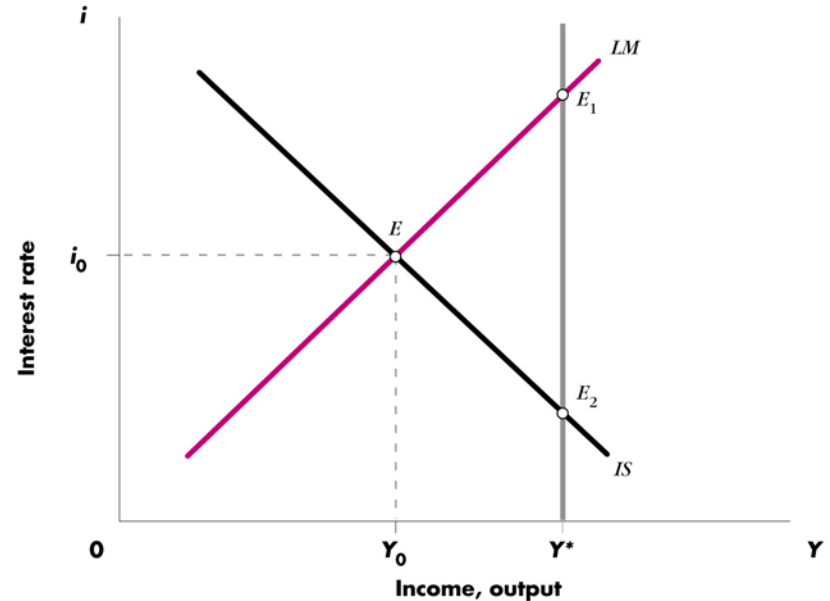
The Composition of Output and the Policy Mix

- All of the policy alternatives increase output, but differ significantly in their impact on different sectors of the economy → problem of political economy

- Given the decision to expand aggregate demand, who should get the primary benefit?
  - An expansion through a decline in interest rates and increased investment spending?
  - An expansion through a tax cut and increased personal consumption?
  - An expansion in the form of an increase in the size of the government?
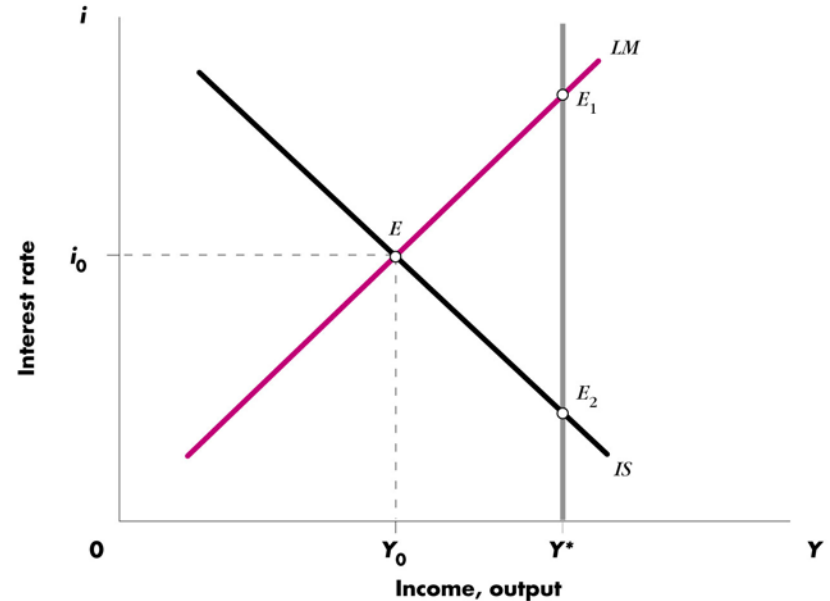
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MACROECONOMICS

Chapter 12

International Linkages

Introduction

- National economies are becoming more closely interrelated

  - Economic influences from abroad have affects on the U.S. economy

  - Economic occurrences and policies in the U.S. affect economies abroad

    - When the U.S. moves into a recession, it tends to pull down other economies

    - When the U.S. is in an expansion, it tends to stimulate other economies

- In this chapter we present the key linkages among open economies and introduce some first pieces of analysis

Introduction

- Economies are linked through two broad channels

  1. Trade in goods and services

     - A trade linkage:

       - Some of a country's production is exported to foreign countries $\rightarrow$ increase demand for domestically produced goods

       - Some goods that are consumed or invested at home are produced abroad and imported $\rightarrow$ a leakage from the circular flow of income

  2. Finance

     - U.S. residents can hold U.S. assets OR assets in foreign countries

       - Portfolio managers shop the world for the most attractive yields

       - As international investors shift their assets around the world, they link assets markets here and abroad $\rightarrow$ affect income, exchange rates, and the ability of monetary policy to affect interest rates

The Balance of Payments and Exchange Rates

- Balance of payments: the record of the transactions of the residents of a country with the rest of the world

- Two main accounts:
  - Current account: records trade in goods and services, as well as transfer payments
  - Capital account: records purchases and sales of assets, such as stocks, bonds, and land

  Any transaction that gives rise to a payment by a country's residents is a deficit item in that country's balance of payments.

TABLE 12-1   The U.S. Balance of Payments
(Billions of Dollars)

	2000	2001	2002	2003	2004	2005
Current account balance	−415.2	−389.0	−472.4	−527.5	−665.3	−791.5
Goods and services balance	−377.6	−362.8	−421.1	−494.9	−611.3	−716.7
Capital account balance	415.2	389.0	472.4	527.5	665.3	791.5
U.S. official reserve assets, net*	−0.3	−4.9	−3.7	1.5	2.8	14.1
Net private capital flows**	415.4	393.9	476.1	526.0	662.5	777.4
Balance of Payments Deficit	−0.3	−4.9	−3.7	1.5	2.8	14.1

*A positive number for net U.S. official reserve assets indicates a decrease in official reserves.

**Including statistical discrepancy.

Source: *Bureau of Economic Analysis.*

External Accounts Must Balance

- The central point of international payments is very simple: *Individuals and firms have to pay for what they buy abroad*

  - If a person spends more than her income, her deficit needs to be financed by selling assets or by borrowing

  - Similarly, if a country runs a deficit in its current account the deficit needs to be financed by selling assets or by borrowing abroad

    - Selling/borrowing implies the country is running a capital account surplus $\rightarrow$ any current account deficit if of necessity *financed* by an offsetting capital inflow:

      Current account + Capital account = 0   (1)

Exchange Rates

- Exchange rate is the price of one currency in terms of another
  - Ex. In august 1999 you could buy 1 Irish punt for \$1.38 in U.S. currency $\rightarrow$ nominal exchange rate was e = 1.38
    - If a sandwich cost 2.39 punts, that is the equivalent of

$$1.39\left(\frac{\$}{punt}\right) \times 2.39\,punt = \$3.30$$

- Discuss two different exchange rate systems:
  - Fixed exchange rate system
  - Floating exchange rate system

Fixed Exchange Rates

- In a fixed exchange rate system foreign central banks stand ready to buy and sell their currencies at a fixed price in terms of dollars
  - Ensures that market prices equal to the fixed rates
    - ➢ No one will buy dollars for more than fixed rate since know that they can get them for the fixed rate
    - ➢ No one will sell dollars for less than fixed rate since know can sell them for the fixed rate
- Foreign central banks hold reserves to sell when have to to intervene in the foreign exchange market
  - Intervention: the buying or selling of foreign exchange by the central bank

Fixed Exchange Rates

- *What determines the level of intervention of a central bank in a fixed exchange rate system?*
  - The balance of payments measures the amount of foreign exchange intervention needed from the central banks
    - Ex. If the U.S. were running a current account deficit vis-à-vis Japan, the <u>demand</u> for yen in exchange for dollars exceeded the <u>supply</u> of yen in exchange for dollars, the Bank of Japan would buy the excess dollars, paying for them with yen
    - → Under a fixed exchange rate, price fixers must make up the excess demand or take up the excess supply
    - → Makes it necessary to hold an inventory for foreign currencies that can be provided in exchange for the domestic currency

Fixed Exchange Rates

- *What determines the level of intervention of a central bank in a fixed exchange rate system?*
  - As long as the central bank has the necessary reserves, it can continue to intervene in the foreign exchange markets to keep the exchange rate constant
  - If a country persistently runs deficits in the balance of payments:
    - The central bank eventually will run out of reserves on of foreign exchange
    - Will be unable to continue its intervention
    - Before this occurs, the central bank will likely devalue the currency

Flexible Exchange Rates

- In a flexible (floating) exchange rate system, central banks allow the exchange rate to adjust to equate the supply and demand for foreign currency
  - Suppose the following:
    - Exchange rate of the dollar against the yen is 0.86 cents per yen
    - Japanese exports to the U.S. increase
    - Americans must pay more yen to Japanese exporters
    - Bank of Japan stands aside and allows the exchange rate to adjust
    - Exchange rate could increase to 0.90 cents per yen
    - Japanese goods more expensive in terms of dollars
    - Demand for Japanese goods by Americans declines

The Exchange Rate in the Long Run

- In the long run, the exchange rate between a pair of countries is determined by the relative purchasing power of currency within each country
    - Two currencies are at purchasing power parity (PPP) when a unit of domestic currency can buy the same basket of goods at home or abroad
        - The relative purchasing power of two currencies is measured by the *real exchange rate*
        - The real exchange rate, R, is defined as $R = \dfrac{eP_f}{P}$ (3), where P_f and P are the price levels abroad and domestically, respectively
        - → If R = 1, currencies are at PPP
        - → If R > 1, goods abroad are more expensive than at home
        - → If R < 1, goods abroad are cheaper than those at home

The Exchange Rate in the Long Run

- Figure 12-2 shows the cost of barley in England relative to that in Holland over a long time period
  - Real barley exchange rate tended towards equalization
  - However, long time periods of deviation from equality
- Best estimate for modern times is that it takes about 4 years to reduce deviations from PPP by half
  - PPP holds in the LR, but only one of the determinants of the exchange rate
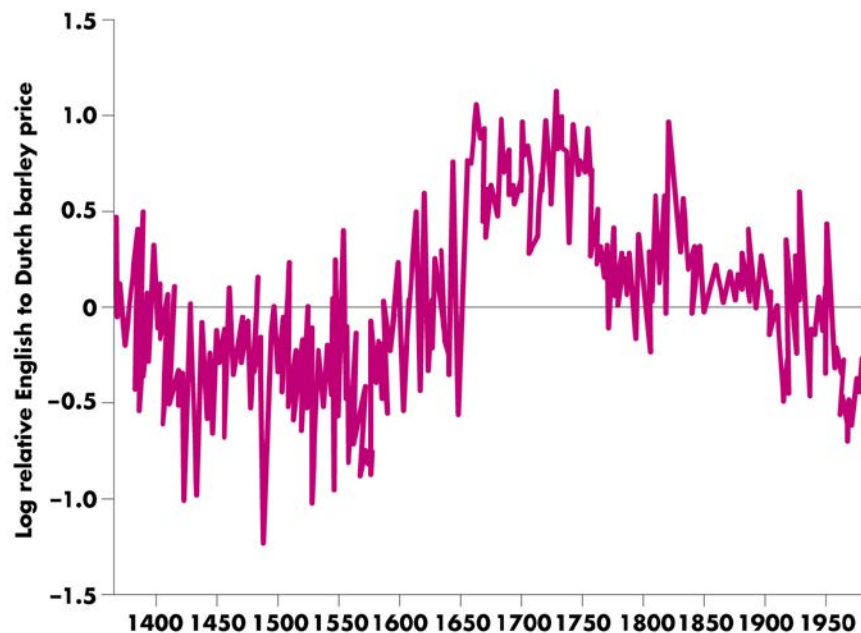
Trade in Goods, Market Equilibrium, and the Balance of Trade

- Need to incorporate foreign trade into the IS-LM model
  - Assume the price level is given, and output demanded will be supplied (flat AS curve)
- With foreign trade, domestic spending no longer solely determines domestic output → *spending on domestic goods* determines domestic output
  - Spending by domestic residents is $DS = C + I + G$ (4)
  - Spending on domestic goods is $DS + NX = (C + I + G) + (X - Q)$
  $$= (C + I + G) + NX \qquad (5)$$
  - Assume DS depends on the interest rate and income:
  $$DS = DS(Y, i) \qquad (6)$$

Net Exports

- Net exports, (X-Q), is the excess of exports over imports
  - NX depends on:
    - domestic income
    - foreign income, Y_f
    - R

    $$NX = X(Y_f, R) - Q(Y, R) = NX(Y, Y_f, R) \quad \textbf{(7)}$$

    → A rise in foreign income improves the home country's trade balance and raises their AD

    → A real depreciation by the home country improves the trade balance and increases AD

    → A rise in home income raises import spending and worsens the trade balance, decreasing AD

Goods Market Equilibrium

- Marginal propensity to import = fraction of an extra dollar of income spent on imports
  - IS curve will be steeper in an open economy compared to a closed economy
    - For a given reduction in interest rates, it takes a smaller increase in output and income to restore equilibrium in the goods market
- IS curve now includes NX as a component of AD

$$IS : Y = DS(Y,i) + NX(Y,Y_f,R) \quad (8)$$

  - level of competitiveness (R) affects the IS curve
    - A real depreciation increases the demand for domestic goods $\rightarrow$ shifts IS to the right
  - An increase in Y_f results in an increase in foreign spending on domestic goods$\rightarrow$ shifts IS to the right

Goods Market Equilibrium

- Figure 12-3 shows the effect of a rise in foreign income
  - Higher foreign spending on our goods raises demand and requires an increase in output at given interest rates
    - Rightward shift of IS
  - Full effect of an increase in foreign demand is an increase in interest rates and an increase in domestic output and employment
- Figure 12-3 can also be used to show the impact of a real depreciation
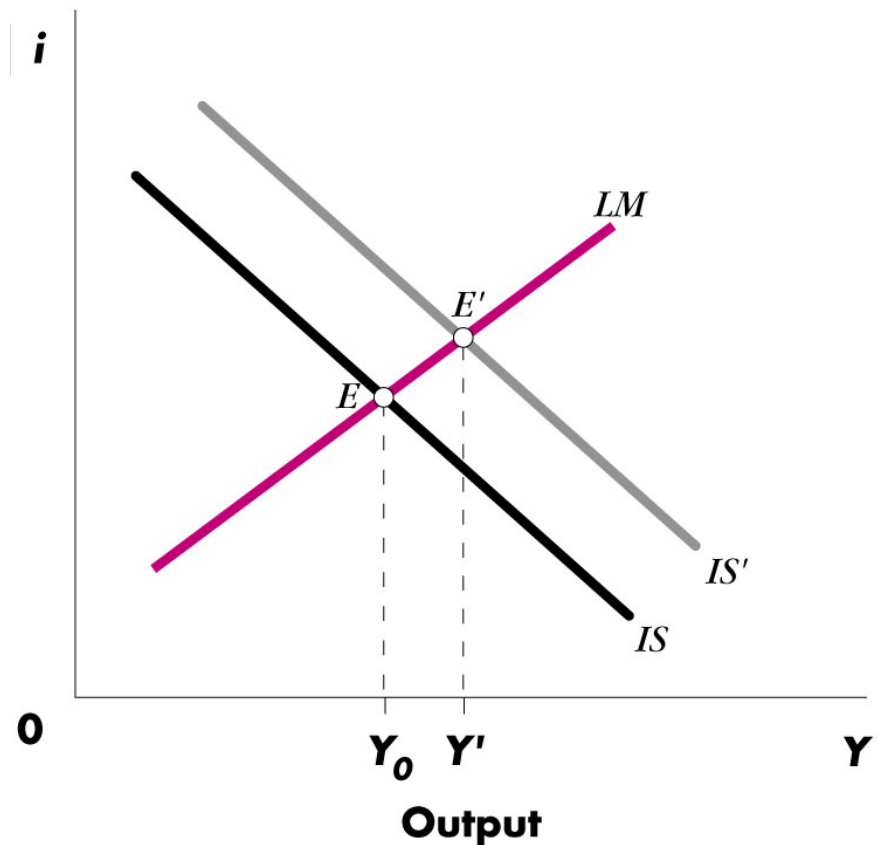
Capital Mobility

- High degree of integration among financial markets → markets in which bonds and stocks are traded
- Start our analysis with the assumption of *perfect capital mobility*
  - Capital is perfectly mobile internationally when investors can purchase in any country they choose quickly, with low transaction costs , and in unlimited amounts
  - Under this assumption, asset holders are willing and able to move large amounts of funds across borders in search of the highest return or lowest borrowing cost
  - Implies that interest rates in a particular country can not get too far out of line without bringing capital inflows/outflows that bring it back in line

The Balance of Payments and Capital Flows

- Assume a home country faces a given price of imports, export demand, and world interest rate, i_f
  - Additionally, capital flows into the home country when the interest rate is above the world rate
- Balance of payments surplus is: $BP = NX(Y, Y_f, R) + CF(i - i_f)\ (9)$, where CF is the capital account surplus
  - The trade balance is a function of domestic and foreign income
    - An increase in domestic income worsens the trade balance
  - The capital account depends on the interest differential
    - An increase in the interest rate above the world level pulls in capital from abroad, improving the capital account

Mundell-Fleming Model: Perfect Capital Mobility Under Fixed Exchange Rates

- The Mundell-Fleming model incorporates foreign exchange under perfect capital mobility into the standard IS-LM framework

  - Under perfect capital mobility, the slightest interest differential provokes infinite capital inflows → *central bank cannot conduct an independent monetary policy under fixed exchange rates*

WHY?

- Suppose a country tightens money supply to increase interest rates

  - Portfolio holders worldwide shift assets into country

  - Due to huge capital inflows, balance of payments shows a large surplus

  - The exchange rate appreciates and the central bank must intervene to hold the exchange rate fixed

  - The central bank buys foreign currency in exchange for domestic currency

  - Intervention causes domestic money stock to increase, and interest rates drop

  - Interest rates continue to drop until return to level prior initial intervention

Monetary Expansion

- Figure 12-5 shows the IS-LM curves in addition to the BP=0

  - BP schedule is horizontal under perfect capital mobility ($i = i_f$)

- Consider a monetary expansion that starts from point E → shifts LM down and to the right to E'

  - At E' there is a large payments deficit, and pressure for the exchange rate to depreciate

  - Central bank must intervene, selling foreign money, and receiving domestic money in exchange

    - Supply of money falls, pushing up interest rates as LM moves back to original position
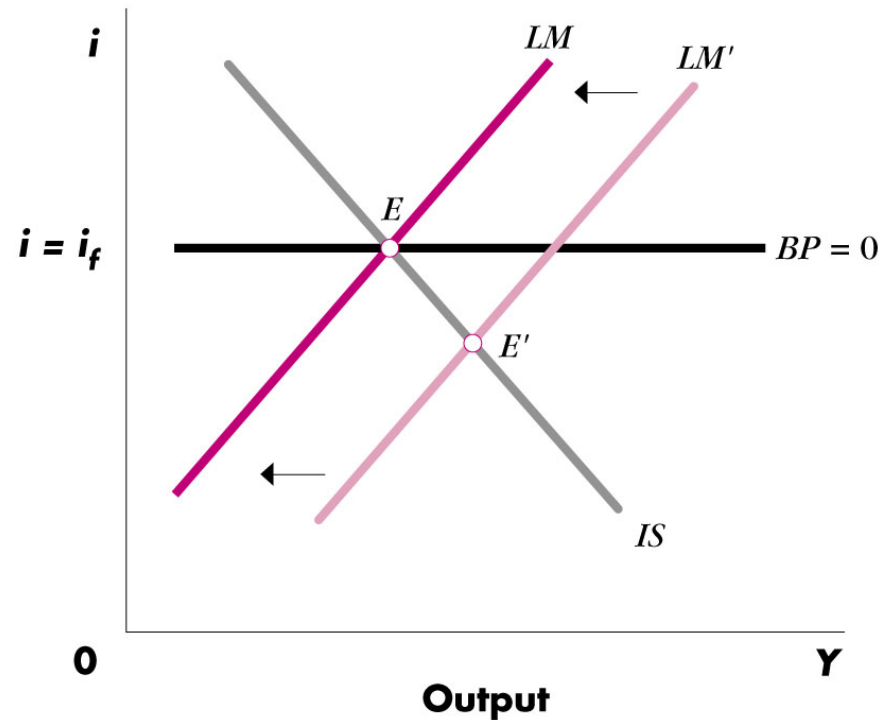
Fiscal Expansion

- Monetary policy is infeasible, but fiscal expansion under fixed exchange rates and perfect capital mobility is effective
  - A fiscal expansion shifts the IS curve up and to the right → increases interest rates and output
  - The higher interest rates creates a capital inflow with the tendency to appreciate the exchange rate
  - To manage the exchange rate the central bank *must* expand the money supply → shifting the LM curve to the right
    - Pushes interest rates back to their initial level, but output increases yet again

Perfect Capital Mobility and Flexible Exchange Rates

- Use the Mundell-Fleming model to explore how monetary and fiscal policy work in an economy with a flexible exchange rate and perfect capital mobility
  - Assume domestic prices are fixed (this is relaxed in Ch. 20)
- Under a flexible exchange rate system, the central bank does not intervene in the market for foreign exchange
  - The exchange rate must adjust to clear the market so that the demand for and supply of foreign exchange balance
  - Without central bank intervention, the balance of payments must equal zero
  - The central bank can set the money supply at will since there is no obligation to intervene → no automatic link between BP and money supply

Perfect Capital Mobility and Flexible Exchange Rates

- Perfect capital mobility implies that the balance of payments balances when $i = i_f$ **(10)**
  - A real appreciation means home goods are relatively more expensive, and IS shifts to the left
  - A depreciation makes home goods relatively cheaper, and IS shifts to the right
- The arrows in Figure 12-6 make the link between the interest rate and AD
  - When $i > i_f$, the currency appreciates
  - When $i < i_f$, the currency depreciates
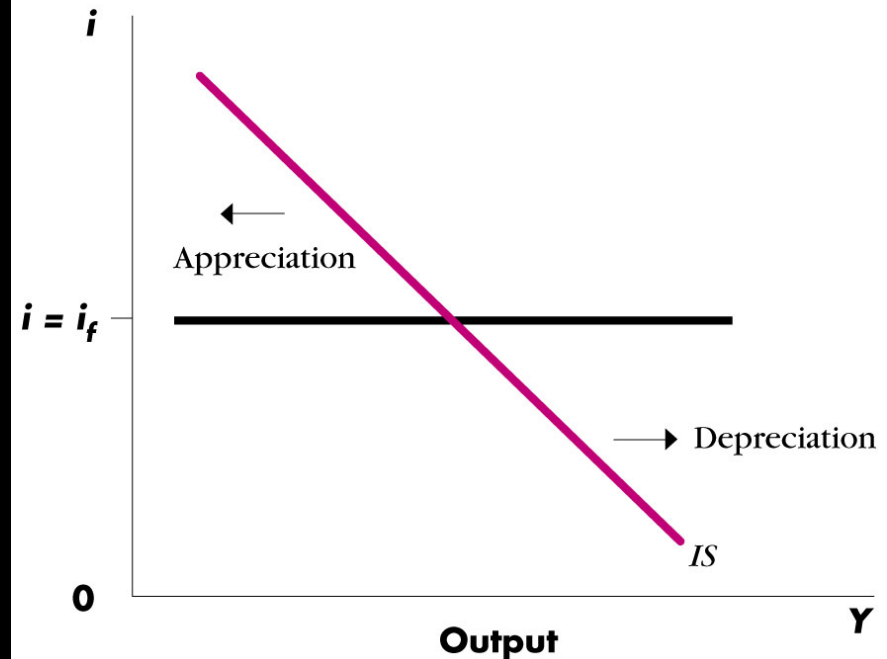
Adjustment to a Real Disturbance

- Using equations 8-10 we can show how various changes affect the output level, interest rate, and exchange rate

- <u>Suppose exports increase</u>:
  - ➤ At a given output level, interest rate, and exchange rate, there is an excess demand for goods
  - ➤ IS shifts to the right
  - ➤ The new equilibrium, E', corresponds to a higher income level and interest rate
  - ➤ But don't reach E' since BP in disequilibrium → exchange rate appreciation will push economy back to E
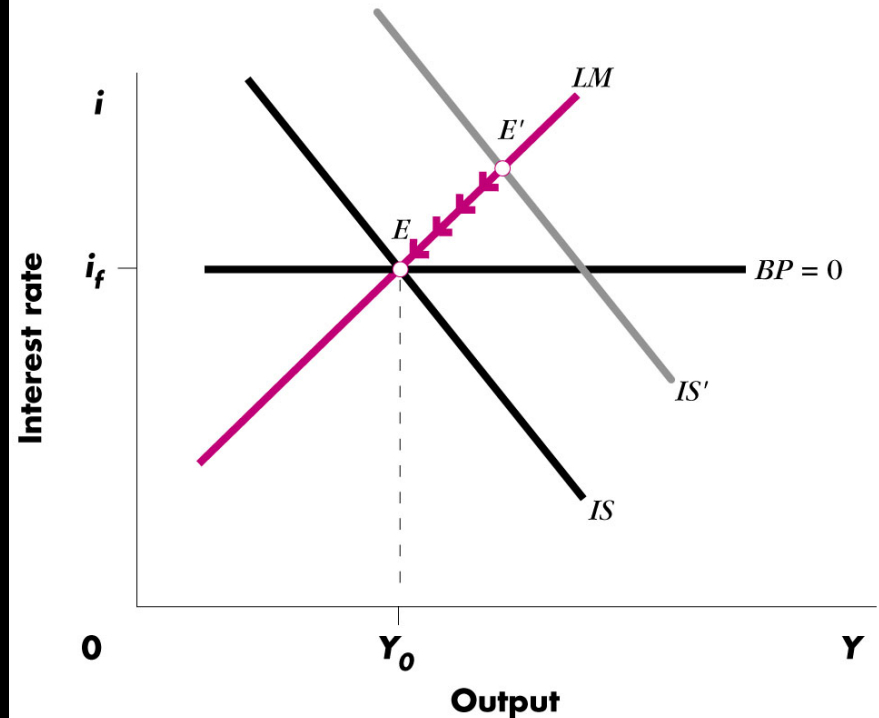
Adjustment to a Real Disturbance

- Using equations 8-10 we can show how various changes affect the output level, interest rate, and exchange rate

- <u>Suppose there is a fiscal expansion</u>:

  - ➤ Same result as with increase in exports → tendency for demand to increase is halted by exchange appreciation

  Real disturbances to demand do not affect equilibrium output under flexible exchange rates with capital mobility.
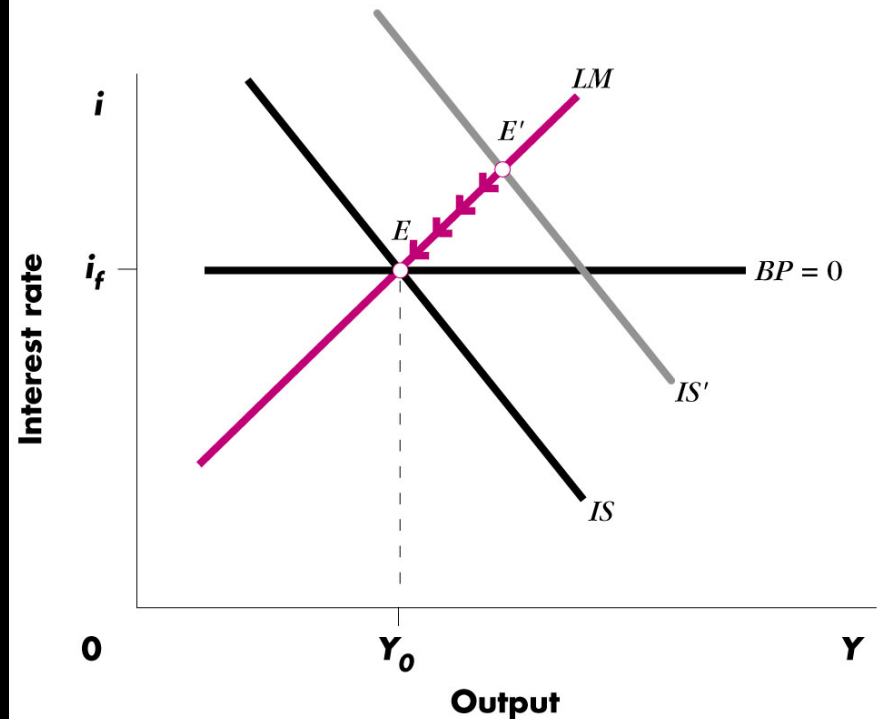
Adjustment to a Change in the Money Stock

- Suppose there is an increase in the nominal money supply:
  - The real stock of money, M/P, increases since P is fixed
  - At E there will be an excess supply of real money balances
  - To restore equilibrium, interest rates will have to fall → LM shifts to the right
  - At point E', goods market is in equilibrium, but i is below the world level → capital inflows depreciate the exchange rate
  - Import prices increase, domestic goods more competitive, and demand for home goods expands
  - IS shifts right to E", where $i = i_f$
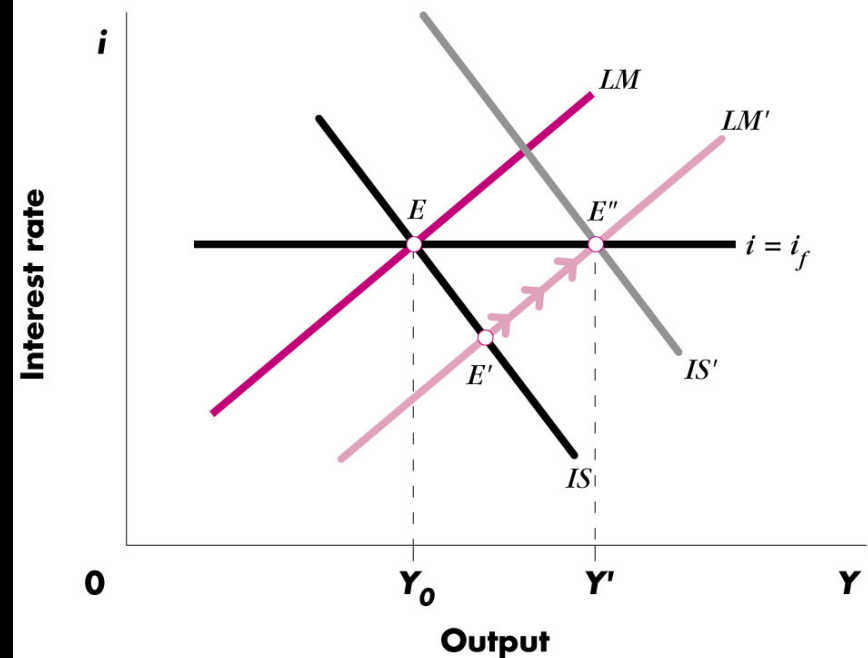
Adjustment to a Change in the Money Stock

- Suppose there is an increase in the nominal money supply:
  - ➢ Result: A monetary expansion leads to an increase in output and a depreciation of the exchange rate under flexible rates

Under fixed rates, the central bank cannot control the nominal money stock.

Under flexible rates, the central bank can control the nominal money stock, and is a key aspect of that exchange rate system.
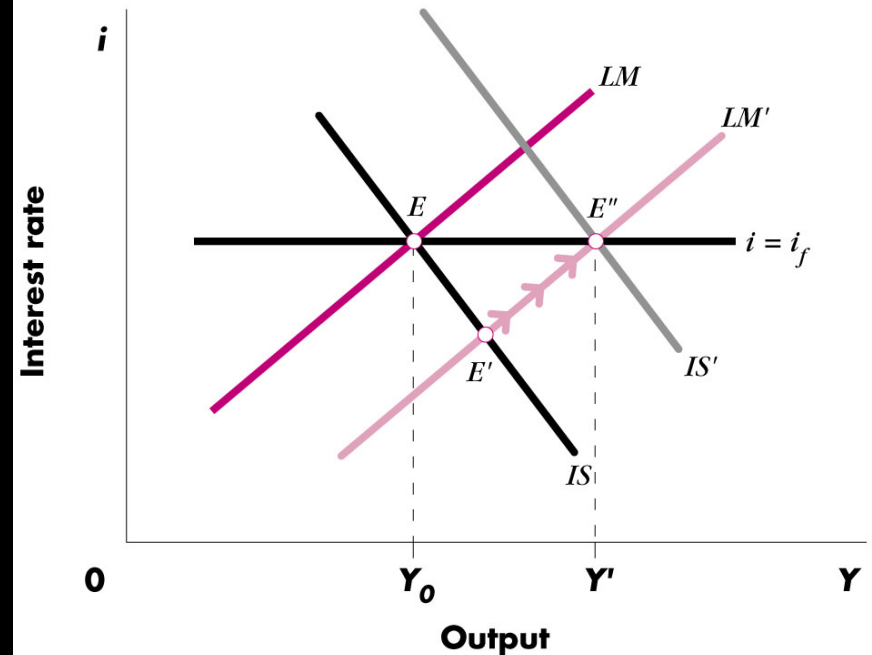
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MACROECONOMICS

Consumption and Saving

Introduction

- Consumption accounts for about 70% of AD
    - Fluctuations in C are proportionately smaller than the fluctuations in GDP
    - Consumption is relatively stable
- In this chapter we seek to understand consumption and the link between consumption and income
    - → Consumption theory
- The debate over different consumption theories = debate over the size of the marginal propensity to consume (MPC)
    - Keynesian model MPC is high, modern theories MPC is low

Introduction

- Figure 13-2 plots changes in per capita consumption and changes in per capita disposable income

  → Consumption follows income swings that last 5-10 years

  → Consumption does not respond to spikes in income

  Long term changes in income generate changes in consumption, but short term changes in income do not.
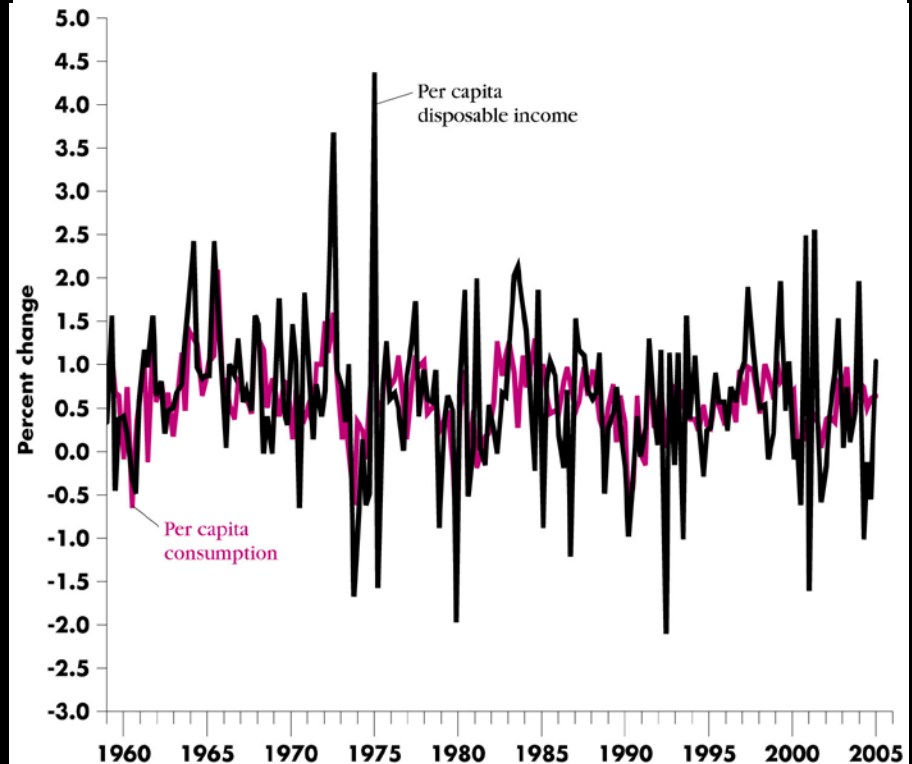
Introduction

- Figure 13-2 compares consumption this quarter to the previous quarter:

$$C_t = \$29.21 + 1.003C_{t-1}$$

→ Consumption is almost perfectly predicted by previous consumption

→ This relationship is an outcome of the link between current consumption and expected future consumption

→ Used in the modern theories of consumption
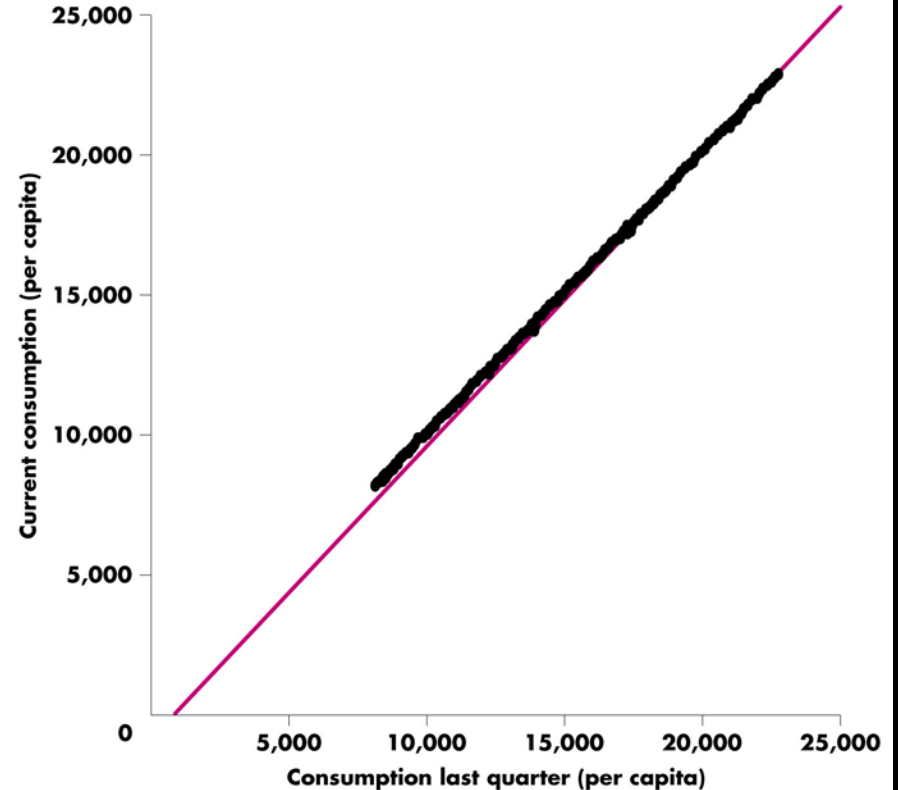
Introduction

- Early Keynesian theories explained consumption as a function of current disposable income (Figure 13-3)
  - No separation for temporary and permanent income
  - This consumption function is of the form: $C_t = \overline{C} + cYD_t$ (1), where c is the MPC and is on the [0,1] range
  - Modern consumption theories incorporate intertemporal dynamics
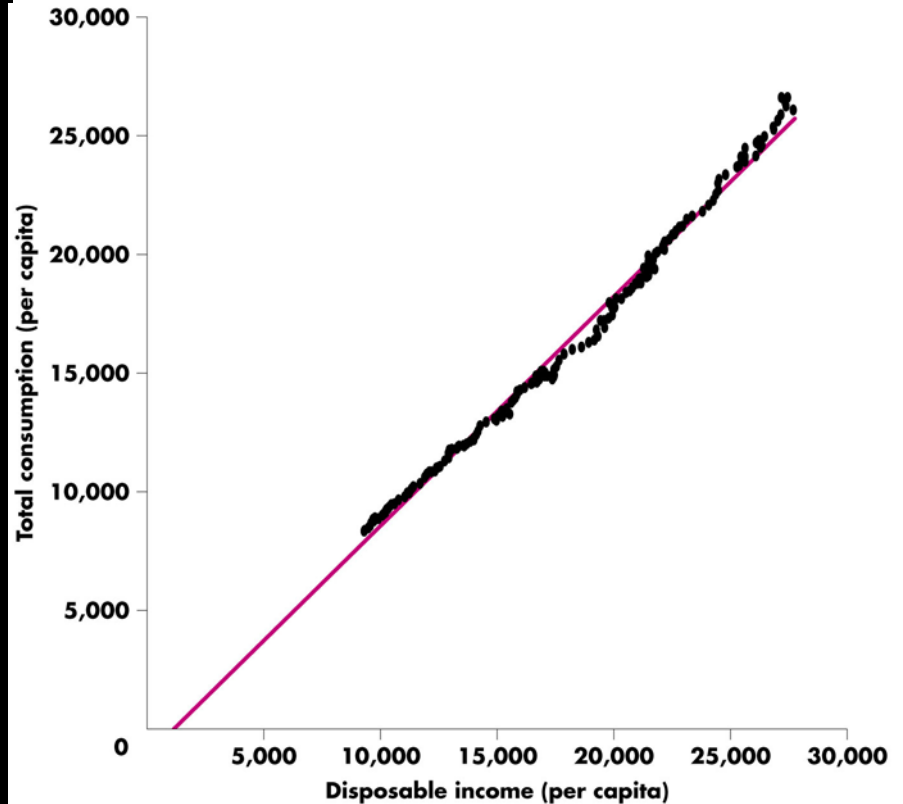
Life Cycle Theory

- The <u>life cycle hypothesis</u> views individuals as planning their consumption and savings behavior over long periods with the intention of allocating their consumption in the best possible way over their entire lifetimes
  - Different MPC out of permanent income, transitory income, and wealth compared to the Keynesian theory with a single MPC
- <u>Key assumption</u>: most people choose stable lifestyles, or smooth out consumption over their lifetime
  - Individuals do not like consumption to change dramatically from year to year
  - The simplest form of this assumption is to consume the same amount in every year

Life Cycle Theory

- Suppose an individual:
  - Starts life at age 20
  - Plans to work until age 65
  - Will die at age 80
  - Has annual labor income of YL = $30,000
  - Lifetime resources are $30,000 x 45 = $1,350,000
  - Spreading lifetime resources over the number of years of life (80-20 = 60) allows for C = $1,350,000/60 = $22,500
    - → The general formula is $C = \dfrac{WL}{NL} \times YL$
    - → The marginal propensity to consume is $\dfrac{WL}{NL}$

Life Cycle Theory

- Once we have a theory of consumption, we have a theory of savings (savings is income less consumption)
- Figure 13-4 traces out the path of consumption and saving using the life cycle theory
  - → Wealth peaks at retirement
  - → Wealth is zero at death
  - → Accumulate savings in working years, but dissave through retirement
  - → Income is positive in working years, and zero in retirement
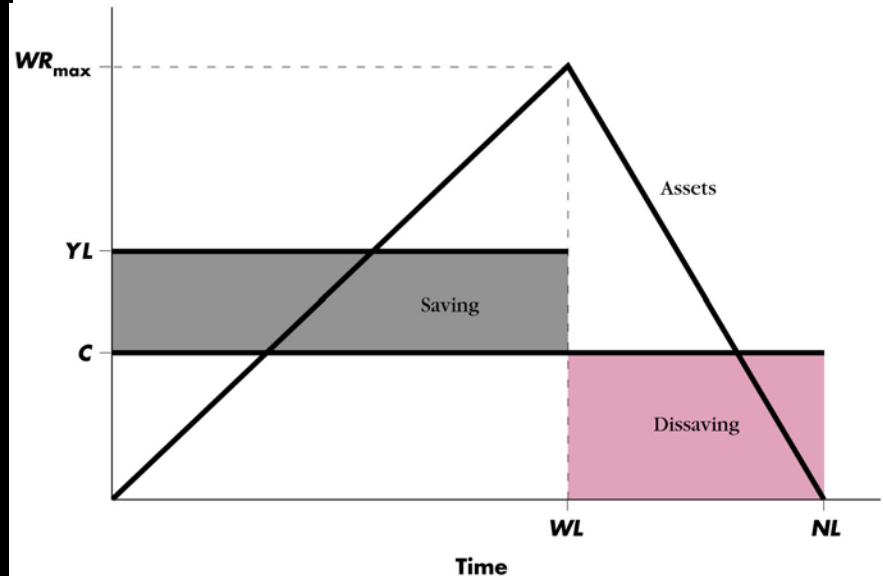
Life Cycle Theory

- Continuing with the example, can compute different marginal propensities to consume for various measures of income: *permanent and transitory income*
  - Suppose income increases permanently by $3,000:
    - → The extra $3,000 for each 45 years spread out over 60 years of life increases consumption by $3,000 \times \dfrac{45}{60} = \$2,250$
    - → The marginal propensity to consume out of permanent income is
      $$\frac{WL}{NL} = \frac{45}{60} = 0.75$$
  - Suppose income increased by $3,000 for only one year:
    - → The extra $3,000 over 60 years would increase consumption by
      $$\$3,000 \times \frac{1}{60} = \$50$$
    - → The MPC out of transitory income is $\dfrac{1}{60} = 0.017$

Life Cycle Theory

- The MPC out of permanent income is large
- The MPC out of transitory income is small and fairly close to zero
- The life-cycle theory implies that the MPC out of wealth should equal the MPC out of transitory income

WHY?

→Spending out of wealth is spread out over remaining years of life

→The MPC out of wealth is used to link changes in the value of assets to current consumption

Permanent Income Theory

- Permanent income theory of consumption is like the life cycle hypothesis in that current consumption is not dependent upon current income, but on a longer-term estimate of income

  → Milton Friedman called this permanent income

  → Permanent income is the steady rate of expenditure a person could maintain for the rest of his/her life, given the present level of wealth and the income earned now and in the future

  → The consumption function is then: $C = cYP$ (2), where YP is permanent disposable income

  Life cycle hypothesis and permanent income hypothesis are very similar, and are often combined as the PILCH.

Consumption Under Uncertainty

- If permanent income were known, according the PILCH, consumption would never change

  - The modern version of PILCH emphasizes the link between <u>income uncertainty</u> and changes in consumption and takes a more formal approach to <u>consumer maximization</u>

→ Under this newer version of consumption theory, changes in consumption arise from *surprise* changes in income

  - Absent such surprises, consumption this period is the same as last period and is the same as next period

  - Consumption can be modeled as: $C_{t+1} = C_t + \varepsilon$, where consumption tomorrow is equal to consumption today plus a truly random error (Robert Hall)
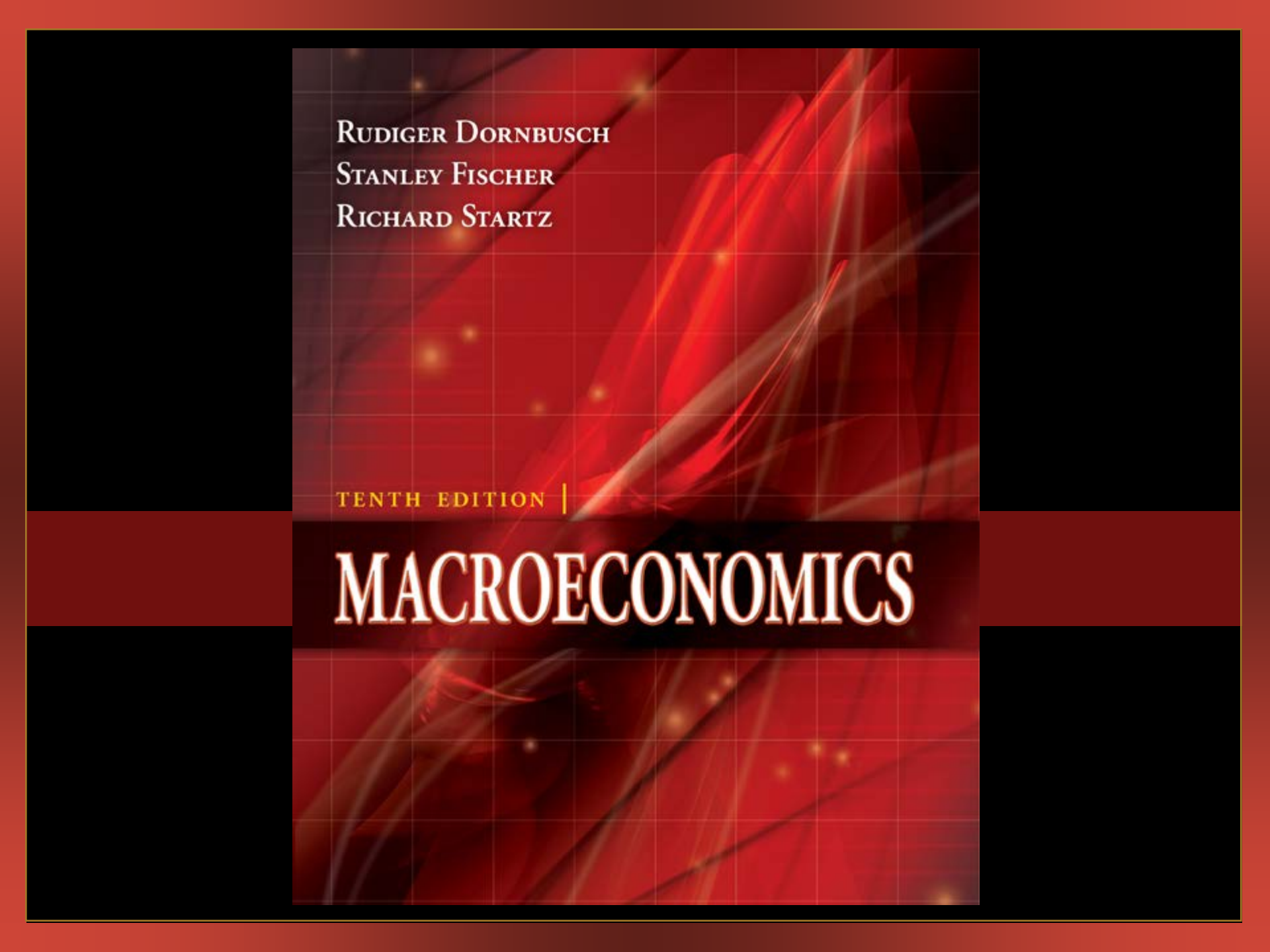
Liquidity Constraints and Myopia

- *Why might the PILCH miss explaining close to half of consumption behavior?*
  - Two explanations include:
    - ➢ Liquidity constraints: consumer unable to borrow to sustain current consumption in the expectation of higher future income
      - When permanent income is higher than current income, consumers are unable to borrow to consume at the higher level predicted by PILCH
      - Consumption more closely linked to current income
    - ➢ Myopia:
      - Consumers simply are not as forward looking as the PILCH suggests

Difficult to differentiate between the two, but both imply current consumption dependent upon current disposable income, rather than future levels.

Uncertainty and Buffer Stock Saving

- Life cycle hypothesis is that people save to finance retirement
  - Additional saving goals also matter, especially with the presence of uncertainty
    - Research suggests that some save to leave bequests to children
      - Different motives for bequests: altruistic motive and strategic motive
    - Some saving is precautionary $\rightarrow$ undertaken to guard against unexpected events (ex. Health care costs)
      - Saving is used as a buffer stock $\rightarrow$ added to when times are good in order to maintain consumption when times are bad
  - One piece of evidence for these other motives is that older people rarely dissave, or draw down their wealth, but live off of income (Ex. Interest and dividends from wealth)

Chapter 14

Investment Spending

Introduction

- Investment:
  - Links the present to the future
  - Links the goods and money markets
  - Drives much of the business cycle
- In this chapter we study how investment depends on interest rates and income
- Figure 14-1 illustrates the volatility of investment by comparing investment and GDP
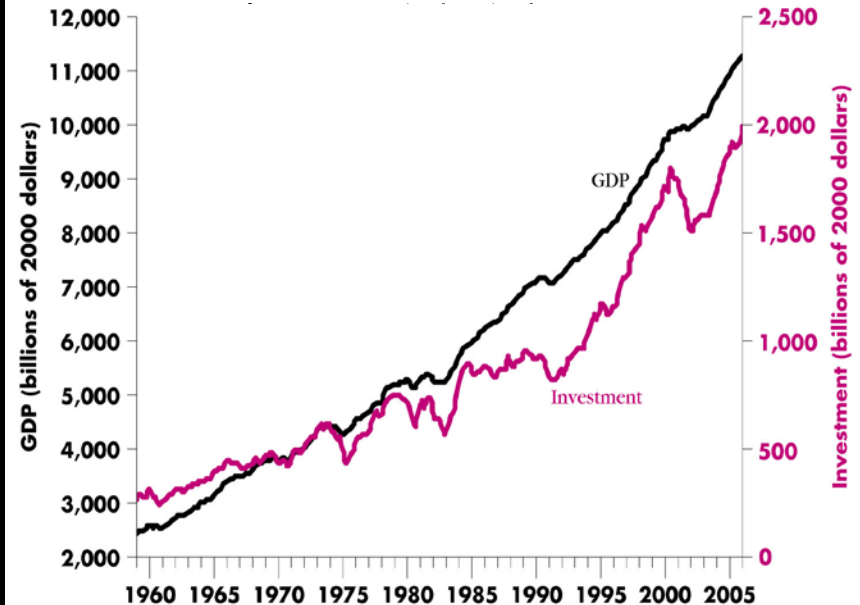
Introduction

- The theory of investment is the theory of the demand for capital

  - Investment is the *flow* of spending that adds to the stock of capital

    - Both GDP and investment are flow variables

  - Capital is the dollar value of all the buildings, machines, and inventories at a given point in time $\rightarrow$ *stock* value

    - Investment is the amount spent by businesses to add to the existing capital stock over a given period

    Flow of investment is quite small compared to the stock of capital.

The Desired Capital Stock

- Firms use capital, along with labor and other resources, to produce output → The goal of a given firm is to <u>maximize profits</u>

  → *When deciding the optimal level of capital, firms must balance the contribution that more capital makes to their revenues against the cost of acquiring additional capital*

  The *marginal product of capital* is the increase in output produced by using 1 more unit of capital in production.

  The *rental (user) cost* of capital is the cost of using 1 more unit of capital in production.

The Desired Capital Stock

- To derive the rental cost of capital:
  - firms finance the purchase of capital by borrowing over time, at an interest rate of i
  - In the presence of inflation, the nominal dollar value of capital rises over time
    - Real cost of capital = nominal interest rate - nominal capital gain
  - At the time the firm makes an investment, the nominal interest rate is known, but the inflation rate for the coming year is not
    - Real cost of borrowing is the expected real interest rate: $r = i - \pi^e$
  - Capital wears out over time $\rightarrow$ must include depreciation, d
  - The complete formula for the rental cost of capital is:

$$rc = r + d = i - \pi^e + d$$

The complete formula for the rental cost of capital is

The Desired Stock of Capital

- Firms add capital until the marginal return of the last unit added drops to the rental cost of capital

  - *Diminishing marginal product* of capital means that each successive unit of capital yields less than the previous unit → Figure 14-2

  - An increase in the rental cost of capital can only be justified by an increase in the marginal product of capital, and a lower level of K

- The general relationship among the desired capital stock, K^*, rc, and output is
$$K^* = g(rc, Y) \qquad (1)$$
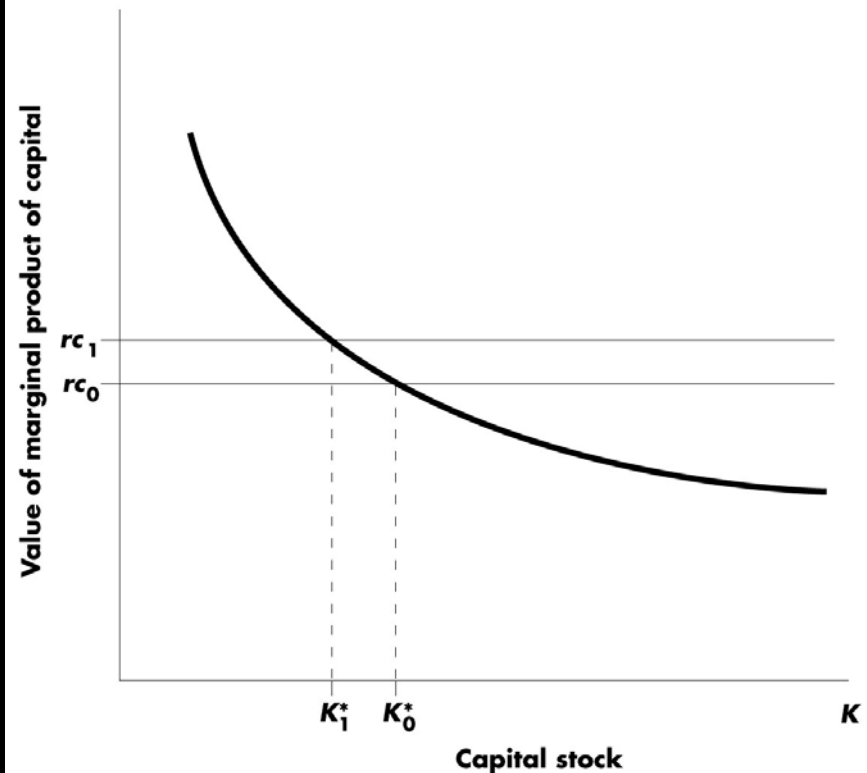
From Desired Capital Stock to Investment

- Figure 14-4 illustrates an increase in the demand for capital stock as a rightward shift in the demand for capital schedule

  - At the initial level of capital, K_0, the price of capital is just high enough to generate enough investment, I_0, to replace the depreciating capital

  - In the LR, supply of new capital is very elastic, so the increase in demand is met without much change in price

  - In the SR, price rises to P_1, increasing investment flow to I_1

(a) Price of capital vs Capital stock, showing P_1, P_0, DD_1, DD_0, K_0, K_1, K

(b) Investment flow, showing I_0, I_1, I
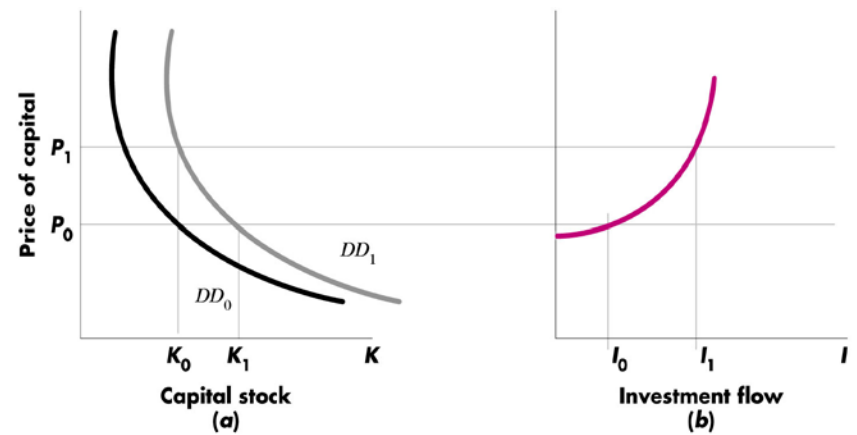
Capital Stock Adjustment

- The flexible accelerator model can be used to explain the speed at which firms plan to adjust their capital stock
  - ➢ <u>Basic notion</u>: the larger the gap between the existing capital stock and the desired capital stock, the more rapid a firm's rate of investment
  - ➢ Firms plan to close a fraction, λ, of the gap between the actual and desired capital stocks each period
    - Capital at the end of last period is K_{-1}
    - The gap between actual and desired capital stock is $(K^* - K_{-1})$
    - A firm plans to add a fraction of the gap to last periods stock
    - Actual capital stock at the end of the current period is then
    $$K_0 = K_{-1} + \lambda(K^* - K_{-1}) \quad (2)$$

Capital Stock Adjustment

- To increase the capital stock from K_{-1} to K_0, the firm must achieve net investment of

$$I \equiv (K_0 - K_{-1})$$

$$= (K_{-1} + \lambda(K^* - K_{-1})) - K_{-1}$$

$$= \lambda(K^* - K_{-1}) \qquad (3)$$

- Figure 14-5 illustrates how the capital stock adjusts from an initial level of K_{-1} to the desired level K^*
  - Upper panel shows the stock of capital
  - Lower panel shows the corresponding level of I
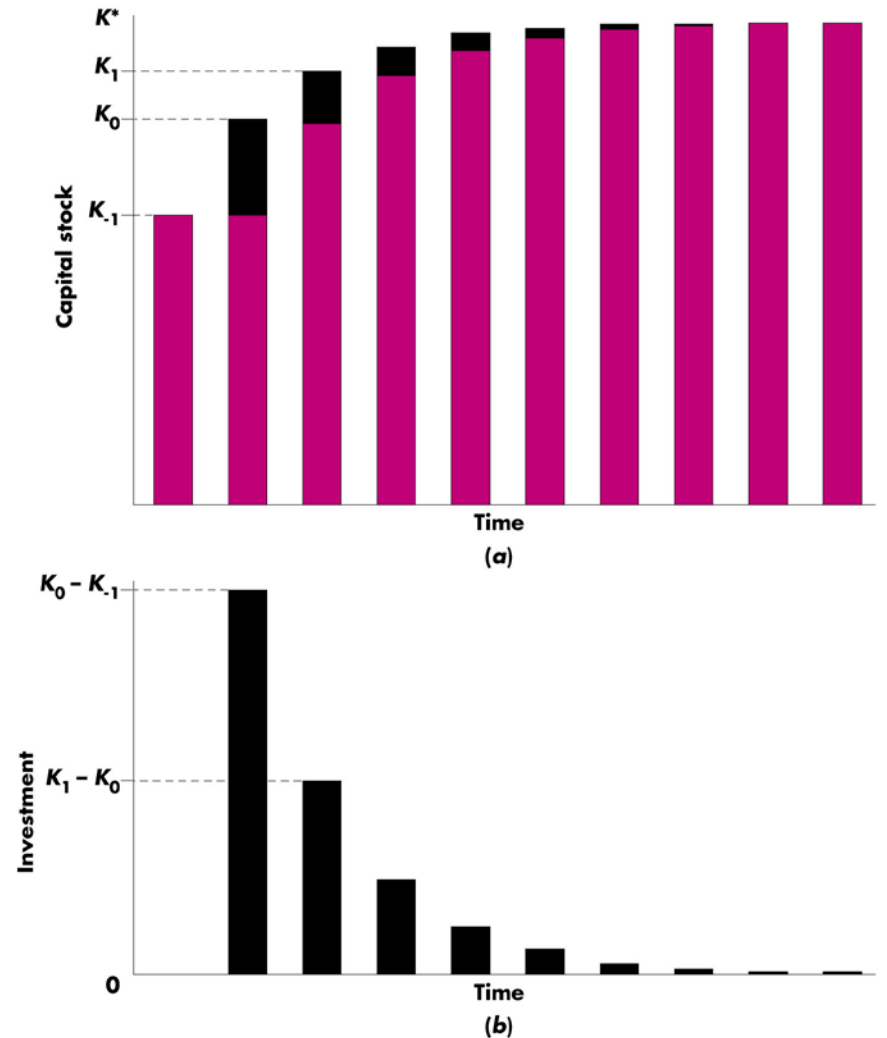
Capital Stock Adjustment

- To increase the capital stock from K_{-1} to K_0, the firm must achieve net investment of

$$I \equiv (K_0 - K_{-1})$$

$$= (K_{-1} + \lambda(K^* - K_{-1})) - K_{-1}$$

$$= \lambda(K^* - K_{-1}) \qquad (3)$$

- Equation (3) shows investment spending as a function of K^* and K_{-1}

  - Any factor that increases K^*, increases the rate of investment

  - Investment contains aspects of *dynamic behavior*
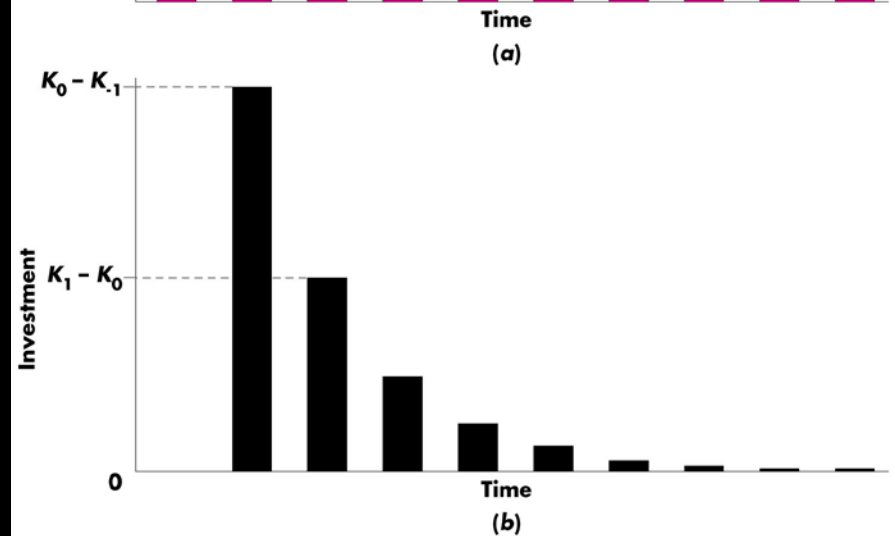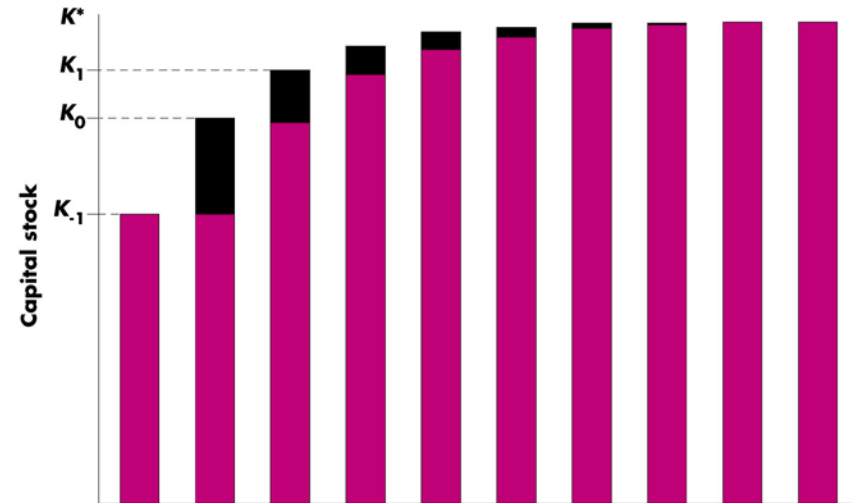
Investment Subsectors

- Figure 14-6 demonstrates the volatility of the three investment subsectors:
  1. Business fixed investment
  2. Residential investment
  3. Inventory investment

  ➢ Business fixed investment is the largest of the three
  ➢ Inventory investment is the most volatile
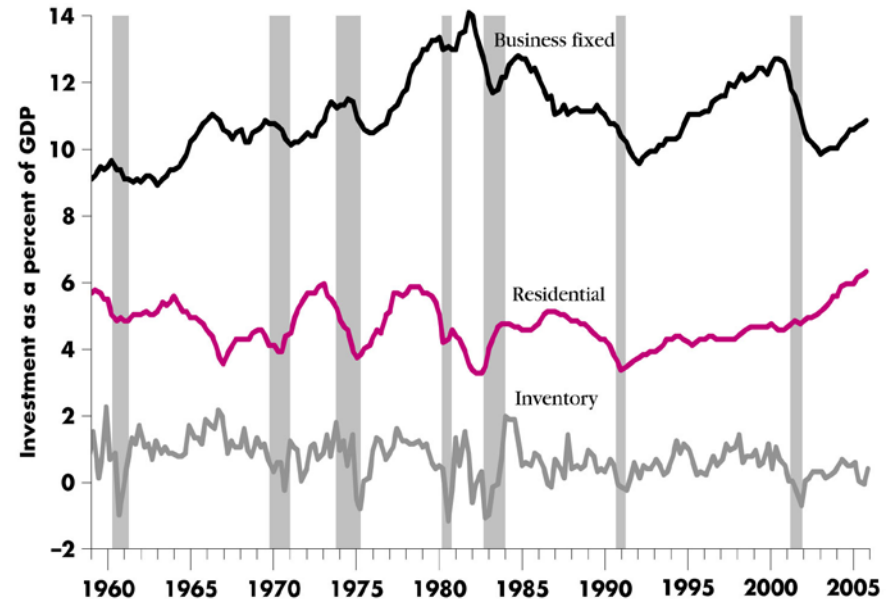
Investment Subsectors

- Figure 14-7 shows residential investment spending as a percentage of GDP <u>AND</u> the nominal mortgage interest rate over time

    - Residential investment is high when mortgage rates are low
    - Residential investment is low when mortgage rates are high

**Mortgage interest rates are the cost of borrowing money for housing → as costs increase, demand for funds and investment decline
(role for monetary policy)**
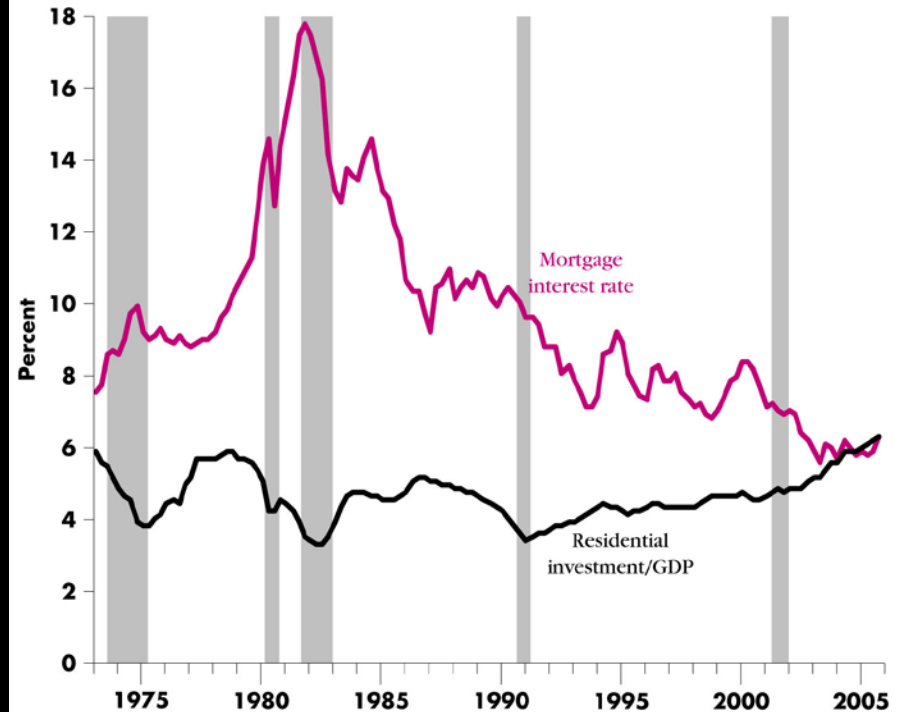
Investment Subsectors

- Inventories include raw materials, goods in the production process, and completed goods held by firms in the anticipation of the products' sale

- Figure 14-8 shows the ratio of manufacturing inventories to sales over time
  - Until 1990, ratio on range of 13 to 17 percent
  - Since then has fallen to close to 10 percent (*just-in-time* manufacturing techniques)
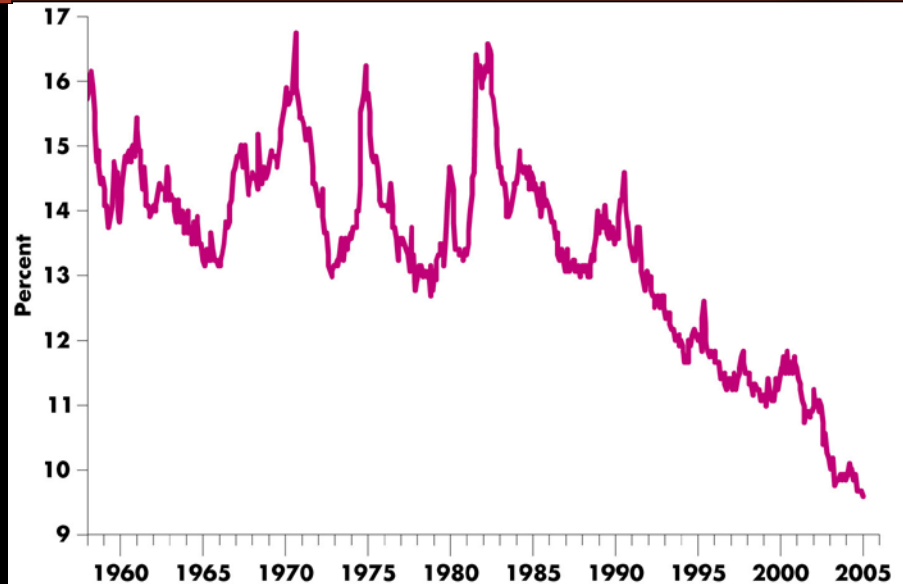
Investment Subsectors

- Firms hold inventories for several reasons:
  - To meet future demand for goods, because goods cannot be instantly manufactured or obtained to meet demand
  - It is less costly for a firm to order goods less frequently in large quantities than to order more frequently in small quantities
  - A way for producers to smooth production and produce at a constant rate
    - Inventories increase when demand falls and decrease when demand increases
  - An unavoidable part of the production process

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STANLEY FISCHER

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MACROECONOMICS

Chapter 15

The Demand for Money

Introduction

What is money? Why does anyone want it?

- In economics, <u>money</u> = medium of exchange

  - What ever is accepted in exchange

  - In U.S., M1 (currency and checkable deposits) comes closest to defining means of payment

    - At the end of 2005, M1 = $4,596 per person

    - Debate whether broader measure, M2, might better meet the definition of money in a modern payment system

- <u>Demand for money</u> refers to the stock of assets held as cash, checking accounts, and closely related assets, specifically not generic wealth or income

Components of the Money Stock

- In the U.S. there are two main monetary aggregates: M1 and M2

  - M1 comprises those claims that can be used *directly*, *instantly*, and *without restrictions* → LIQUID

  - M2 includes M1, plus some less liquid assets (ex. savings accounts and money market funds)

- As liquidity of an asset decreases, the interest yield increases

  - A typical economic tradeoff: in order to get more liquidity, asset holders have to sacrifice yield

The Functions of Money

- There are four traditional functions of money:
  1. Medium of exchange
     - Money is used to pay for goods and services
     - Eliminates the need for a "double coincidence of wants"
  2. Store of value
     - An asset that maintains value
     - If money were not a store of value, it would not be used as a medium of exchange
  3. Unit of account
     - The unit in which prices are quoted
  4. Standard of deferred payment
     - Money units are used in long term transactions (ex. loans)

The Demand for Money: Theory

- The demand for money is the demand for real money balances → people hold money for its purchasing power
  - Two implications:
    1. Real money demand is unchanged when the price level increases, and all real variables, such as the interest rate, real income, and real wealth, remain unchanged
    2. Equivalently, nominal money demand increases in proportion to the increase in the price level, given the real variables just specified

An individual is free from *money illusion* if a change in the level of prices, holding all real variables constant, leaves the person's real behavior, including real money demand, unchanged.

The Demand for Money: Theory

- The theories covered here correspond to Keynes's famous three motives for holding money:
  - The *transactions motive*, which is the demand for money arising from the use of money in making regular payments
  - The *precautionary motive*, which is the demand for money to meet unforeseen contingencies
  - The *speculative motive*, which arises from uncertainties about the money value of other assets that an individual can hold

  Transaction and precautionary motives → mainly discussing M1
  Speculative motive → M2, as well as non-money assets

Transaction Demand

- The transaction demand for money arises from the lack of synchronization of receipts and disbursements
  - You are not likely to get paid at the exact moment you need to make a payment → keep money on hand to make purchases between pay periods
- There is a tradeoff between the amount of interest an individual forgoes by holding money and the costs of holding a small amount of money
  - Benefits of keeping small amounts of money on hand is interest earned on money left in the bank
  - Cost of keeping small amounts of money is the cost and inconvenience of making trips to the bank to withdraw more

Transaction Demand

- Suppose the following:
  - Y = $1800/month
  - Person spends the Y evenly over the month, at a rate of $60/day
- Alternative 1:
  - Person could keep the entire $1800 in cash and spend $60/day
    - Cash balances falls smoothly from $1800 to $0 at the end of the month
    - Average balance of
    $$\frac{(\$1800 - \$0)}{2} = \$900$$
    - Forgone interest of $i \times \$900$

- Alternative #2:
  - Person could deposit entire amount, and each day take the needed $60 out of the bank
  - $\rightarrow$ earn interest on money left in the bank over the course of the month
    - Cash balances fall from $1800/30 to zero every day
    - Average balance of
    $$\frac{\left(\$1800/30 - \$0\right)}{2} = \$30$$
    - Forgone interest of $i \times \$30$

Transaction Demand

- In general:
  - Starting income of Y
  - n trips to the bank
  - → The average cash balance is $\dfrac{Y}{2n}$
  - Each trips costs tc
  - → The combined cost of trips plus forgone interest is:

  $$\left(n \times tc\right) + i \times \left(Y\!\!\big/\!{2n}\right)$$

  - Choose n to minimize costs and compute the average money holdings → Baumol-Tobin formula for the demand for money:

  $$\frac{M}{P} = \sqrt{\frac{tc \times Y}{2i}} \qquad (1)$$

Transaction Demand

- The Baumol-Tobin model is a model of the transaction demand for money

$$\frac{M}{P} = \sqrt{\frac{tc \times Y}{2i}}$$

Demand for money:

1) **Decreases with the interest rate**

2) **Increases with the cost of transactions**

3) **Increases with income**

The Precautionary Motive

- The Baumol-Tobin model ignored uncertainty
  - People are uncertain about the payments they might want or have to make → there is demand for money for these uncertain events
- The more money a person holds, the less likely he or she is to incur the costs of illiquidity
  - The more money a person holds, the more interest he/she will give up → similar tradeoff encountered with transactions demand for money
    - Added consideration is that greater uncertainty about receipts and expenditures increases the demand for money
- Technology and the structure of the financial system are important determinants of precautionary demand

Speculative Demand for Money

- Speculative demand for money focuses on the store-of-value function of money → concentrates on role of money in the investment portfolio of an individual

- Wealth held in specific assets → *portfolio*
  - Due to uncertainty, unwise to hold entire portfolio in a single risky asset → diversify asset holdings

- Money is a safe asset
  - Demand for money depends upon the expected yields and riskiness of the yields on other assets (James Tobin)
    - Increase in the opportunity cost of holding money lowers money demand
    - Increase in the riskiness of the returns on other assets increases money demand

Empirical Estimates

- Empirical work establishes four essential properties of money demand:

  - The demand for money balances responds negatively to the rate of interest. An increase in interest rates reduces the demand for money.

  - The demand for money increases with the level of real income.

  - The short-run responsiveness of money demand to changes in the interest rates and income is considerably less than the long-run response. The long-run responses are estimated to be about 5 times the size of the short-run responses.

  - The demand for nominal money balance is proportional to the price level. There is no money illusion; in other words, the demand for money is a demand for real balances.

The Income Velocity

- The income velocity of money: the number of times the stock of money is turned over per year in financing the annual flow of income.

  - It is equal to the ratio of nominal GDP to the nominal money stock, or:

$$V \equiv \frac{P \times Y}{M} = \frac{Y}{M/P} \qquad (2)$$

  $\rightarrow$ can also be interpreted as the ratio of nominal income to nominal money stock OR the ratio of real income to real balances

The Income Velocity

- The concept of velocity is important largely because it is a convenient way of talking about money demand
  - Demand for real balances is: $M/P = L(i,Y)$
  - → Substituting into equation (2), velocity can be written as:

$$V = \frac{Y}{L(i,Y)}$$

  - → Money demand can be written as: $L(i,Y) = Y \times l(i)$
  - → Velocity of money is: $V = \frac{1}{l(i)}$

    - → This gives a convenient way of thinking about the effect of interest rates on money demand

The Income Velocity

- Figure 15-1 shows M2 velocity (left scale) and the Treasury bill interest rate (right scale)

  - M2 is relatively stable, as left hand scale is only between 1.5 and 2.2 over a 40 year period

  - Velocity has a strong tendency to rise and fall with market interest rates

  - Over the last decade M2 velocity has become much less stable than in the past

  - → When monetary aggregates become relatively unstable, monetary authority should use the interest rate rather than money supply as the direct operating target
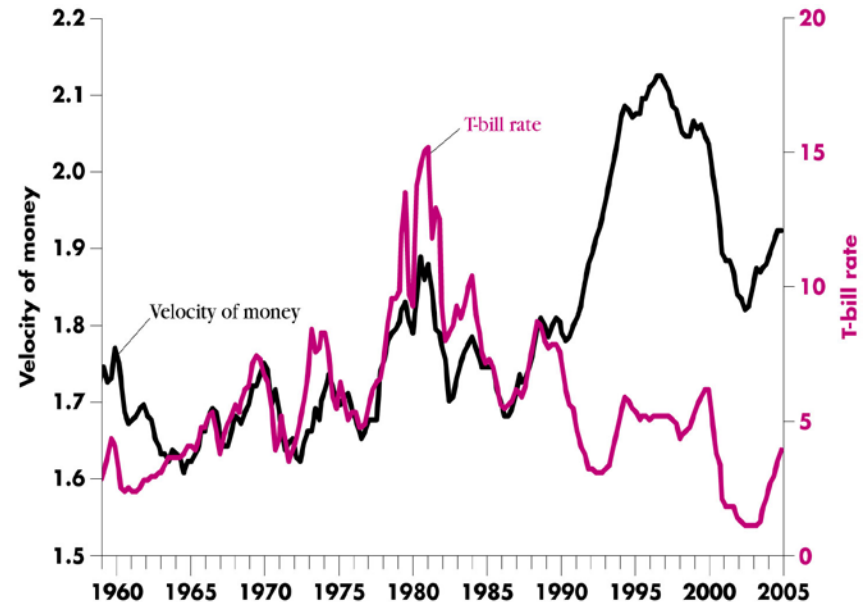
The Quantity Theory

- The *quantity theory of money* provides a very simple way to organize thinking about the relation between money, prices, and output: $M \times V = P \times Y$ (3)

  - Equation (3) is the famous *quantity equation*, linking the price level and the level of output to the money stock
  - The quantity equation became the *classical quantity theory* of money with it was argued that both V and Y were fixed

    $\rightarrow$ If both V and Y are fixed, it follows that the price level is proportional to the money stock

The Quantity Theory

- The classical quantity theory = theory of inflation
  - The price level is proportional to the money stock:

$$P = \frac{V \times M}{Y} \quad \text{(3a)}$$

  - If V is constant, changes in the money supply translate into proportional changes in *nominal GDP*
  - With the classical case (vertical) supply function, Y is fixed, and changes in money translate into changes in the overall price level, P

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MACROECONOMICS

Chapter 16

The Fed, Money, and Credit

Introduction

- In the recession of 2001, the Fed cut interest rates repeatedly (Figure 16-1)

- <u>Questions</u>:
  1. Should the Fed have cut interest rates more rapidly?
  2. Could the Fed have made M2 grow faster if it had wanted to?
  3. What does the Fed do to cut interest rates?

In this chapter we will see <u>what</u> the Fed does, <u>how</u> they do it, and <u>why</u> they do it.
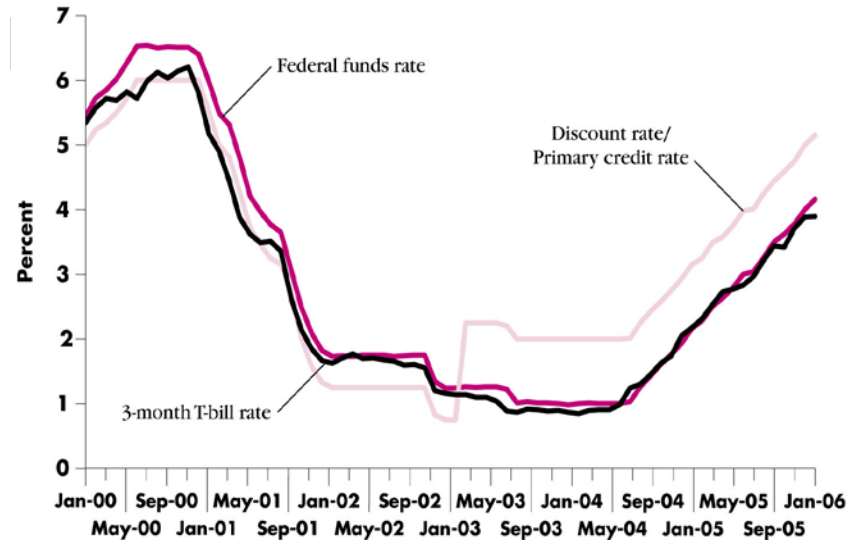
Money Stock Determination

- The money supply consists mainly of deposits at banks $\rightarrow$ Fed does not control directly

  - A key concept concerning money in the U.S. is the *fractional reserve banking system*: banks required to keep only a fraction of all deposits on hand or on reserve (not loaned out)

    - Compared to a 100% reserve banking system, where all deposits are kept on hand, and none is loaned out

- High powered money (monetary base) consists of currency and banks' deposits at the Fed

  - The part of the currency held by the public forms part of the money supply

  - Currency in bank vaults and banks' deposits at the Fed are used as reserves backing individual and business deposits at banks

  - Fed's control over the monetary base is the main route through which it determines the money supply

Money Stock Determination

- The Fed has direct control over high powered money (H)
- Money supply (M) is linked to H via the money multiplier, mm → Figure 16-2 shows this relationship:
  - Top of figure is the money stock
  - Bottom of figure is the stock of high-powered money = *monetary base*
- Money multiplier (mm) is the ratio of the stock of money to the stock of high powered money → mm > 1
  - The larger deposits are, as a fraction of M, the larger the multiplier
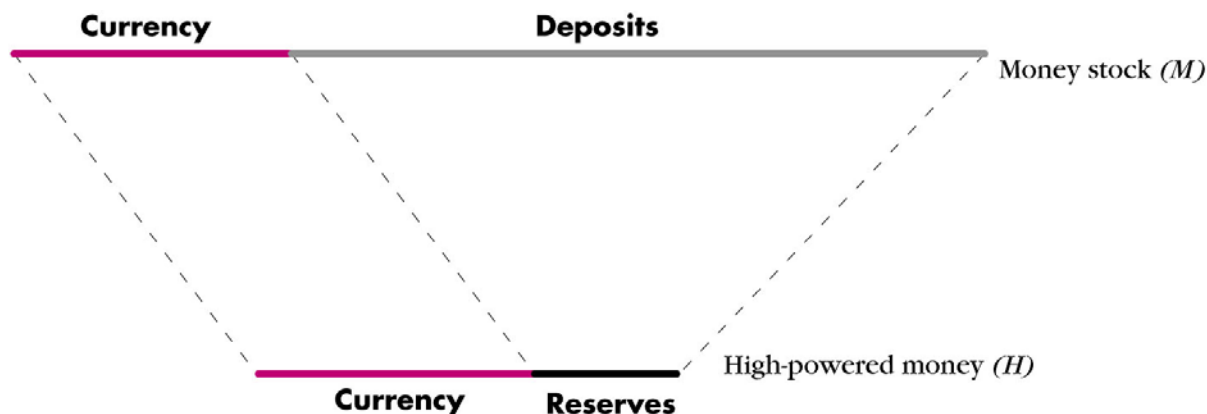
Money Stock Determination

- Money supply consists of currency, CU, plus deposits:

$$M = CU + D \qquad (1)$$

- High powered money consists of currency plus reserves:

$$H = CU + reserves \qquad (2)$$

- Summarize the behavior of the public, the banks, and the Fed in the money supply process by three variables:
  - Currency-deposit ratio: $cu \equiv CU/D$

  - Reserve ratio: $re \equiv reserves/D$

  - Stock of high powered money: H

Money Stock Determination

- We can rewrite equations (1) and (2) as:

$$M = (cu + 1)D \quad \text{and} \quad H = (cu + re)D$$

→ This allows us to express the money supply in terms of its principal determinants, re, cu, and H:

$$M = \frac{1 + cu}{re + cu} H \equiv mm \times H \qquad (3)$$

where mm is the money multiplier, given by:

$$mm \equiv \frac{1 + cu}{re + cu}$$

Money Stock Determination

- Some observations of the money multiplier:

$$mm \equiv \frac{1 + cu}{re + cu}$$

➢ The money multiplier is larger the smaller the reserve ratio, re

➢ The money multiplier is larger the smaller the currency-deposit ratio, cu

→ The smaller is cu, the smaller the proportion of H that is being used as currency AND the larger the proportion that is available to be reserves

The Currency Deposit Ratio

➢ The payment habits of the public determine how much currency is held relative to deposits

  ➢ The currency deposit ratio is affected by the cost and convenience of obtaining cash

  ➢ Currency deposit ratio falls with shoe leather costs

    → Ex. If there is a cash machine nearby, individuals will on average carry less cash with them because the costs of running out are lower

  ➢ The currency deposit ratio has a strong seasonal pattern

    ➢ Highest around Christmas

The Reserve Ratio

- Bank reserves = <u>deposits banks</u> hold at the Fed and "<u>vault cash</u>," notes and coins held by banks
  - In the absence of regulation, banks would hold reserves to meet:
    1. The demands of their customers for cash
    2. Payments their customers make by checks that are deposited in other banks
  - In the U.S. banks hold reserves primarily because the Fed requires them to (*required reserves*)
    - In addition to required reserves, banks hold *excess reserves* to meet unexpected withdrawals
    - → Reserves earn no interest, so banks try to minimize excess reserves, especially when interest rates are high

The Instruments of Monetary Control

- The Federal Reserve has three instruments for controlling money supply
  1. Open market operations
     - Buying and selling of government bonds
  2. Discount rate
     - Interest rate Federal Reserve "charges" commercial banks for borrowing money
     - Federal Reserve is often the lender of last resort for commercial banks
  3. Required-reserve ratio
     - Portion of deposits commercial banks are required to keep on hand, and not loan out

Open Market Operations

- Table 16-1 illustrates the impact of the Fed buying $1 million of government bonds on the Fed's balance sheet:

  - Fed's ownership of securities increases by $1 million

  - Fed writes a check for the purchase, which is deposited by the seller, and then deposited with the Fed → Bank deposits at the Fed increases by $1 million

  - NOTE: Commercial banks have increased reserves by $1 million, which are initially held with the Fed

  - NOTE: The Fed can create H at will by buying assets and paying for them with its own liabilities

TABLE 16-1 Effects of an Open Market Purchase on the Fed Balance Sheet (Millions of Dollars)

ASSETS		LIABILITIES	
Government securities	+1	Currency	0
All other assets	0	Bank deposits at Fed	+1
Monetary base (sources)	+1	Monetary base (uses)	+1

The Fed's Balance Sheet

- Tables 16-2 and 16-3 show two ways of looking at the balance sheets of the Fed
  - Table 16-2 shows the principal assets and liabilities of the Fed
    - Government bonds
    - Currency
  - Table 16-3 shows the monetary base and two different ways of looking at reserves
    - Most reserves are required
    - Only a small fraction is borrowed at the discount window

TABLE 16-2 Main Assets and Liabilities of All Federal Reserve Banks, June 14, 2006
(Billions of Dollars)

ASSETS (SOURCES)		LIABILITIES (USES)	
Gold and Special drawing rights certificate account	$ 13.24	Federal Reserve notes	$758.10
Total U.S. Government securities	766.25	Total deposits	25.17

Source: Federal Reserve Board, *Factors Affecting Reserve Balances*, June 15, 2006.

TABLE 16-3 Aggregate Reserves of Depository Institutions and the Monetary Base, April 2006
(Billions of Dollars)

Reserves of depository institutions	$ 44.58
Required reserves	42.77
Excess reserves	1.82
Reserves of depository institutions	44.58
Nonborrowed reserves	44.33
Borrowed reserves	0.25
Monetary base	801.96
Vault cash in excess of required reserves	18.58
Currency	738.80
Reserves	44.58

Source: Federal Reserve Board, *Aggregate Reserves of Depository Institutions and the Monetary Base; Money Stock Measures*, June 15, 2006.

Loans and Discounts

- A bank that runs short on reserves can borrow to make up the difference
  - Can borrow from either the Fed or other commercial banks
- The cost of borrowing from the Fed is the *discount rate*
  - Discount rate also serves as a <u>signal</u> of the Fed's intentions
- The cost of borrowing from other banks is the *federal funds rate*
  - Federal funds are reserves that some banks have in excess and others need
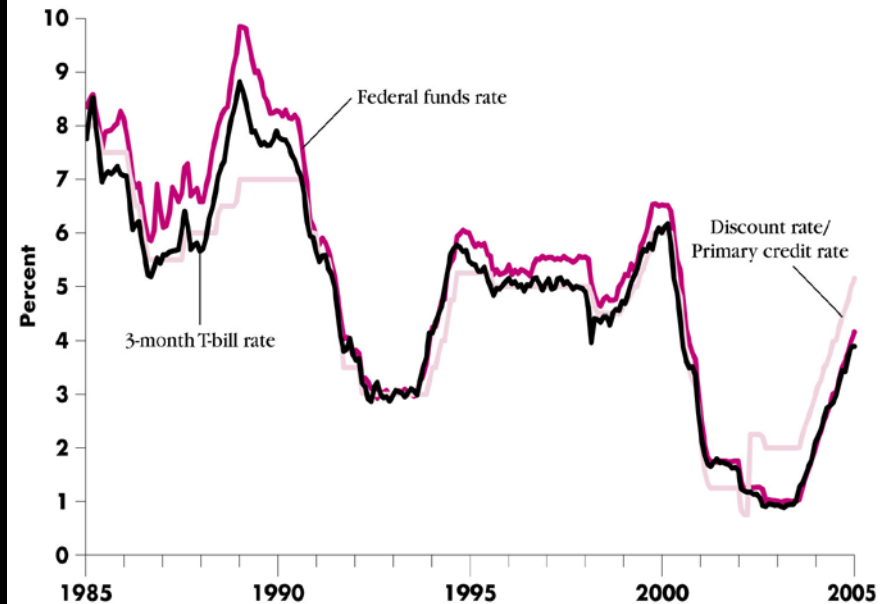
The Reserve Ratio

- The Federal Reserve sets the required reserve ratio: the portion of each deposit commercial banks must keep on hand

- Looking at the money multiplier shown in equation (3), it is easy to see that the Fed can increase the money supply by reducing the required reserve ratio (RRR):

$$M = \frac{1+cu}{re+cu}H \equiv mm \times H$$

- The RRR is not a policy tool of choice as reserves pay no interest, and thus are an interest free loan from banks to the Fed
  - Changes in the RRR have undesirable effects on bank profits

The Money Multiplier and Bank Loans

- Provide an alternative way of describing the working of the multiplier by showing how adjustments by banks and the public following an increase in H produce a multiple expansion of M
  - A Fed open market purchase increases H, and increases bank reserves (as discussed in earlier example)
  - The bank in which the original check was deposited has a reserve ratio that is too high (has excess reserves) $\rightarrow$ increase lending
  - When bank makes loan, person receiving a loan gets a bank deposit of the amount of the loan $\rightarrow$ money supply has increased by more than the amount of the open market operation
  - The expansion of loans (and money) continues until the reserve-deposit ratio has fallen to the desired level and the public has achieved its desired currency deposit ratio

  The money multiplier summarizes the total expansion of money created from a dollar increase in the monetary base.

Control of the Money Stock and Control of the Interest Rate

- The Fed cannot simultaneously set the interest rate AND the stock of money at any given target levels that it may choose
  - Suppose that the Fed wants to set the interest rate at i^* and the money stock at M^*, with the demand for money at LL
  - The Fed can move the money supply around, but not LL
    - It can only set combinations of i and M that lie along LL
    - At interest rate i^*, can have M_0/P
    - At the target money supply, M^*/P, can have interest rate of i_0
    - Cannot achieve BOTH targets
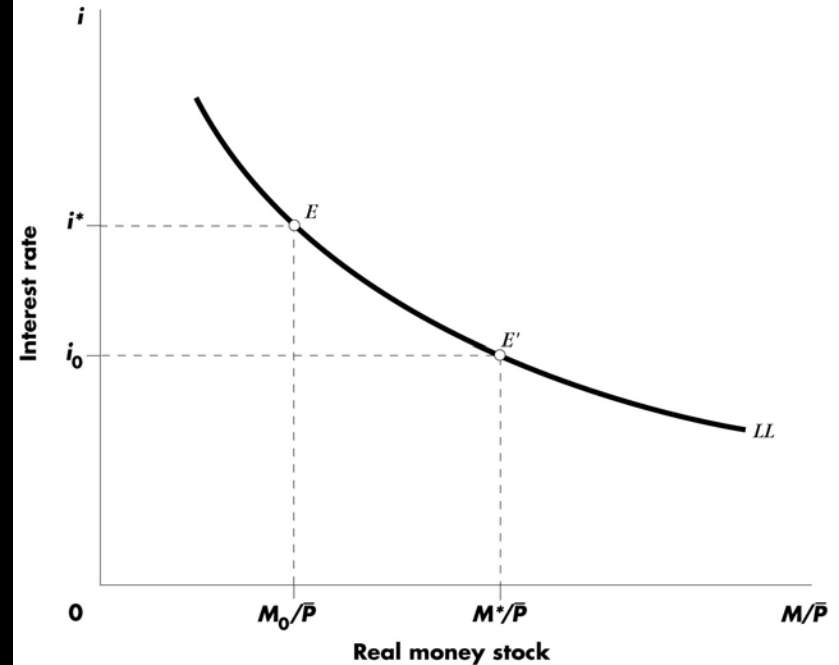
Money Stock and Interest Rate Targets

- William Poole presented an article discussing the issues involved in the choice between interest rate and money stock targets
  - Assume Fed's aim is to have the economy reach a particular level of output → uses IS-LM model, in the short-run
  - LM(M) = LM curve that exists when Fed fixes money stock
  - LM(i) = LM curve that exists when Fed fixes the interest rate
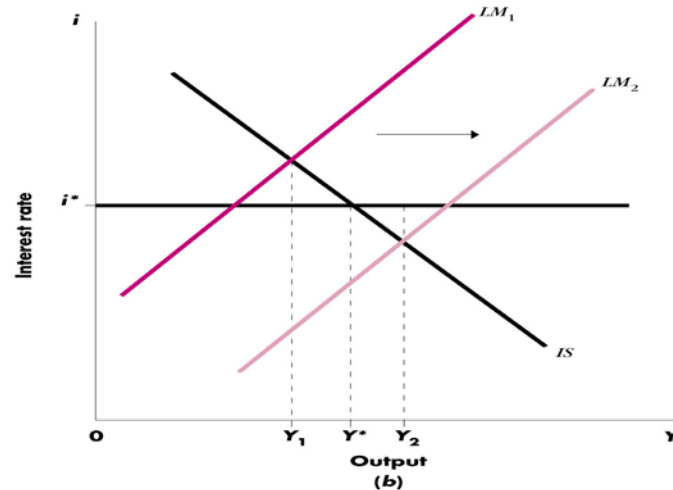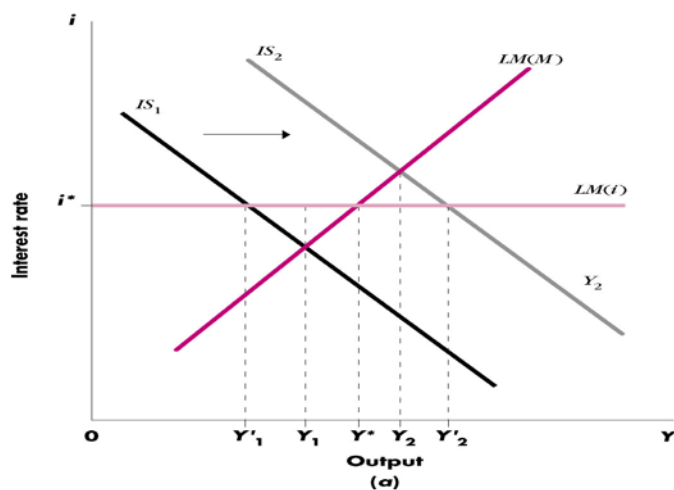
Money Stock and Interest Rate Targets

- The problem: IS and LM curves shift unpredictably
  - When shift, output moves away from the target level
- Figure 16-5(a) shows two possible IS curves, and Fed does not know in advance which is the true IS curve
  - Fed's aim is to achieve Y^*
  - Output closer to Y^* when LM is LM(M)
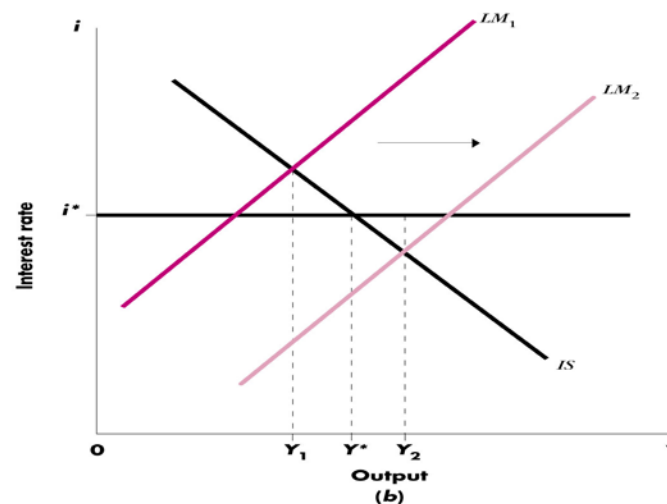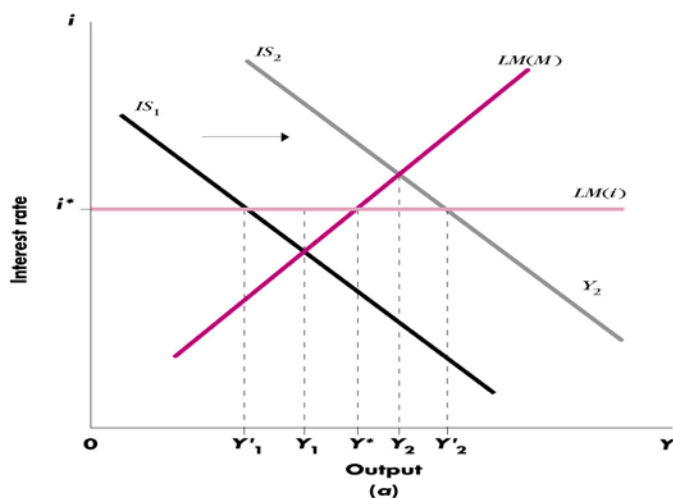
Money Stock and Interest Rate Targets

- First conclusion: **If Y deviates from its equilibrium level mainly because of shifts in IS, Y is *stabilized* by keeping the money stock constant → MONEY STOCK TARGET**
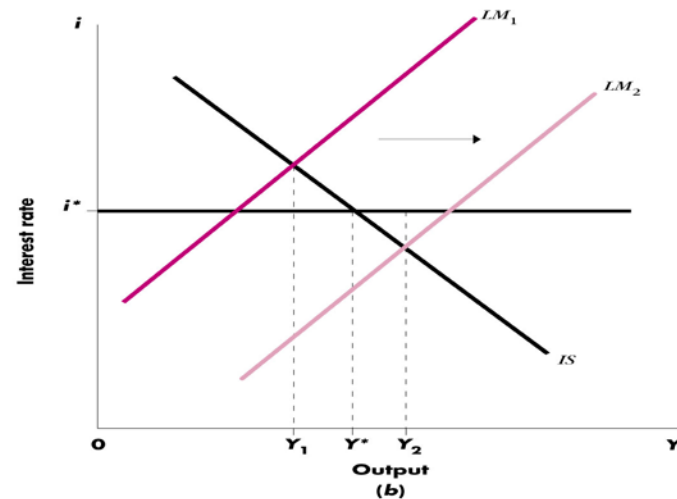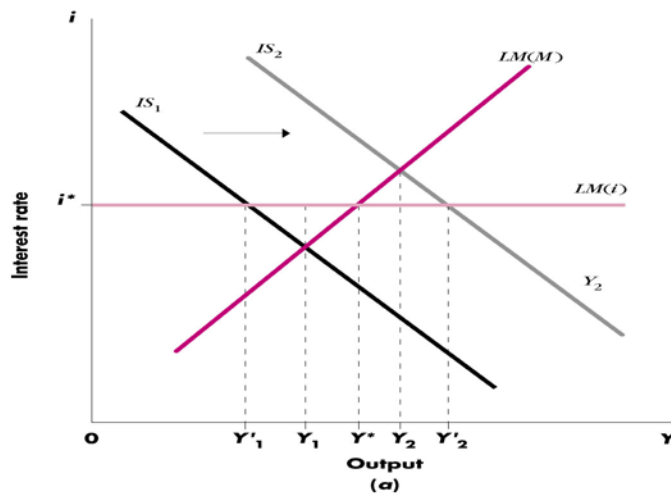
Money Stock and Interest Rate Targets

- Figure 16-5(b) assumes IS is stable, and uncertainty arises from shifts in the LM curve
  - Assuming the Fed sets M, LM shifts due to shifts in money demand
  - When Fed sets money supply, does not know what i will be → LM could be either LM_1 or LM_2
  - Alternatively, Fed could set i at i^* to ensure $Y=Y^*$
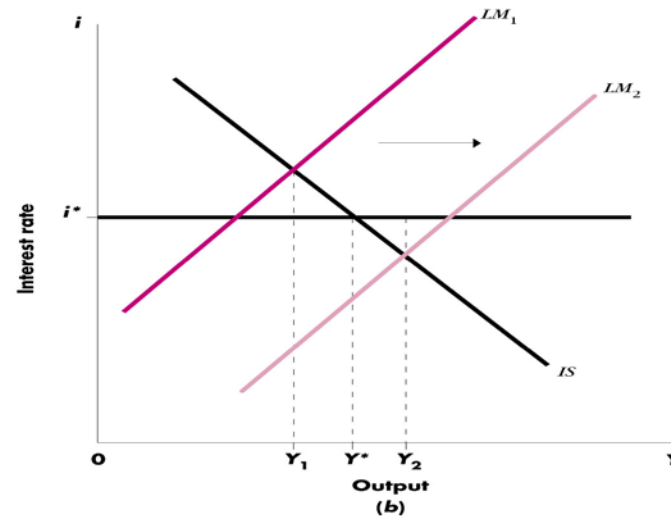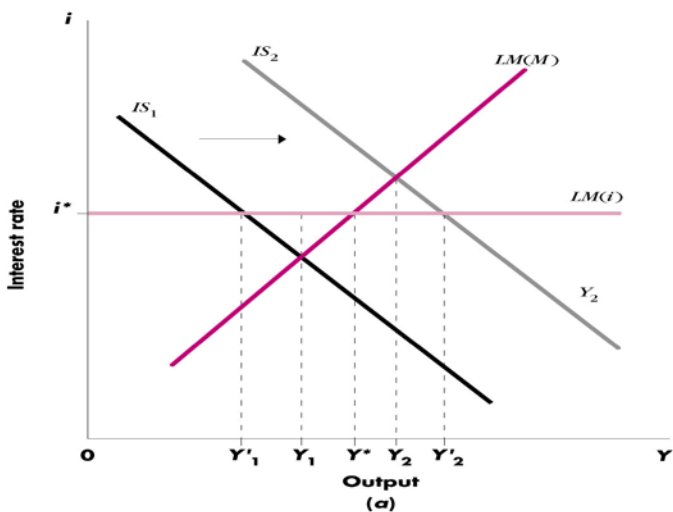
Money Stock and Interest Rate Targets

- Second conclusion: **If Y deviates from its equilibrium level mainly because of shifts in money demand, the Fed should operate monetary policy by fixing the interest rate.**
$\rightarrow$ INTEREST RATE TARGET
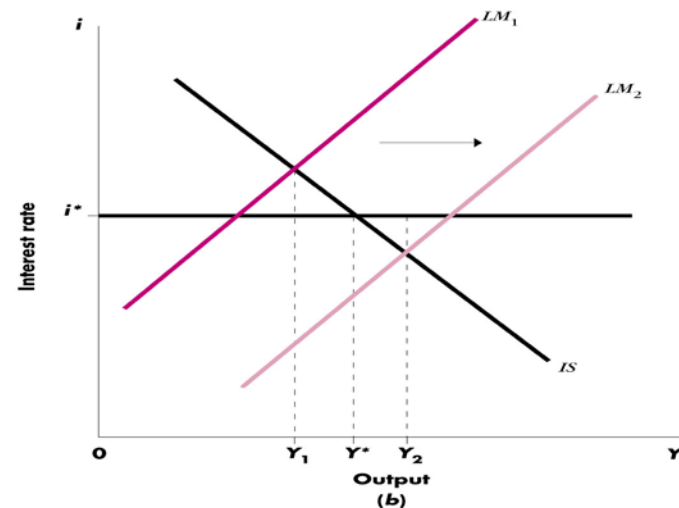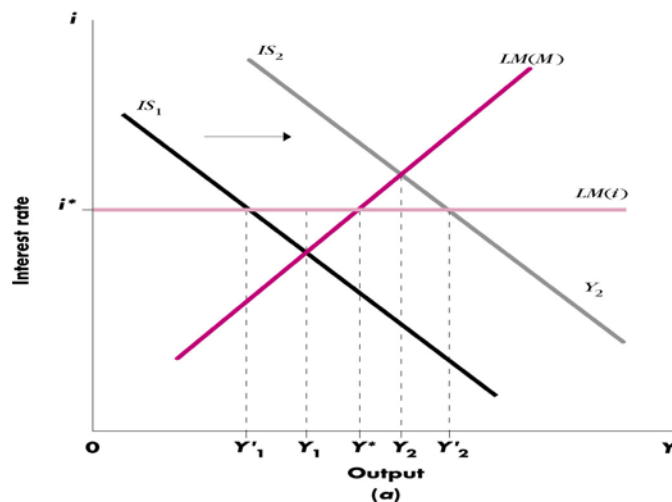
Which Targets for the Fed?

Three key points:

1. There is a distinction is between <u>ultimate targets</u> and <u>intermediate targets</u>.

   - Ultimate targets are variables such as the inflation rate and unemployment rate whose behavior matters.

   - Intermediate targets, including the interest rate, are targets the Fed aims at in order to hit the ultimate targets more accurately

   - The discount rate, RRR, and OMO are the instruments Fed has to hit the targets

Which Targets for the Fed?

Three key points:

2. It matters how often the intermediate targets are reset.

    - If the Fed were to commit itself to a 5.5% money growth over a period of several years, it would have to be sure that the velocity of money was not going to change unpredictably

      $\rightarrow$ else the actual level of GDP would be far different from the targeted level

    - If the money target were reset more often, as velocity changed, the Fed could come closer to hitting its ultimate targets

Which Targets for the Fed?

Three key points:

3.   The need for targeting arises from a lack of knowledge

   • If the Fed had the right ultimate goals and knew exactly how the economy worked, it could do whatever was needed to keep the economy as close to its ultimate targets as possible

      $\rightarrow$ but the Fed does not have a crystal ball or perfect foresight

Which Targets for the Fed?

- Intermediate targets give the Fed something concrete and specific to aim for in the next year
  - Enables the Fed itself to focus on what it should be doing
  - Helps the private sector know what to expect
- Specifying targets also makes it possible to hold the Fed *accountable* for its actions
- Ideal target is a variable that:
  1. The Fed can control exactly
  2. Has exact relationship with the ultimate target
  In reality: *The Fed has to trade off between those targets it can control exactly and those targets that are most closely related to its ultimate targets.*

RUDIGER DORNBUSCH
STANLEY FISCHER
RICHARD STARTZ

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MACROECONOMICS

Chapter 17

Policy

Introduction

- In this chapter we examine how policymakers formulate appropriate policy measures
  - Must consider:
    - Timing
    - Uncertainty
    - How individuals will respond to specific policies
    - Role of credibility
    - Monetary or fiscal policy, or a mix
    - Different policy instruments
    - Different intermediate and ultimate targets

Lags in the Effects of Policy

- Suppose the economy is at full employment:

  - Affected by a negative aggregate demand disturbance → reduces the equilibrium level of income below full employment

  - No advance warning of disturbance → no policy action taken in anticipation of its occurrence

Policymakers must decide:

1. *Should they respond to the disturbance?*
2. *If so, how should they respond?*

Lags in the Effects of Policy

- Is the disturbance *permanent* (or persistent) or *temporary*?
  - Figure 17-1 illustrates a temporary aggregate demand shock
    - A one period reduction in consumption → best policy is to *do nothing* at all
    - Today's policy actions take time to have an effect → would hit economy after back at full-employment level, driving it away from the optimal level
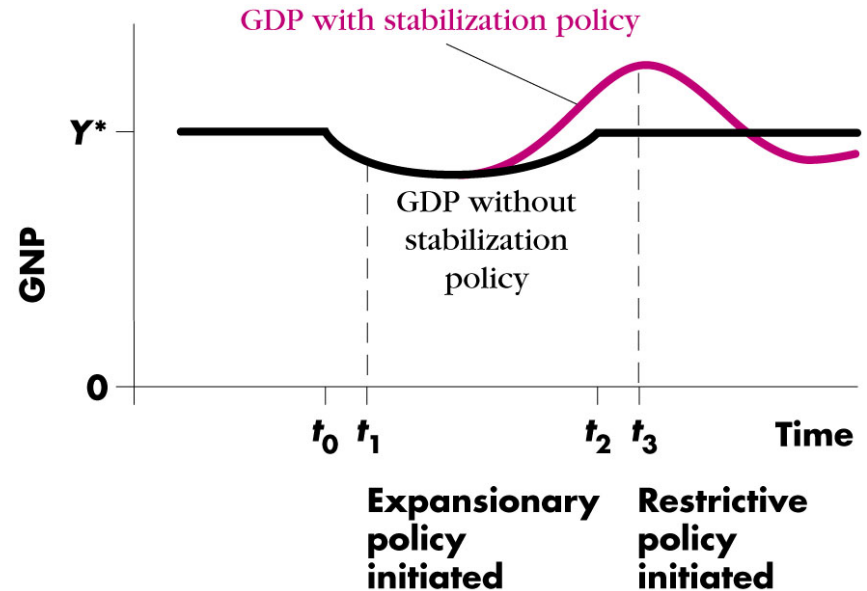
GDP with stabilization policy

Y*

GDP without stabilization policy

GNP

0

t_0 t_1 t_2 t_3 Time

Expansionary policy initiated   **Restrictive policy initiated**

Lags in the Effects of Policy

- Policymaking is a process:
  - Takes time to recognize and implement a policy action
  - Takes time for an action to work its way through the economy
- Each step involves delays or lags:
  1. Inside lags
     - Recognition lags
     - Decision lags
     - Action lags
  2. Outside lags

- Inside Lags: the time period it takes to undertake a policy action
  - Recognition Lag: the period that elapses between the time a disturbance occurs and the time the policymakers recognize that action is required
  - → Lag is negative if the disturbance is predicted and appropriate policy actions considered *before* it occurs (Ex. Increase money supply prior Christmas)
  - → Lag is typically positive

Lags in the Effects of Policy

- Policymaking is a process:
  - Takes time to recognize and implement a policy action
  - Takes time for an action to work its way through the economy
- Each step involves delays or lags:
  1. Inside lags
     - Recognition lags
     - Decision lags
     - Action lags
  2. Outside lags

- <u>Inside Lags</u>: the time period it takes to undertake a policy action
  - <u>Decision Lag</u>: the delay between the recognition of the need for action and the policy decision
  - Differs between monetary and fiscal policy
    - FOMC meets regularly to discuss and decide on policy

Lags in the Effects of Policy

- Policymaking is a process:
  - Takes time to recognize and implement a policy action
  - Takes time for an action to work its way through the economy
- Each step involves delays or lags:
  1. Inside lags
     - Recognition lags
     - Decision lags
     - Action lags
  2. Outside lags

- <u>Inside Lags</u>: the time period it takes to undertake a policy action
  - <u>Action Lag</u>: the lag between the policy decision and its implementation
  - → Also differs for monetary and fiscal policy
    - Monetary policy makers typically act immediately
    - Fiscal policy actions are less rapid → administration must prepare legislation and then get it approved

Lags in the Effects of Policy

- Policymaking is a process:
  - Takes time to recognize and implement a policy action
  - Takes time for an action to work its way through the economy
- Each step involves delays or lags:
  1. Inside lags
     - Recognition lags
     - Decision lags
     - Action lags
  2. Outside lags

- Outside Lags: time it takes a policy measure to work its way through the economy
  - Inside lags are discrete, but outside lags are typically *distributed lags*
    - Once a policy action has been taken, its effects on the economy are spread out over time
    - Immediate impacts may be small, but other effects occur later

Lags in the Effects of Policy

- Figure 17-2 illustrates the dynamic multiplier
  - Shows the effects of a once-and-for-all 1 percent increase in the money supply in period zero
  - Impact is initially very small, but continues to increase over a long period of time
- *Why are there outside lags?*
  - <u>Monetary policy</u>: initially impacts investment via interest rates, not income
    - When AD ultimately affected, increase in spending itself produces a series of induced adjustments in output and spending
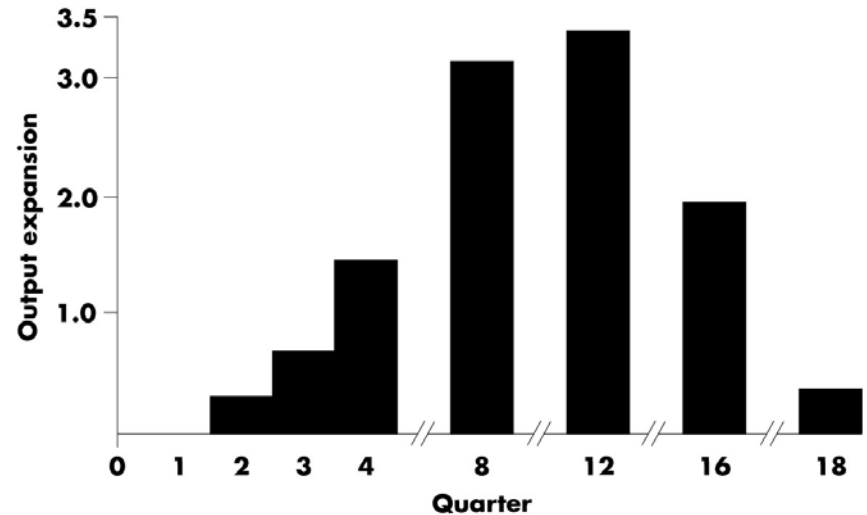
Monetary Versus Fiscal Policy Lags

- Fiscal policy directly impacts aggregate demand
  - Affect income more rapidly than monetary policy
    - → Shorter outside lags than monetary policy
    - → Longer inside lags than monetary policy
- Long inside lags makes fiscal policy less useful for stabilization and used less frequently to stabilize the economy

**It takes time to set the policies in action, and then the policies themselves take time to affect the economy.
Further difficulties arise because policymakers cannot
be certain about the size and the timing
of the effects of policy actions.**

Expectations and Reactions

- Government uncertainties about the effects of policies on the economy arise because:

  1. Policymakers do not know what expectations firms and consumers have
  2. Government does not know the true model of the economy

  → Work with econometric models of the economy in estimating the effects of policy changes
     ➢ An econometric model is a statistical description of the economy, or some part of it

Reaction Uncertainties

- Suppose the government decides to cut taxes to stimulate a weak economy $\rightarrow$ temporary tax cut

    How big of a cut is needed?

    ➢ One possibility: temporary tax cut will not affect long-term income, and thus not long-term spending $\rightarrow$ Large tax cut needed

    ➢ Alternatively: consumers may believe tax cut will last longer than announced, and MPC out of tax cut is larger $\rightarrow$ Smaller tax cut might be sufficient

    If the government is wrong about consumers' reactions, it could destabilize rather than stabilize the economy.

Uncertainty and Economic Policy

- Policymakers can go wrong in using active stabilization policy due to:
  - Uncertainty about the expectations of firms and consumers
  - Difficulties in forecasting disturbances
  - Lack of knowledge about the true structure of the economy
    - Uncertainty about the correct model of the economy
    - Uncertainty about the precise values of the parameters within a given model of the economy

  Instead of choosing between fiscal and monetary policies when the multipliers are unknown, best to employ a *portfolio of policy instruments*. <u>DIVERSIFICATION</u>

Targets, Instruments, and Indicators

- Economic variables play a variety of roles in policy discussions

  - Useful to divide them into *targets*, *instruments*, and *indicators*

  - ➢ <u>Targets</u>: identified goals of policy

    - Ultimate targets

      - Ex. "to achieve zero inflation"

    - Intermediate targets

      - Ex. Targeting money growth
      - Used to achieve ultimate target

Targets, Instruments, and Indicators

- Economic variables play a variety of roles in policy discussions
  - Useful to divide them into *targets*, *instruments*, and *indicators*

  - <u>Instruments</u>: tools policymakers manipulate directly
    - Ex. An exchange rate target
  - <u>Indicators</u>: economic variables that signal us as to whether we are getting closer to our desired targets
    - Ex. Increases in interest rates (indicator) sometimes signal that the market anticipates increased future inflation (target)
    - Provide useful feedback → policymakers can use to adjust the instruments in order to do a better job of hitting targets

Rules Versus Discretion

In determining how policymakers should operate, policymakers must answer several questions:

Should policymakers actively try to offset shocks?

<u>If yes</u>:

Should responses be precommitted to specific rules?

<u>OR</u>

Should policy makers work on a case-by-case basis?

Rules Versus Discretion

- Milton Friedman and others argued:
  - There should be no use of active countercyclical monetary policy
  - Monetary policy should be confined to making the money supply grow at a constant rate
  - Friedman advocated a simple monetary rule $\rightarrow$ Fed does not respond to the condition of the economy
- Policies that respond to the current or predicted state of the economy = *activist policies/discretionary policies*
- Debate over whether fiscal and monetary authorities should follow rules or execute discretionary policy
  - Activist rules are possible as well

RUDIGER DORNBUSCH
STANLEY FISCHER
RICHARD STARTZ

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MACROECONOMICS

Chapter 18

Financial Markets and Asset Prices

Introduction

- Financial markets link the macroeconomy and government policy directly to the lives of everyday people
  - Changes in interest rates affect our ability to finance a home, car
  - Movements in the stock market determine the value of pensions
- In this chapter we examine the behavior of three financial markets:
  - Bond market
  - Stock market
  - Foreign exchange market

Interest Rates: Long and Short Term

- Interest rates summarize the promised repayment terms on bonds, loans → not just one interest rate
  - Interest rates differ according to:
    - Credit worthiness of issuer
    - Tax treatments
    - Risk
    - Term
    - Other factors
- The factor of greatest focus here is the term or the length of time the interest rate covers
  - The relation between interest rates of different *maturities* is called the *term structure of interest*

Interest Rates: Long and Short Term

- Figure 18-1 shows interest rates for U.S. Treasury securities from 3 months to 30 years

  - Interest rates of different maturities mostly go up and down together
  - The gap between long term rates and short-term rates varies
  - Long-term rates are usually higher than short-term rates
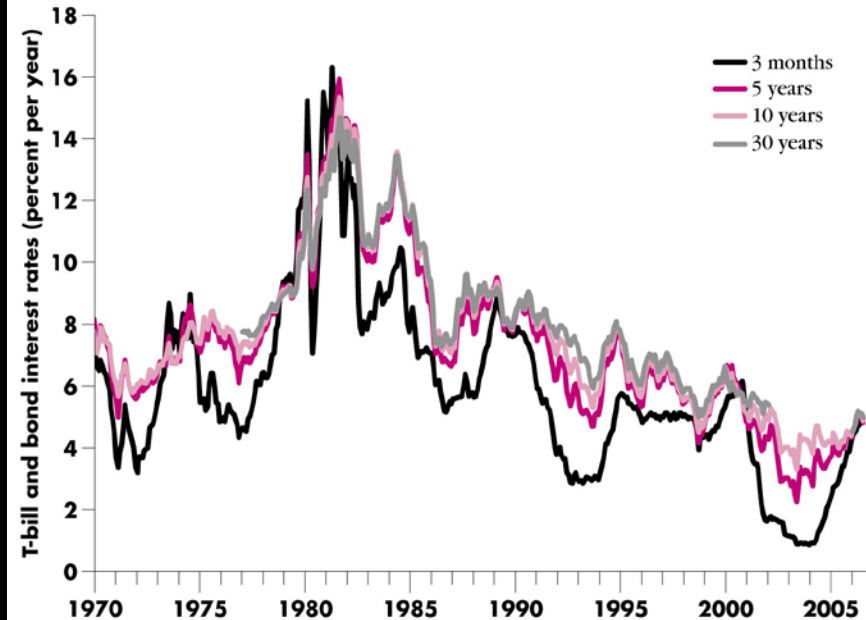
Interest Rates: Long and Short Term

- Consider the relation between the 1-year and 3-year rates (today is January 1, 2020)
  - You have the option of:
    - ➤ Making a three year investment today and earning $_3i_{2020}$ each year <u>OR</u>
    - ➤ Investing for one year, reinvesting for another year at the prevailing rate at the beginning of 2021, and doing the same at the beginning of 2022

$$\longleftarrow \hspace{4cm} _3i_{2020} \hspace{4cm} \longrightarrow$$

$\longleftarrow\ _1i_{2020}\ \longrightarrow$	$\longleftarrow\ _1i_{2021}\ \longrightarrow$	$\longleftarrow\ _1i_{2022}\ \longrightarrow$
2020	**2021**	**2022**
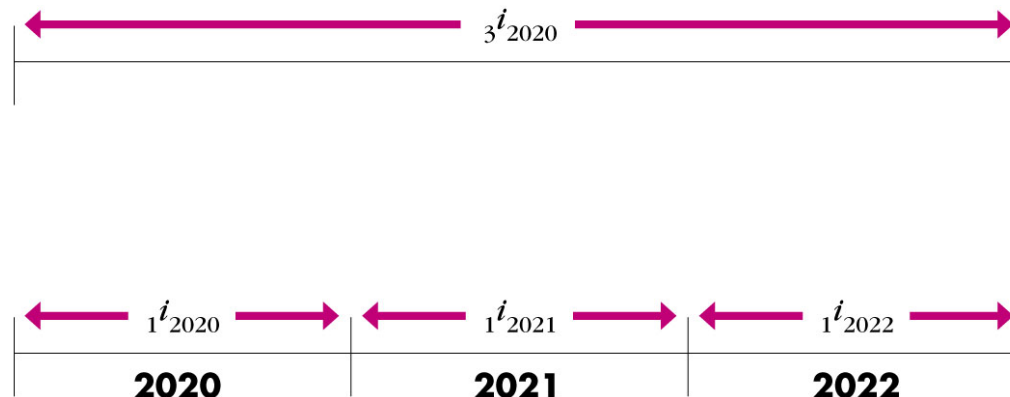
Interest Rates: Long and Short Term

- If all of the rates in Figure 18-2 were known in advance, the total returns would be equal for both options
  - If the total returns were not equal, everyone would invest in the alternative with the greatest return
  - $\rightarrow$ illustrates the idea of   <u>ARBITRAGE</u>: $_3i_{2020} = \left({}_1i_{2020} + {}_1i_{2021} + {}_1i_{2022} \right) \Big/ 3$

    The long-term interest rate equals the average of current and future short-term interest rates.
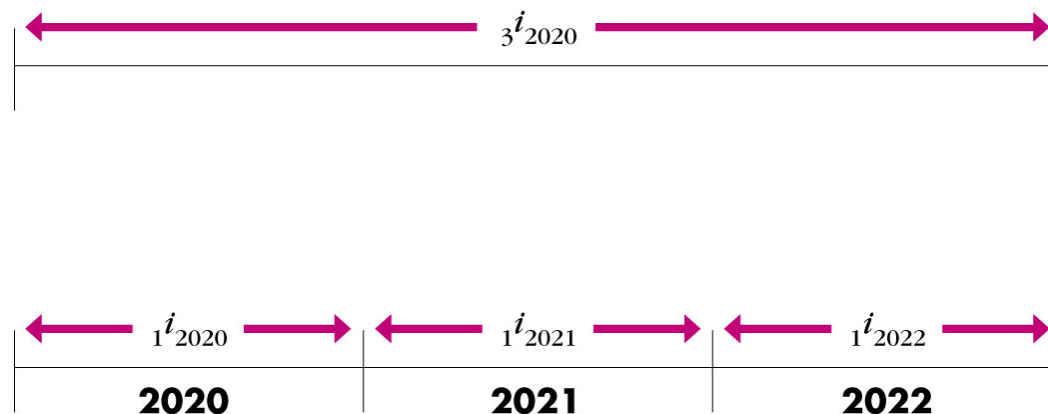
Interest Rates: Long and Short Term

- The problem is, in 2020 we do not know $_1i_{2021}$ or $_1i_{2022}$ with certainty
  - Need to modify our equation in two ways:
    - Today's long-term rate depends on the current short-term rate and the *expected* future short-term rates
    - Uncertainty implies risk, and long-term investments command a *term premium*, PR, to compensate for this risk

    $\rightarrow$ The term structure equation becomes:

$$_3i_{2020} = \frac{\left(_1i_{2020} + _1i^e_{2021} + _1i^e_{2022}\right)}{3} + PR \qquad (1)$$

Interest Rates: Long and Short Term

$$_3i_{2020} = \frac{\left(_1i_{2020} + _1i^e_{2021} + _1i^e_{2022}\right)}{3} + PR$$

- Table 18-1 shows the average term premiums based on the interest rates shown in Figure 18-1

  - Equation (1) shows the expectations theory of the term structure
  - Term premiums vary over time, but are generally higher for longer-term rates

TABLE 18-1   Average Term Premiums above 3-Month Treasury Bill, 1970–2005

TERM	PREMIUM
3 months	—
6 months	0.14
1 year	0.65
2 years	1.01*
3 years	1.14
5 years	1.39
7 years	1.57
10 years	1.66
30 years	1.91**

*For 1976–2005.

**For 1977–2002.

Source: Federal Reserve Economic Data
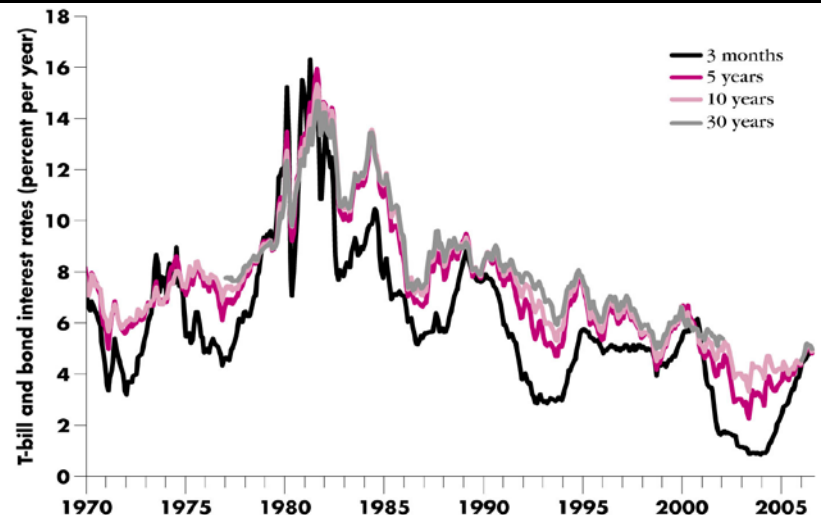
The Yield Curve

- Interest rates for different maturities are illustrated by the yield curve → Figure 18-3
  - Typically upward sloping since long-term rates are generally higher than short-run rates
  - If yield curve slopes downward, indicates financial markets expect interest rates to fall
    - Often a recessionary signal
    - Indicates the market anticipates a coming drop in interest rates
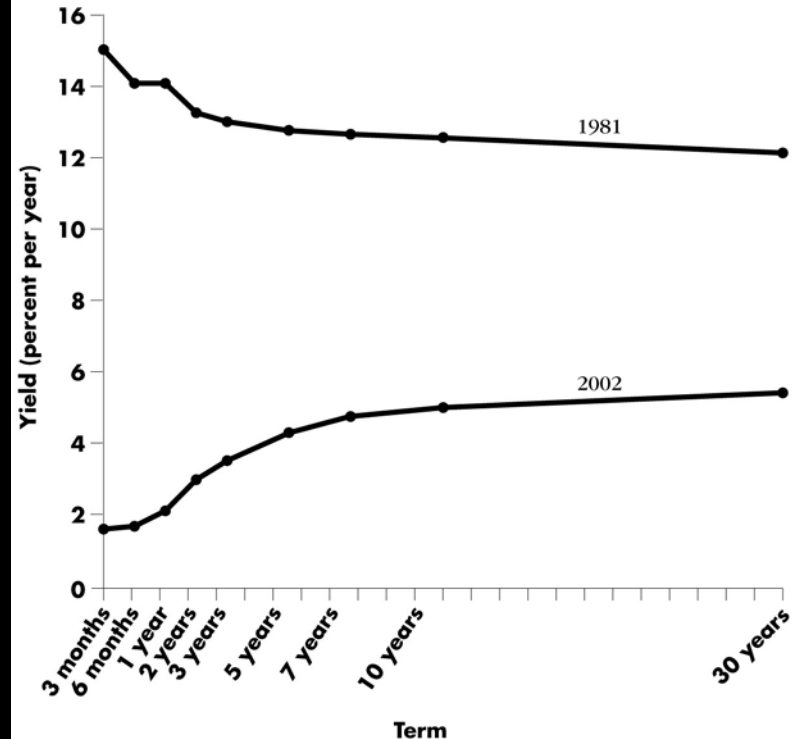
Bond Prices and Yields

- Bond prices are inversely related to interest rates
  - If a bond is to pay $100 a year from now and has an interest rate i, then its price, P, must be such that:

$$P(1+i) = 100 \Rightarrow P = \frac{100}{(1+i)}$$

    - Ex. A $100 bond will have a 5% yield if its price is $95.24
  - Suppose after you buy a bond, i rises from 5% to 10%
    - In order to sell the bond, must compensate the buyer for the lower earnings for this bond compared to a new bond at 10%
    - The longer the term of the bond, the greater the required change in the price to compensate for a change in the interest rate

Long term bonds are subject to considerable price fluctuations.

The Random Walk of Stock Prices

- Stock prices are essentially unpredictable, and are said to follow a random walk:

$$P_{t+1} = a + P_t + \varepsilon \qquad (2)$$

  - The price tomorrow is equal to the price today plus a random error term/surprise change, ε

  $\rightarrow$ *Changes in stock prices are unpredictable*

  - "a" is small and accounts for the expected return to holding assets

- Figure 18-4 plots an index of Canadian stock prices against their lags
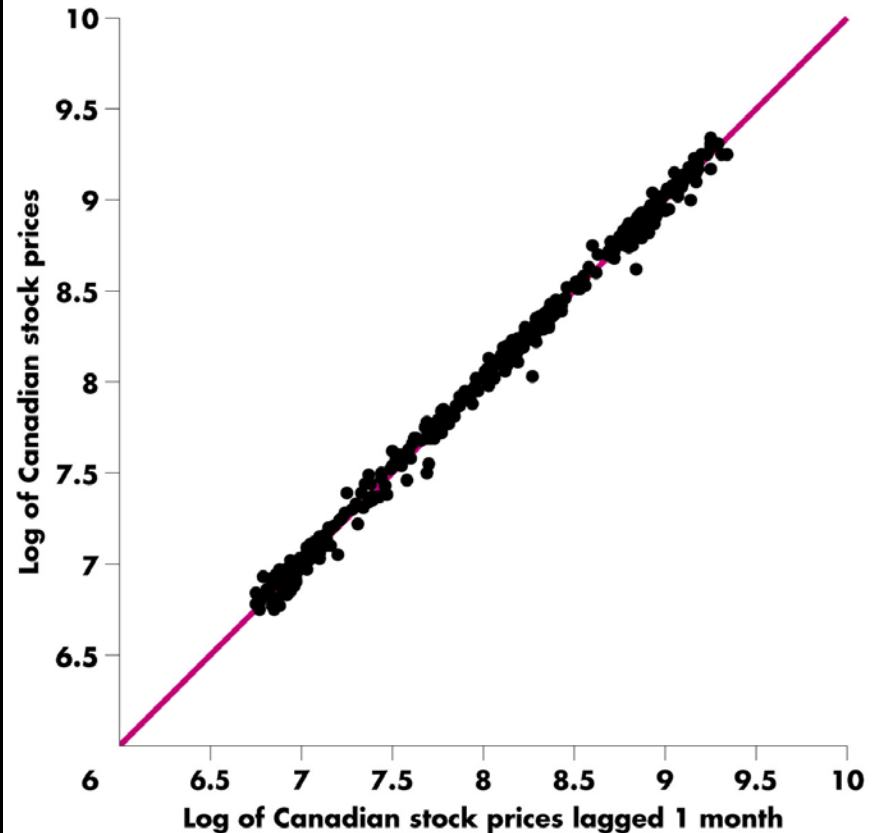
The Random Walk of Stock Prices

$$P_{t+1} = a + P_t + \varepsilon \quad (2)$$

- A random walk is a sign of market efficiency
- Using two assumptions, can show a random walk is just what we should expect from a well-functioning market:
  - The price of a stock is the net present value of expected dividends
  - New information changes expectations of future dividends but only by surprise
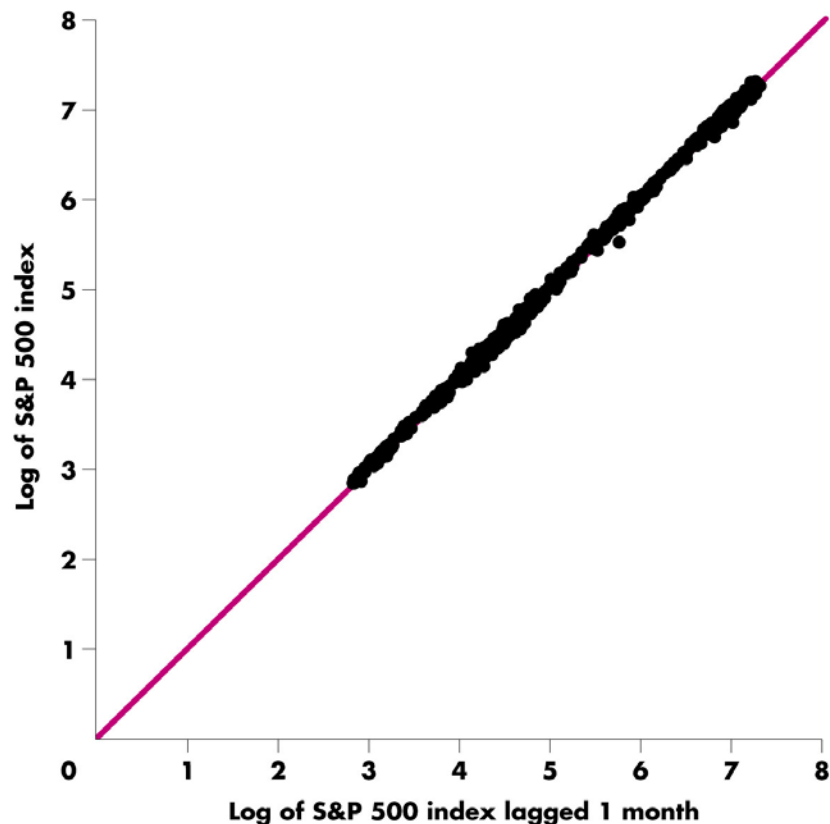
Exchange Rates and Interest Rates

- Arbitrage arguments also link exchange rates to international interest rate differentials

- Suppose an individual faces two investment options for an American with $100:

  1. Invest in the U.S.

  2. Convert $100 to Canadian dollars, and invest in Canada for one year. At the end of the year, convert back to U.S. dollars

- Option 1:
  - Investor ends the year with $100 \times (1 + i)$ dollars
  - If the interest rate is the U.S. is 5%, the investor will end up with US$105

Exchange Rates and Interest Rates

- Arbitrage arguments also link exchange rates to international interest rate differentials
- Suppose an individual faces two investment options for an American with $100:
  1. Invest in the U.S.
  2. Convert $100 to Canadian dollars, and invest in Canada for one year. At the end of the year, convert back to U.S. dollars

- Option 2:
  - U.S. dollars are converted to Canadian dollars
    - Suppose exchange rate, e_t, is US$0.90 per CDN$1.00
    - The conversion gives the investor $100/e_t$ Canadian $
  - If the Canadian interest rate is i^*, after a year the investor will have CDN$$(100/e_t)$ x $(1+i^*)$
  - CDN$ are converted back to US$ at an exchange rate of e_{t+1}, for a final U.S. value of

$$e_{t+1} \times \left[\left(\frac{100}{e_t} \right) \times \left(1 + i^* \right) \right]$$

Exchange Rates and Interest Rates

- Arbitrage arguments also link exchange rates to international interest rate differentials

- Suppose an individual faces two investment options for an American with $100:
  1. Invest in the U.S.
  2. Convert $100 to Canadian dollars, and invest in Canada for one year. At the end of the year, convert back to U.S. dollars

- Option (1) and (2) have equal returns if:

$$(1+i) = \left(e_{t+1} \middle/ e_t \right) \times \left(1 + i^* \right)$$

- This relationship can be closely approximated by:

$$\frac{e_{t+1} - e_t}{e_t} = i - i^* \qquad (7)$$

"*uncovered interest parity*"

International differences in interest rates are approximately equal to the expected proportional change in the exchange rate.

RUDIGER DORNBUSCH
STANLEY FISCHER
RICHARD STARTZ

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MACROECONOMICS

Chapter 19

Big Events: The Economics of Depression, Hyperinflation, and Deficits

Introduction

- Great events shape both the economy and the study of economics
  - The study of macroeconomics in particular grows out of economic experiences – especially traumatic ones
    - In the Great Depression 25% of the labor force was unemployed
    - During the 20th century many countries experienced hyperinflation
    - Over the later part of the 20th century the budget balance in the U.S. swung from deficit to surplus, and then back to deficit
    - Looking to the future, will the U.S. social security system remain solvent, or will it crash in the 21st century?

  In this chapter we examine these issues and their influence on economic theory.

The Great Depression: The Facts

- The Great Depression shaped many institutions in the economy, including the Federal Reserve and modern macroeconomics
  - The essential facts about the Depression are shown in Table 19-1
- During the Great Depression:
  - The stock market fell by 85%
  - GNP fell by 30%
  - The unemployment rate rose from 3 to 25%
  - Net investment was negative
  - CPI fell nearly 25%

TABLE 19-1   Economic Statistics of the Great Depression (see back endsheet)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	GNP, 1992 $,	I/GNP,	G, 1992 $,	UN-EMPLOY-MENT	CPI, 1929	COM-MERCIAL PAPER	AAA RATE,	STOCK MARKET	MI 1929	FULL EMPLOY-MENT SURPLUS/Y*,
YEAR	BILLIONS	%	BILLIONS	RATE, %	= 100	RATE, %	%	INDEX*	= 100	%†
1929	938.1	17.8	121.9	3.2	100.0	5.9	4.7	83.1	100.0	−0.8
1930	850.2	13.5	133.0	8.7	97.4	3.6	4.6	67.2	96.2	−1.4
1931	784.9	9.0	137.7	15.9	88.7	2.6	4.6	43.6	89.4	−3.1
1932	676.1	3.5	131.2	23.6	79.7	2.7	5.0	22.1	78.0	−0.9
1933	662.1	3.8	127.6	24.9	75.4	1.7	4.5	28.6	73.5	1.6
1934	713.7	5.5	145.2	21.7	78.0	1.0	4.0	31.4	81.4	0.2
1935	777.4	9.2	148.5	20.1	80.1	0.8	3.6	33.9	96.6	−0.1
1936	882.7	10.9	174.4	16.9	80.9	0.8	3.2	49.4	110.6	−1.1
1937	923.5	12.8	167.8	14.3	83.3	0.9	3.3	49.2	114.8	1.8
1938	885.7	8.1	182.7	19.0	82.3	0.8	3.2	36.7	115.9	0.6
1939	953.0	10.5	190.2	17.2	81.0	0.6	3.0	38.5	127.3	−0.1

*Stock market index is Standard & Poor's composite index, which includes 500 stocks; September 1929 = 100.

†Y* denotes full-employment output.

Source: Cols. 1, 2, 3: U.S. Department of Commerce, *The National Income and Product Accounts of the United States, 1929–1974.* Col. 4: Revised Bureau of Labor Statistics data taken from Michael Darby, "Three-and-a-Half Million U.S. Employees Have Been Mislaid: Or, an Explanation of Unemployment, 1934–1941," *Journal of Political Economy,* February 1976. Cols. 5, 6, 7: *Economic Report of the President,* 1957. Col. 8: Standard & Poor's Statistical Service, *Security Price Index Record,* 1978. Col. 9: Milton Friedman and Anna J. Schwartz, *A Monetary History of the United States, 1867–1960* (Princeton, NJ: Princeton University Press, 1963), table A1, col. 7. Col. 10: E. Cary Brown, "Fiscal Policy in the Thirties: A Reappraisal," *American Economic Review,* December 1956, table 1, cols. 3, 5, and 19.

The Great Depression: The Facts

- What was economic policy during this period?
  - Money stock fell rapidly due to bank failures, increased currency-deposit ratio, and the *failure of the Fed to take adequate expansionary measures*
  - Fiscal policy was weak
    - Figure 19-2 shows large budget deficits
    - Attempts to balance the budget through increased taxes → contractionary policies at an inopportune time

TABLE 19-2   Government Spending and Revenue, 1929–1939
(Percent)

| | TOTAL GOVERNMENT* | | FEDERAL GOVERNMENT | | |
| | (1) | (2) | (3) | (4) | (5) |
YEAR	EXPEN-DITURE/ GNP	ACTUAL SURPLUS/ GNP	EXPEN-DITURE/ GNP	ACTUAL SURPLUS/ GNP	TOTAL GOVERNMENT:* FULL-EMPLOYMENT SURPLUS/Y*†
1929	10.0	1.0	2.5	1.2	−0.8
1930	12.3	−0.3	3.1	0.3	−1.4
1931	16.4	−3.8	5.5	−2.8	−3.1
1932	18.3	−3.1	5.5	−2.6	−0.9
1933	19.2	−2.5	7.2	−2.3	1.6
1934	19.8	−3.7	9.8	−4.4	0.2
1935	18.6	−2.8	9.0	−3.6	−0.1
1936	19.5	−3.8	10.5	−4.4	−1.1
1937	16.6	0.3	8.2	0.4	1.8
1938	19.8	−2.1	10.2	−2.5	0.6
1939	19.4	−2.4	9.8	−2.4	−0.1

*Includes federal, state, and local.
†Y* denotes full-employment output.

Source: Cols. 1, 2, 3, 4: *Economic Report of the President,* 1972, tables B1 and B70. Col. 5: E. Cary Brown, "Fiscal Policy in the Thirties: A Reappraisal," *American Economic Review,* December 1956, table 1, cols. 3, 5, and 19.

The Great Depression:
The Issues and Ideas

- What macroeconomic theories can explain the Great Depression?

  - How could it have been avoided? Can it happen again?

- Classical economics of the time had no well-developed theory that could explain the persistent and excessive unemployment <u>NOR</u> any policy recommendations to solve the problem

- The Great Depression and the inadequacy of prevailing economic theories was the setting for John Maynard Keynes and his great work *The General Theory of Employment, Interest, and Money*

  - His theory explained

    ➢ What had happened

    ➢ What could have been done to prevent the Great Depression

    ➢ What could be done to prevent future depressions

    Keynesian revolution

The Keynesian Explanation

- Essence of the Keynesian explanation of the Great Depression is contained in the simple aggregate demand model
  - Growth in the 1920s based on:
    - Mass production of the automobile
    - Mass production of the radio
    - Housing boom
  - Collapse in the 1930s resulted from:
    - Drying up of investment opportunities
    - Reduction in consumption expenditures
    - Poor fiscal policy

The Keynesian Explanation

- The Great Depression showed:
  - The private economy was inherently unstable
  - Active stabilization policy needed to maintain a strong economy
- Keynesian model offered:
  - An explanation of what had happened
  - Suggestions for policy measures that could have prevented the Great Depression
  - Suggestions for policy measures that could prevent future depressions

  Vigorous use of countercyclical fiscal policy was preferred method for reducing cyclical fluctuations.

The Monetarist Challenge

- Keynesian emphasis on fiscal policy and its downplaying of the role of money was challenged by Milton Friedman and his coworkers in the 1950s.
  - They emphasized the role of monetary policy in determining the behavior of output and prices
- Friedman attacked view that monetary policy was impotent during the 1930s
  - He argued that the Depression was evidence of the importance of monetary factors
    - → Failure of the Fed to prevent bank failures and decline of money stock was largely responsible for the severity of the depression
    - → Monetary view came close to being accepted as the orthodox explanation of the Depression

Money and Inflation in Ordinary Business Cycles

- In examining the links between money growth and inflation, convenient to use the quantity theory of money:

$$MV = PY \qquad (1)$$

or in growth rate form:

$$m + v = \pi + y \qquad (2)$$

Putting inflation on the left-hand side, we have:

$$\pi = m - y + v \qquad (3)$$

Equation (3) can be used to account for the sources of inflation. Monetarists claim that inflation is predominantly a monetary phenomenon, and velocity and output changes are small.

Money and Inflation in Ordinary Business Cycles

- Figure 19-1 shows annual M2 growth and the inflation rate of the GDP deflator for the U.S.
  - Inflation rate and money growth generally move together
  - Relationship is very rough, with large gaps between the growth lines that persist for years
  - → Changes in output growth or velocity, or both, affect inflation

Conclusion:
Inflation is a monetary phenomenon, *at least in the long run*

Hyperinflation

- <u>Hyperinflation</u>: very high rates of inflation → around 1,000 percent per annum
- Table 19-6 shows recent extreme inflation experiences
- In a hyperinflationary economy, inflation is so pervasive that is dominates daily economic life
  - People spend significant amounts of time minimizing inflationary damage

TABLE 19-6   Recent High-Inflation Experiences
(Percent per Year)

LATIN AMERICAN COUNTRIES AND ISRAEL

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	2000	2005
Argentina	672	90	131	343	3080	2314	172	25	11	4	3	−1	10
Bolivia	11750	276	15	16	15	17	21	12	9	8	10	5	5
Brazil	226	147	228	629	1431	2948	433	952	1928	2076	66	7	7
Israel	305	48	20	16	20	17	19	12	11	12	10	1	1
Mexico	58	86	132	114	20	27	23	16	10	7	35	9	4
Nicaragua	219	681	912	10205	4770	7485	2945	24	20	7	11	12	9
Peru	163	78	86	667	3390	7482	410	74	49	24	11	4	2

FORMER EASTERN BLOC NATIONS

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Belarus	1190	2221	709	53	64	73	294	169	61	43	28	18	10
Lithuania	410	72	40	25	9	5	1	1	1	0	−1	1	3
Romania	255	137	32	39	155	59	46	46	34	23	15	12	9
Russia	875	308	197	48	15	28	86	21	21	16	14	11	13
Ukraine	4735	891	377	80	16	11	23	28	12	1	5	9	14

Source: IMF, *International Financial Statistics*, 2006.

Stopping Hyperinflation

- All hyperinflations come to an end
  - Dislocation of the economy becomes too great, and the government finds a way of reforming its budget process
    - Often a new money is introduced and the tax system is reformed
    - Often exchange rate of a new currency is pegged to that of a foreign currency to provide an anchor for prices and expectations
    - Frequently there are unsuccessful attempts at stabilization before the final success
- Often a coordinated attack on hyperinflation: *heterodox approach to stabilization*
  - Monetary, fiscal, and exchange rate policies combined with income policies

Disinflation and the Sacrifice Ratio

- Inflation reduction always costs a recession, but what exactly is the tradeoff?

  How much output is lost through different methods of disinflation?

- Discussion of the costs of disinflation makes extensive use of the concept of the *sacrifice ratio*

  - <u>Sacrifice ratio</u>: ratio of the cumulative percentage loss of GDP to the reduction in inflation that is actually achieved

    - Before the disinflation of the 1980s, economists estimated sacrifice ratios of proposed disinflation programs between 5 and 10, with the actual value was estimated to be 1.83 (Laurence Ball)

Deficits, Money Growth, and the Inflation Tax

What is the link between budget deficits and inflation?

➢ We have seen that a sustained increase in money growth ultimately results in increased inflation

➢ Some argue that money growth is the result of government budget deficits

• The federal government (Fed and Treasury) can finance the deficit in two ways:

➢ Sell bonds

➢ "Print money" → Fed prints money when it increases the stock of high-powered money, typically via OMO that buy up the debt that the Treasury is selling

Deficits, Money Growth, and the Inflation Tax

- The government budget constraint is :

  Budget deficit = sales of bonds + increase in money base (6)

- There are two types of possible links between budget deficits and money growth:

  - In the short run, an increase in the deficit caused by expansionary fiscal policy will tend to raise nominal and real interest rates

    - If the Fed is targeting interest rates it may increase the growth rate of money in an attempt to keep interest rates from rising

  - The government may deliberately be increasing the stock of money as a means of financing itself over the long run

    - The Fed is said to monetize deficits when it purchases a part of the debt sold by the Treasury to finance the deficit

Deficits, Money Growth, and the Inflation Tax

- Monetization of deficits is an alternative to explicit taxation
  - As the government creates money to finance the deficit, the money is absorbed by the public → *Why is the public willing to increase its holdings of nominal money balances?*
    - The public increases money holdings to offset the effects of inflation <u>OR</u> to maintain a constant level of real holdings
  - Inflation acts just like a tax because people are forced to spend less than their income and pay the difference to the government in exchange for extra money

  When the government finances its deficit by issuing money, which the public adds to its holdings of nominal balances to maintain the real value of money balances constant, we say the government is financing itself through the *inflation tax*.

Budget Deficits: Facts and Issues

Outlays:

- Table 19-8 shows the outlays of the federal government since 1962

  - Mandatory outlays: outlays made under entitlement programs

    - Ex. Social Security

  - Discretionary outlays: outlays that are governed by the congressional appropriation process

    - Ex. National defense expenditures

TABLE 19-8 Federal Government Outlays
(Percent of GDP; Fiscal Years; Period Average)

	1962–1969	1970–1979	1980–1989	1990–1999	2000–2005
National defense	8.7	5.9	5.8	4.1	3.5
Mandatory spending	6.2	9.4	10.8	11.2	11.4
Nondefense discretionary spending	3.8	4.5	4.1	3.6	3.7
Net interest	1.3	1.5	2.8	3.0	1.7
Total outlays*	18.8	20.0	22.2	20.7	19.4

*Column totals do not match total outlays because "offsetting receipts" are excluded.

Source: Congressional Budget Office, *Historical Budget Data*, January 26, 2006.

Budget Deficits: Facts and Issues

Receipts:

- Table 19-9 shows the sources of revenue and totals from 1962-2005
    - Revenue sources are largely from taxes
    - Total revenue as a share of GDP has been constant, but there has been a shift in the sources
        - Social security taxes and contributions have risen
        - Corporate income taxes have declined
        - Personal consumption taxes have remained stable

TABLE 19-9 Sources of Federal Revenue
(Percent of GDP; Fiscal Years; Period Average)

	1962–1969	1970–1979	1980–1989	1990–1999	2000–2005
Individual income tax	7.8	8.1	8.4	8.4	8.4
Corporate income tax	3.8	2.7	1.7	1.9	1.7
Social insurance taxes and contributions	3.5	5.0	6.3	6.6	6.7
Other*	2.7	2.1	1.8	1.6	1.4
Total revenue	17.9	17.9	18.3	18.6	18.2

*Includes excise (sales) taxes, estate and gift taxes, custom duties, and miscellaneous receipts.

Source: Congressional Budget Office, *Historical Budget Data,* January 26, 2006.

Burden of the Debt

- As deficits continue, the debt grows
  - The U.S. federal debt in 2005 was about $8 trillion, which is $27,000 per capita
- By in large we owe the national debt to ourselves
  - Many individuals own the national debt in the form of Treasury bonds held directly or indirectly by financial intermediaries
    - Liability of future taxes to repay the debt = asset that the debt represents to the individuals who hold claims on the government → BUT a portion of the debt is owned by foreigners
- Debt a burden through the potential long-run effects of the deficit and debt on capital stock → debt can limit economic growth

RUDIGER DORNBUSCH
STANLEY FISCHER
RICHARD STARTZ

TENTH EDITION |

MACROECONOMICS

Chapter 20

International Adjustment and Interdependence

Introduction

- Countries are interdependent
    - Booms or recessions in one country spill over to other countries through trade flows
    - Changes in interest rates in any major country cause immediate exchange or interest rate movements in other countries
- In this chapter we explore the issues of international interdependence further:
    - Mechanisms through which a country with a fixed exchange rate adjusts to balance of payments problems
    - Aspects of behavior of the current flexible exchange rate system

Adjustment Under Fixed Exchange Rates

- Adjustment to a balance-of-payments problem can be achieved in two ways:
  - Change in economic policy
    - Monetary policy
    - Fiscal policy
    - Tariffs
    - Devaluations
  - Automatic adjustment mechanisms
    - Money supply $\rightarrow$ spending
    - Unemployment $\rightarrow$ wages and prices $\rightarrow$ competitiveness

The Role of Prices in the Open Economy

- The real exchange rate is expressed as:
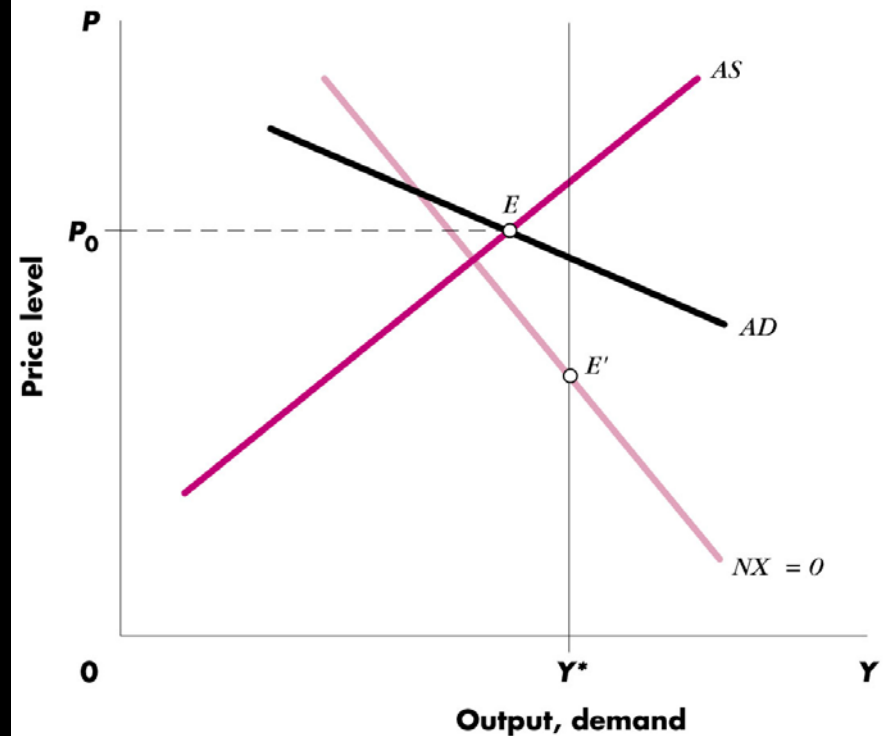
$$R = \frac{eP_f}{P} \quad (1)$$

$\rightarrow$ assume that exchange rate and foreign prices are given

   How does the openness of the economy affect
   the aggregate demand curve?

➢ An increase in the price level reduces demand

   ➢ Higher price level implies lower real balances, higher interest rates, and <u>reduced spending</u>

   ➢ Given the exchange rate, our goods are more expensive to foreigners and their goods are relatively cheaper for us to buy $\rightarrow$ <u>exports decrease and imports increase</u>
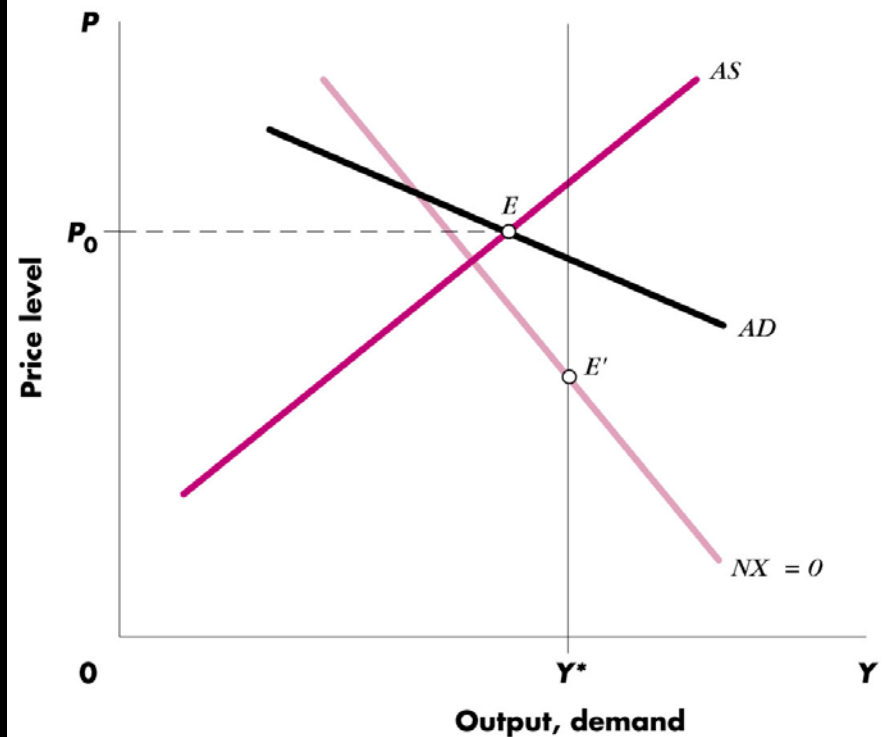
The Role of Prices in the Open Economy

- Figure 20-1 shows the downward sloping AD curve where $AD \equiv DS + NX$ and the NX = 0 curve

- At point E the home country has a trade deficit
  - To achieve trade balance equilibrium, we would have to
    - Become more competitive (exporting more and importing less)
    - Reduce our level of income in order to reduce import spending

The Role of Prices in the Open Economy
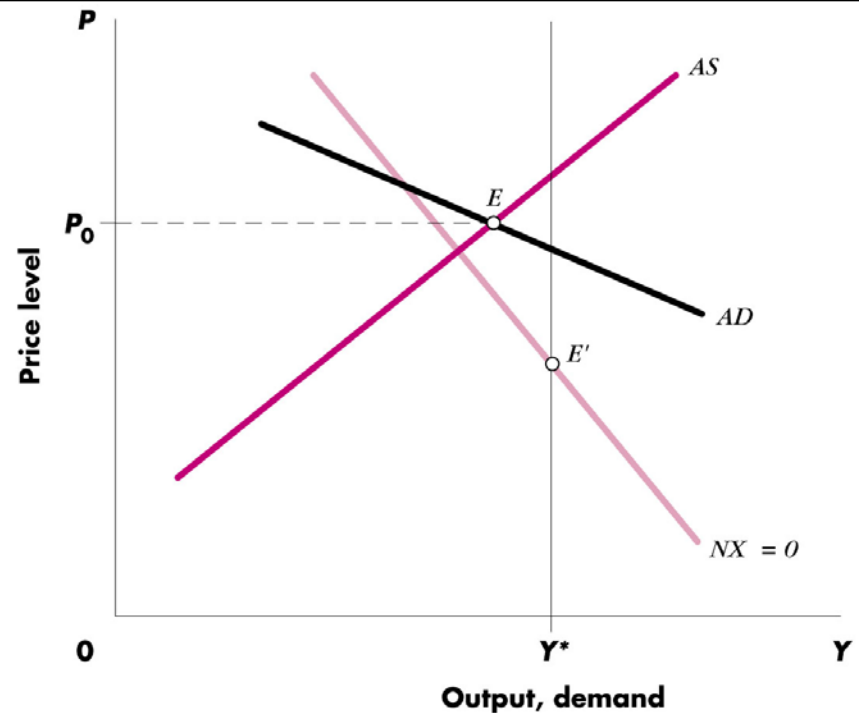
What should the country do?

- The central bank could use its reserves to finance temporary imbalances of payments

- Can borrow foreign currencies abroad
  - May be troublesome if the country's ability to repay the debt is in question

→ Country must find a way of adjusting the deficit
  - Cannot maintain and finance current account deficits indefinitely or for long periods of time

The Role of Prices in the Open Economy
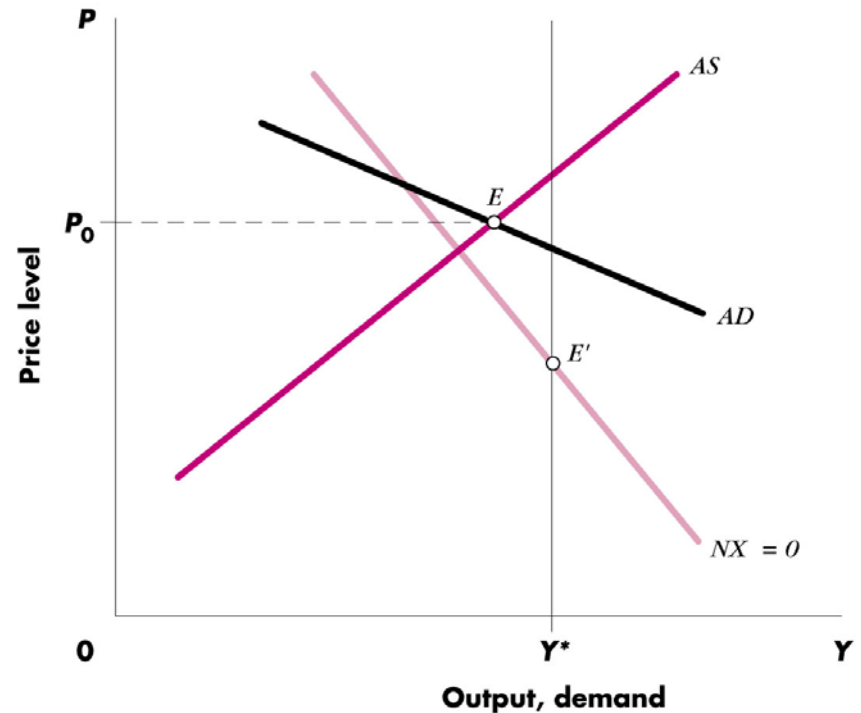
Automatic adjustment

- When the central bank sells foreign exchange, it reduces domestic high powered money and the money stock

  - The deficit at E implies the central bank is pegging the exchange rate, selling foreign exchange to keep the exchange rate from depreciating

  - Over time the AD schedule, which is drawn for a given money supply, will be shifting downward and to the left

The Role of Prices in the Open Economy

Automatic adjustment

- Point E is also a point of unemployment
  - Unemployment leads to declines in wages and costs
  - Over time, the SR equilibrium point, E, moves downward as the AS and AD shift
    - Process continues until reach point E'
- Point E' is a LR equilibrium point and there is no need for exchange market equilibrium → automatic adjustment

Policies to Restore Balance

- The classical adjustment process may take time $\rightarrow$ alternative is policies to restore external balance

  - Because of their side effects, policies to restore external balance must generally be combined with policies to achieve full employment

    - Policies to create employment will typically worsen the external balance

    - Policies to create a trade surplus will affect employment

    Necessary to combine *expenditure-switching policies*, which shift demand between domestic and imported goods, and *expenditure-reducing/increasing policies* in order to cope with the two targets of *internal balance* and *external balance*.

Policies to Restore Balance

- Can use policies to reduce aggregate demand $\rightarrow$ expenditure reducing policies
  - The trade deficit is expressed as $NX \equiv Y - (C + I + G)$ (2)
    - A balance-of-trade deficit can be reduced by reducing spending (C+I+G) relative to income through restrictive monetary and/or fiscal policy
  - The link between the external deficit and budget deficits is shown in equation (2a): $NX \equiv (S - I) + [TA - (G + TR)]$ (2a)
    - If S and I are constant, changes in the budget would translate one for one into changes in the external balance
    - Budget cutting would bring about equal changes in the external deficit $\rightarrow$ but budget cutting will affect S and I, thus need a more complete model to explain how budget cuts affect external balance

Devaluation

- The unemployment that accompanies automatic adjustment suggests the need for an alternative policy for restoring internal and external balance

- The major policy instrument for dealing with payment deficits is *devaluation* = an increase in the domestic currency price of foreign exchange

  - Given the nominal prices in the two countries, devaluation:
    - ➤ Increases the relative price of imported goods in the devaluing country
    - ➤ Reduces the relative price of exports from the devaluing country

  Devaluation is primarily an expenditure switching policy.

Exchange Rates and Prices

- The price level typically changes with the exchange rate (including after a devaluation)

- The essential issue when a country devalues is whether it can achieve a *real devaluation*

  - A real devaluation occurs when it reduces the price of the country's own goods relative to the price of foreign goods

  - Using the definition of the real exchange rate:

$$R = \frac{eP_f}{P}$$

  - A real devaluation occurs when e/P rises or when the exchange rate increases by more than the price level

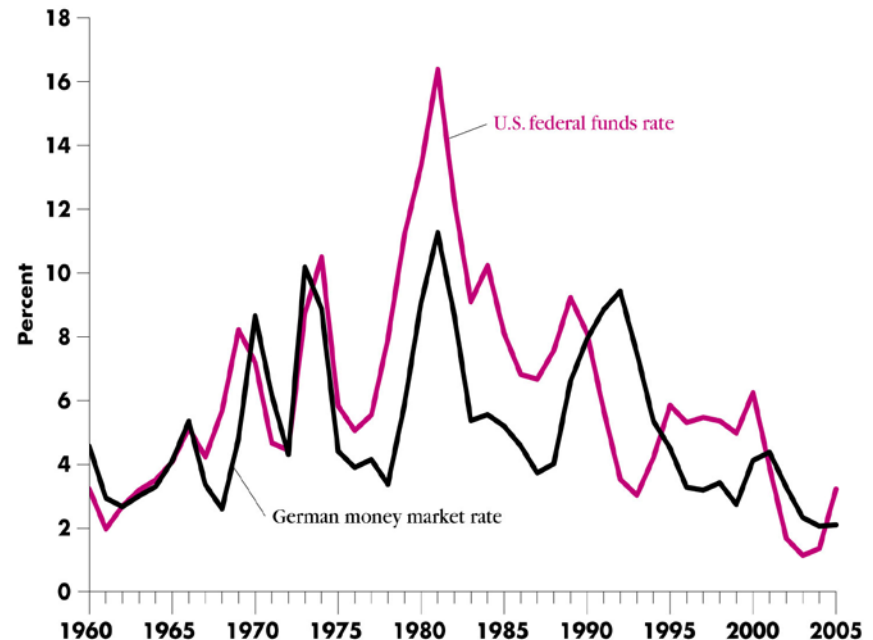# The Monetary Approach to the Balance of Payments

- There is a link between the money supply and the external balance → the adjustment process must ultimately lead to the right money stock so that external payments will be in balance

- The only way the adjustment process can be suspended is through *sterilization* operations

  - Central banks frequently offset the impact of foreign exchange market intervention on the money supply through OMO

  - A deficit country that is selling foreign exchange and correspondingly reducing its money supply may offset this reduction by open market purchases of bonds that restore the money supply   STERILIZATION

    - Persistent deficits are possible → CB actively maintaining the stock of money too high for external balance

STERILIZATION

Interest Differentials and Exchange Rate Expectations

- In our model of exchange rate determination international capital mobility was assumed

  - When capital markets are sufficiently integrated, we expect interest rates to be equated across countries

- Figure 20-9 shows the U.S. federal funds rate and the money market rate in Germany

  - These rates are not equal

  How do we square this fact with our theory?

Exchange Rate Expectations

- Have assumed that capital flows internationally in response to nominal interest differentials
  - Theory is incomplete when exchange rates can and are expected to change
  - Must extend our analysis to incorporate expectations of exchange rate changes
- Total return on foreign bonds measured in our currency is the interest rate on the foreign currency plus whatever earned from the appreciation of the foreign currency, OR

$$i_f + \Delta e \Big/ e \qquad (5)$$

Exchange Rate Expectations

- Investor does not know at the time of investment how much the exchange rate will change

  - The term $\Delta e / e$ should be interpreted as the expected change in the exchange rate

- The balance of payments equation needs to be modified

  - Net capital flows are governed by the difference between our interest rate and the foreign rate adjusted for expected depreciation: $i - i_f - \Delta e / e$

  - The balance of payments equation is:

  $$BP = NX\left(Y, \frac{eP_f}{P}\right) + CF\left(i - i_f - \frac{\Delta e}{e}\right) \quad (6)$$

Exchange Rate Expectations

- The adjustment for exchange rate expectations thus accounts for international differences in interest rates that persist even when capital is freely mobile among countries

  - When capital is completely mobile, we expect interest rates to be equalized, after adjusting for expected depreciation:

  $$i = i_f + \frac{\Delta e}{e} \quad \text{(6a)}$$

- Expected depreciation helps account for differences in interest rates among low and high-inflation countries

  - When inflation in a country is high, its exchange rate is expected to depreciate and nominal interest rates will be high