Macroeconomics

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Topic 1: Introduction - definitions & measure

Chapter 1 and 2

1.1 THE CRISIS

- From 2000 to 2007, the world economy grew and had a sustained expansion. In 2007, however, signs that the expansion might be coming to an end started to appear.
- US housing prices started declining. Lower house pricing might lead to lower housing construction and to lower spending by consumers.
- Housing prices continued to decrease, and this led to a major financial crisis. Banks became unable to borrow, and this led to many banks finding themselves in trouble. For a few weeks it even looked as if the whole financial system might collapse.

Figure 1-1

Output Growth Rates for the World Economy, for Advanced Economies, and for Emerging and Developing Economies, 2000–2018

Source: IMF, World Economic Outlook Database, July 2018. NGDP_RPCH.A.
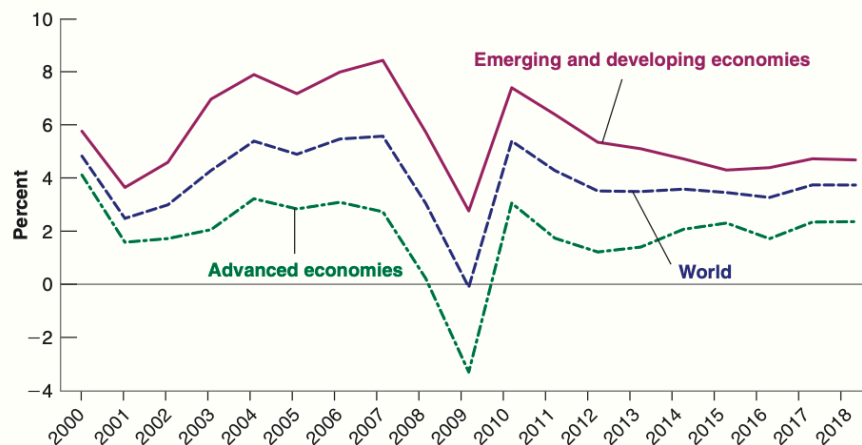
- Stock prices of the whole world was affected:

Figure 1-2

Stock Prices in the United States, the Euro Area, and Emerging Economies, 2007–2010

Source: Haver Analytics USA (S111ACD), Eurogroup (S023ACD), all emerging markets (S200ACD), all monthly averages.
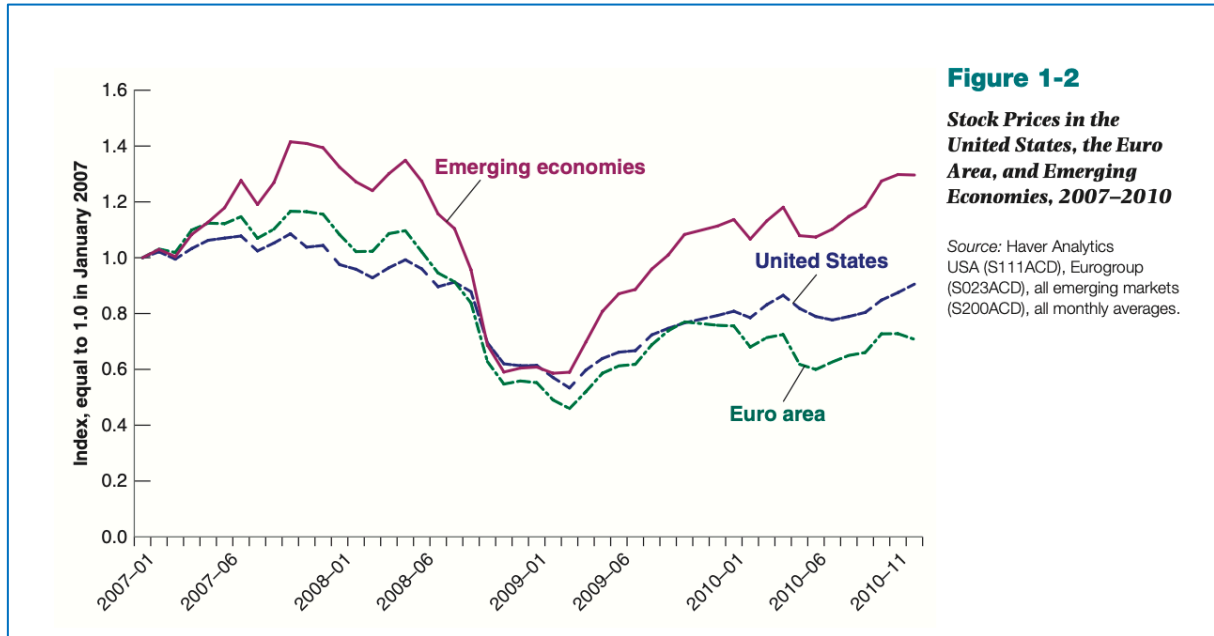
- In fear of a new Great Depression, people cut their consumption quickly. Other countries than the US was affected due to 1) trade and 2) finance.

1.2 THE UNITED STATES

- The output in the United States is big, with an output of $20.5 trillion in 2018, accounting for 24% of world output. The standard of living is also high with output per person being $62,500.

Three variables of the health of a country:

1. **OUTPUT GROWTH** → the rate of change of output
2. **THE UNEMPLOYMENT RATES** → the proportion of workers in the economy who are not employed and are looking for a job
3. **THE INFLATION RATES** → the rate at which the average price of goods in the economy is increasing over time

The two macroeconomic problems for US policymakers are:
1. Do policymakers have the necessary tools to handle a recission?
2. How can the productivity growth be increased in the long run?

Do policymakers have the tools to handle the next recission?

- The Fed needs to play its role of fighting recessions, and it needs to use the interest rates. By lowering the interest rates, the Federal Reserve can stimulate demand, increase output, and decrease unemployment. By increasing the interest rate, it can slow down demand and increase unemployment.
- The constraint of not being able to set a negative interest rate is known as the **zero lower bound**.

How worrisome is low productivity growth?

- In the long run, growth is determined by other factors than movements in demands and the decisions of the central bank - the main factor is productivity growth.

- This is concerning for the US, because their productivity growth has been declining.
    - A factor can be, that it is hard to measure improvement of productivity.

- **TWO MAJOR CHALLENGES FOR US POLICYMAKER ARE:**
    - Raising productivity growth
    - Limit the rise of inequality
    - [or doing both]

1.3 THE EURO AREA

- In 1957, the European Union [EU] was formed based on creating an **ECONOMIC ZONE** where people, goods, and services could move freely.

- Since 1999 they have had a common currency: the euro.
    - 19 countries belong to this **common currency area**
    - The euro area is a strong economic power

- The euro area faces two main issues today:
    - How to **REDUCE UNEMPLOYMENT**?
    - How can it **FUNCTION EFFICIENTLY AS A COMMON CURRENCY AREA**?

Can European unemployment be reduced?

- Greece and Spain have unemployment rates of 20% and 15%

- Germany's is close to 3%

- Thus, **HOW TO REDUCE UNEMPLOYMENT MUST BE TAILORED TO THE SPECIFIC COUNTRIES**.
- Some economists argue that European countries are too protective of their citizens when it comes to employment, and that might keep up the unemployment rates. Not all agree with this.

What has the Euro done for its members?

- The euro has enormous **SYMBOLIC IMPORTANCE**.
- There is no change in exchange rated for European firms to worry about.
- Common currency = common monetary policy = same interest rate across the euro countries.
- This has been an **OBSTACLE FOR COUNTRIES GOING THROUGH RECISSIONS** such as Ireland, Portugal, and Greece.

1.4 CHINA

- China is perceived as one of the major economic powers in the world.
- Its output, $13.5 trillion, is about 60% of the US's.
- Output per person is about $9.70, roughly 15% of output per person in the US.

- Two major reasons for China's attention:
  - **Many goods** in relatively poor countries [as China] **are cheaper**. So, the same income buys you more in Beijing than in New York City.
    - These differences can be corrected by compared **purchasing power parity [PPP]** measures.
    - This measure makes China higher than the US in output and makes the output per person 33% of the US [instead of 15% from above].
  - **China has been growing very rapidly** for more than three decades.
    - Growth barely decreased during 2008 and 2009, while unemployment barely increased.

- China's growth has come from two sources:
  - **High accumulation of capital**
    - The investment rate is very high.
    - More capital = higher productivity and output
  - **Rapid technological progress**
    - Encouragement towards joint ventures from foreign and Chinese companies.

2.1 AGGREGATE OUPUT

- Aggregate output → total output
- At the end of World War II, **NATIONAL INCOME AND PRODUCT ACCOUNTS** were put together to measure aggregate output.

GDP: Production and income

- **GROSS DOMESTIC PRODUCT [GDP]** is the measure of aggregate output in the national income accounts.
  - **1st definition [production side]**: *GDP is the value of the final goods and services produced in the economy during a given period.*
    - Constructs GDP by recording and adding up the production of all final goods.
  - **2nd definition [production side]**: *GDP is the sum of value added in the economy during a given period.*
    - **Value added** → the value of a firm's production minus the value of the intermediate goods used in production.
  - **3rd definition [income side]**: *GDP is the sum of incomes in the economy during a given period*

- An **INTERMEDIATE GOOD** is a goods used in the production of another good. Thus, it is not part of the GDP measure, because that is only the final goods.
- **LABOR INCOME** → payment to worker.
- **CAPITAL INCOME** or **PROFIT INCOME** → money to the firm

Nominal and Real GDP

- Much of increase in GDP come from prices and not output.
- **NOMINAL GDP** [*dollar GDP or GDP in current dollars*] is the sum of quantities of final goods produces times their **current** prices.
  - **Nominal GDP increases over time** due to:
    - Production of most goods increases over time.
    - The price of most goods increases over time.
    - Therefore, nominal GDP should not be used to compared evolvement over time.
    - Nominal GDP: United States number 1, Denmark number 35
    - Nominal GDP per capita: Monaco number 1, Denmark number 10

- o **Method 1:** Value of the final goods and services produced in the economy of a given period
  - Example from Topic 1, Slide 9: $\text{Nom. GDP} = 250 \cdot 10 = 2,500$
- o **Method 2:** The sum of value added in the economy during a given period.
  - Example from Topic 1, Slide 9: $\text{Nom. GDP} = (1,200 - 0) + (2,000 - 1,200) + (2,500 - 2,000) = 2,500$
- o **Method 3:** The sum of incomes [wages, profits and taxes] in the economy during a given period:
  - Example from Topic 1, Slide 9: $\text{Nom. GDP} = (1,000 + 500 + 300) + (200 + 300 + 200) + 0 = 2,500$

Firms	Quantity	Price	Val of prod	Wages	Interm goods
Firm A	100 planks	12	1200	1000	0
Firm B	10 wardrobes	200	2000	500	1200
Firm C	10 wardrobes	250	2500	300	2000

- **BECAUSE GDP IS ALSO THE SUM OF INCOMES, GDP IS MIRRORED BY GDI** [Gross Domestic Income]

- **REAL GDP** [*GDP in terms of goods, GDP in constant dollars, GDP adjusted for inflation, GDP chained in [year] dollars, GDP in [year] dollars*] is constructed as the sum of quantities of final goods times **constant** prices.
  - o **Relative prices** of the goods should be the natural weights. If one good is worth twice as much as another, then the good should count for twice as much.
  - o **Real GDP in chained [year] dollars** reflects relative prices and change over time.
  - o The prices are held constant [example from Topic 1, Slide 22]:
    - $\text{Nom. GDP 2011} = 15,000 \cdot 10 + 100 \cdot 10,000 + 50 \cdot 100 = 1,155,000$
    - $\text{Nom. GDP 2012} = 16,000 \cdot 15 + 125 \cdot 10,500 + 70 \cdot 104 = 1,559,780$
    - $\text{Real. GDP 2011} = 15,000 \cdot 10 + 100 \cdot 10,000 + 50 \cdot 100 = 1,155,000$
    - $\text{Real. GDP 2012} = 16,000 \cdot 10 + 125 \cdot 10,000 + 70 \cdot 100 = 1,417,000$
    - By construction, nominal GDP = real GDP for the base year

		Quantities	Prices
	Books	15000	10
2011	Cars	100	10000
	Bicycles	50	100
	Books	16000	15
2012	Cars	125	10500
	Bicycles	70	104

- Growth rate for nominal GDP: $\frac{1,559,780 - 1,155,000}{1,155,000} = 35.05\%$
- Growth rate for real GDP: $\frac{1,417,000 - 1,155,000}{1,155,000} = 22.68\%$
- If the real GDP growth rate is smaller than the nominal GDP growth rate if there is inflation.

- **PPP** [Purchasing Power Parity] **ADJUSTED GDP**:
    - Real GDP is calculated using **prices of a base country**
    - Price level in a given country, often US, so the prices are the same for all countries. The difference is then only the quantity.
    - China is number 1, Denmark is number 53.

Figure 2-1

Nominal and Real US GDP, 1960–2018.

From 1960 to 2018, nominal GDP increased by a factor of 38. Real GDP increased by a factor of 5.7.

Source: FRED. Series GDPC, GDP.
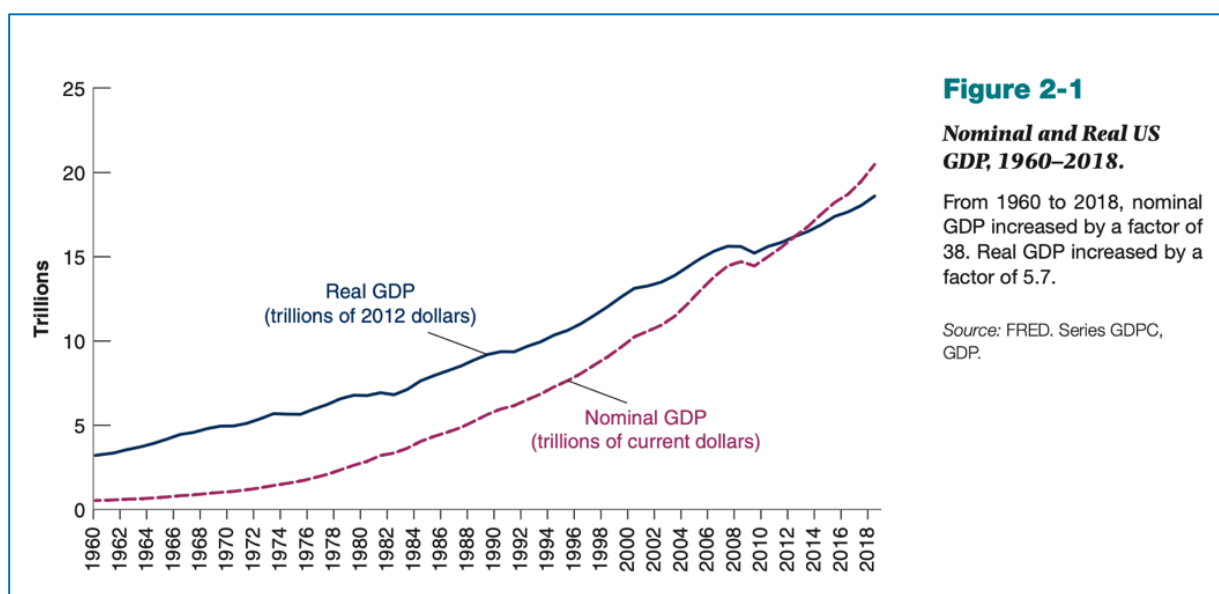
- From now on, GDP refer to real GDP
- Y_t denotes real GDP in year t
- Nominal GDP, and variables measured in current dollars, will be denoted by a dollar sign in front of them → $\$Y_t$ for nominal GDP in year t

- To measure the standard of living of a country, the **HUMAN DEVELOPMENT INDEX [HDI]**

- o Measures **education**, **life expectancy**, **GDP per capita**
- o Index between 0 and 1

- The correlation between GDP per person PPP and inflation adjusted:
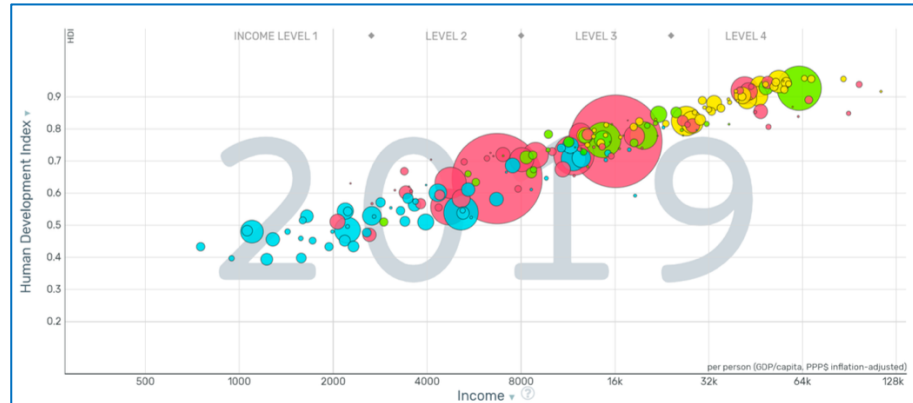
GDP: Level versus Growth Rate

- The **LEVEL** of real GDP gives the economic size of a country.
- **REAL GDP PER PERSON** is the ratio of real GDP to the population of the country → the average standard of living per person.
- **GDP GROWTH** is the performance from year to year
  - o **Positive periods = expansions**
  - o **Negative periods = recessions**
  - o Constructed as $\frac{Y_t - Y_{t-1}}{Y_{t-1}}$ and is expressed as a percentage.
- **HEDONIC PRICING** is when goods are treated as a collection of characteristics.

Figure 2-2

Growth Rate of US GDP, 1960–2018.

Since 1960, the US economy has gone through a series of expansions, interrupted by short recessions. The 2008–2009 recession was the most severe recession in the period from 1960 to 2018.

Source: Calculated using series GDPC in Figure 2-1.
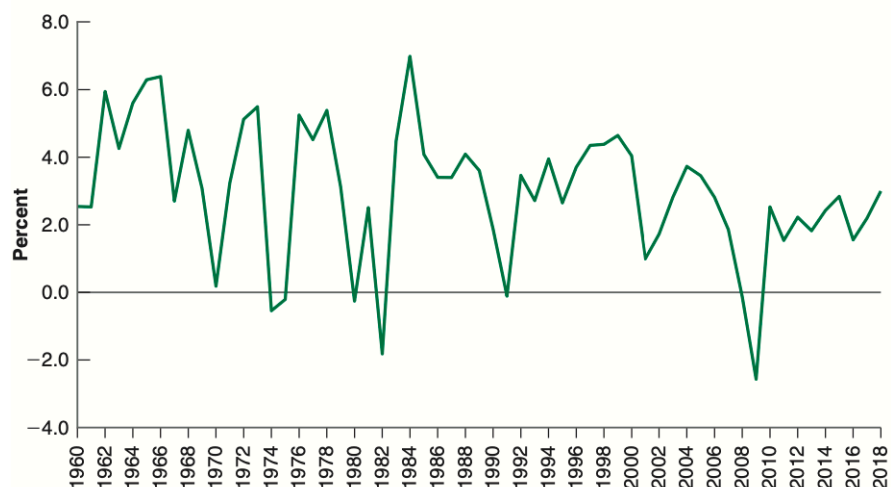
2.2 THE UNEMPLOYMENT RATE

- **EMPLOYMENT (N)** is the number of people who have a job.
- **UNEMPLOYMENT (U)** is the number of people who do not have a job but are looking for one.
  - Most countries rely on large surveys of households to compute the unemployment rate.
  - In the US, it is called the **Current Population Survey [CPS]**
- The **LABOR FORCE (L)** is the sum of employment and unemployment → $L = N + U$
- The **UNEMPLOYMENT RATE (u)** is the ratio of the number of people who are unemployed to the number of people in the labour force → $u = \frac{U}{L}$
- The **EMPLOYMENT RATE (e)** is the ratio of the number of people who are employed to the number of people in the population → $e = \frac{N}{population}$
- **DISCOURAGED WORKERS** are workers that give up on finding a job and therefore is out of the labour force.
  - When the economy slows down, there is typically an increase in unemployment and an increase in dropouts of the labour force.
- **PARTICIPATION RATE** → the ratio of the labour force to the total population of working age.

Why do economists care about unemployment?

- Due to its direct effect on the welfare of the unemployed.
- It provides a signal that the economy is not using some of its resources.
  - Low unemployment can also be a problem due to overuse of resources and running into labour shortages.

2.3 THE INFLATION RATE

- **INFLATION** is a sustained rise in the general level of price → rise in the **PRICE LEVEL**.
  - There are two measures of the price level [two indexes]:
    - **GDP deflator**
    - **Consumer Price Index**
- **INFLATION RATE** is the rate at which the price level increases.
  - The average growth in price level
  - In periods of inflation, not all incomes proportionally, and this can lead to impoverishment of some people.
  - When inflations are high [two- or three digits], is increases uncertainty, which makes investment decisions harder.

- o When comparing incomes over year, people does not keep track of the history of inflation.
- **DEFLATION** is a sustained decline in the price level [negative inflation rate].

The GDP Deflator

- If nominal GDP increase faster than real GDP, the difference must come from an increase in prices.
- The **GDP DEFLATOR**, P_t, in year t is defined as the ratio of nominal GDP to real GDP in year $t \rightarrow P_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} = \frac{\$Y_t}{Y_t}$
  - o Called an **index number**
  - o Example from topic 1, slide 51: $\frac{\text{Nominal GDP 2012}}{\text{Real GDP 2012}} = \frac{1,559,780}{1,417,000} = \mathbf{1.10} \rightarrow$ **GDP deflator 2012 = 10%**
- In the year that real GDP is equal to nominal GDP, it implies that the price level is equal to 1.
- The **RATE OF CHANGE** gives the rate at which the general level of prices increases over time [**THE RATE OF INFLATION**] $\rightarrow \pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$
- Nominal GDP is equal to the GDP deflator times the real GDP $\rightarrow \$Y_t = P_t Y_t$

The Consumer Price Index

- The set of goods produces in the economy is not the same as the set of goods purchased by consumers due to:
  - o Some of the goods in GDP are not sold to consumers [machine tools e.g.]
  - o Some of the goods bought by consumers are not produced domestically but are imported from abroad.
- To measure average price of consumption [**COST OF LIVING**], there is the **CONSUMER PRICE INDEX [CPI]**
  - o Gives the cost in dollars of a specific list of goods and services over time.
  - o It is an **index**.
  - o Set equal to 100 in the period chosen as the base period.
  - o If the level is 250, it costs 2.5 times as much as the base period.
- CPI and the GDP deflator move together most of the time.
  - o When the price of imported goods increases relative to the price of goods produced in the US, the CPI increases faster than the GDP deflator [1979 and 1980].

Figure 2-4

Inflation Rate, Using the CPI and the GDP Deflator, 1960–2018.

The inflation rates, computed using either the CPI or the GDP deflator, are largely similar.

Source: FRED: CPIAUCSL and GDPDEF.
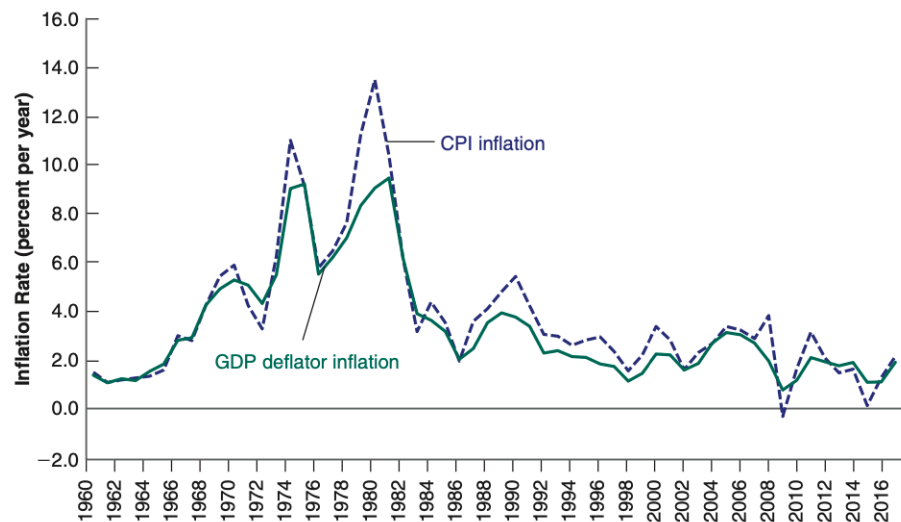
- On average, the **BUSINESS CYCLE** is 7 years. It is upward and downward movements of levels of GDP and refers to the period of **EXPANSIONS** and **CONTRACTION** in the level of economic activities around its **LONG-TERM GROWTH TREND**.
- Inflation is procyclical [moves in the same direction as the business cycle].
- When economy grows, inflation grows.
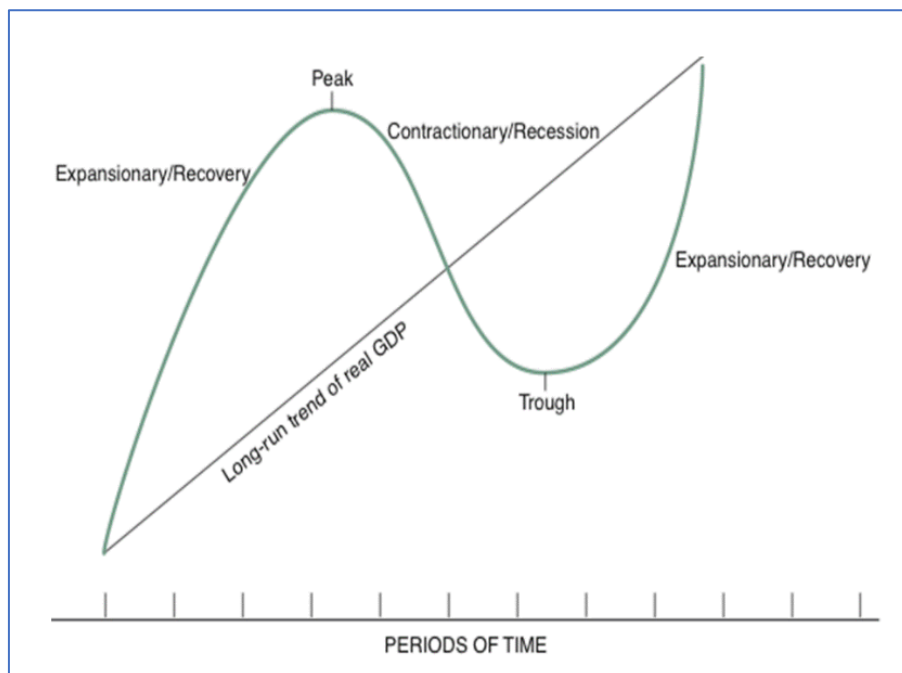
Why do economists care about inflation?

- If a higher inflation rate meant just a faster, but proportional increase, in all prices and wages [this is called **PURE INFLATION**] inflation would not be a big problem due to relative prices being unaffected.
  - There is no such thing as inflation.
- **REAL WAGE** → the wage measured in terms of goods rather than dollars.
- During periods of inflation, not all prices and wages rise proportionally.
- Inflation leas to other distortions → variations in relative prices also lead to uncertainty.
- Deflation is not good either, and the 'best' inflation rate is supposedly between 1% and 4%.

2.4 OKUN'S LAW AND THE PHILLIPS CURVE

Okun's law

- If output growth is high, unemployment will decrease. This is known as **OKUN'S LAW**.
- The line in the model of unemployment is downward sloping → there is a strong relation between the two variable of output growth and unemployment.
- On average and increase in the growth rate of 1% decreases the unemployment rate by -0.3%.
- **UNEMPLOYMENT GOES UP IN RECESSIONS AND DOWN IN EXPANSIONS.**
- Unemployment is **COUNTERCYCLICAL**.
- Policy makers want to limit unemployment during recissions.
- The key to decreasing unemployment is a high enough rate of growth.
- It takes an annual growth of 2% to keep unemployment constant.
  - Due to labour force increases over time, so employment must grow to keep the unemployment rate constant.
  - Output per worker is also increasing with time, so output growth is higher than employment growth.

Figure 2-5

Changes in the Unemployment Rate versus Growth in the United States, 2000 Q1 to 2018 Q4.

Output growth that is higher than usual is associated with a reduction in the unemployment rate; output growth that is lower than usual is associated with an increase in the unemployment rate.
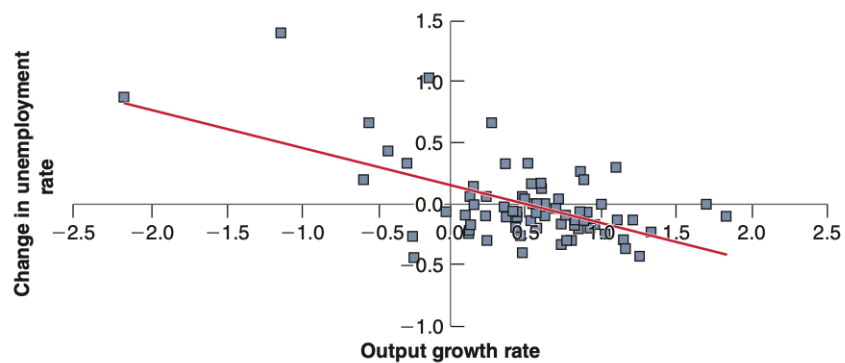
The Phillips curve

- When unemployment becomes very low, the economy is likely to overheat, and this will lead to upward pressure on inflation. This is illustrated in the **PHILLIPS CURVE**.
- The quarterly **CORE INFLATION RATE** is the inflation rate constructed by leaving out volatile prices, such as food and energy.
- Core inflation rate is on the vertical axis, and unemployment rate is on the horizontal axis.
- The line is downward sloping → higher unemployment is associated with higher inflation. This is only true on average.
- If the inflation rate is to be 2%, then the unemployment rate should be around 5%. When unemployment has been either above or below 5%, inflation has typically been above 2%.
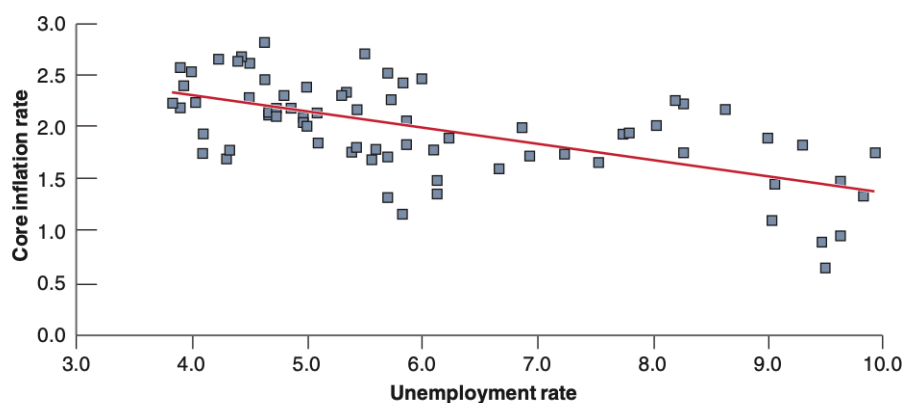
Figure 2-6

Changes in the Inflation Rate versus the Unemployment Rate in the United States, 2000 Q1 To 2018 Q4.

Lower unemployment rate is associated with a higher inflation rate, higher unemployment rate with a lower inflation rate.

Source: FRED. Series GDPC, CPILFESL.

2.5 THE SHORT, MEDIUM, AND LONG RUN

- In the **SHORT RUN** [a few years] year-to-year movements in output are primarily driven by movements in **DEMAND**.

- In the **MEDIUM RUN** [a decade] the economy tends to return to the level of output determined by supply factors: the capital stock, level of technology, and the size of labour force.
- In the **LONG RUN** [few decades or more] factors like education system, the saving rate, and the role of government influences the aggregate output in an economy.

EUROZONE INFLATION HITS NEW RECORD

- Due to the shock of the pandemic, activity restriction has been lifted and supply struggles to keep pace with demand, driving up energy costs, and creating shortages of many materials.

- *How high was inflation in December 2021 in the eurozone? Is it high or low compared to the last two decades?*
    - Eurozone inflation hits 5% in 2022, which is the highest ever. In October 2022, it hit 10%.

- *Which components of the CPI have been driving this increase?*
    - Soaring energy and food, alcohol, tobacco and other prices.

- *Which institution is in charge of stabilizing inflation? What is the inflation target?*
    - The European Central Bank is in charge of stabilizing the inflation, and they aim for an inflation rate of 2%.

- *How do investors expect the ECB [European Central Bank] to react?*
    - Investors expect the ECB to start raising interest rates earlier than it expects.

Topic 2: The goods market

Chapter 3

3.1 THE COMPOSITION OF GDP

- **CONSUMPTION (C)** → goods and services purchased by consumers.
  - Largest component of GDP (around 68%)
- **INVESTMENT (I)** → sometimes called **FIXED INVESTMENT** [to distinguish it from inventory investment]. It is the sum of **NONRESIDENTIAL INVESTMENT** [the purchase by firms of new plants or machines] and **RESIDENTIAL INVESTMENT** [the purchase by people of new houses or apartments].
  - Accounts for around 17.5% of GDP
- **GOVERNMENT SPENDING (G)** → the goods and services by the federal, state, and local governments.
  - It does not include **government transfers** like Medicare of Social Security payments, nor interest payments on the government debt.
  - Approximately 17.2% of GDP [33.0% with transfers and interest payments].
- **EXPORTS (X)** → the purchases of US goods and services by foreigners.
- **IMPORTS (IM)** → the purchases of foreign goods and services are **SUBTRACTED**.
- **NET EXPORTS** or **TRADE BALANCE ($X - IM$)** → the difference between exports and imports.
  - If exports exceed imports, it is **trade surplus**
  - If exports are less than imports, it is **trade deficit**
- **INVENTORY INVESTMENT** → the difference between goods produced and goods sold in a given year.
  - Some produced goods will not be sold this year, but be sold in another year, and some sold goods have been produces earlier.

3.2 THE DEMAND FOR GOODS

- **THE DEMAND FOR GOODS (Z)** → $Z \equiv C + I + G + X - IM$
  - This is an **identity**, which is why the symbol $\equiv$ is used instead of an equal sign. It defines Z as the sum of consumption, plus investment, plus government spending, plus exports, minus imports.
  - Assume, that the **economy is closed**, so $X - IM = 0$. This yields the demand for goods to: $Z \equiv C + I + G$

Consumption (C)

- **DISPOSABLE INCOME (Y_D)** → the income that remains once consumers have received transfers from the government and paid their taxes → $Y_D \equiv Y - T$
  - When it goes up, people buy more goods
  - When it goes down, they buy fewer goods
- Consumptions is a function of disposable income. The **CONSUMPTION FUNCTION** → $C = C(Y_D)$.
  - It is a **behavioural equation**
- The relation between consumption and disposable income is given by the simple relation → $C = c_0 + c_1 Y_D$
  - c_1 → **propensity to consume** [marginal propensity to consume]. It gives the effect an additional dollar of disposable income has on consumption. It is positive and less than 1.
  - c_0 → what people would **consume** if their **disposable income in the current year were equal to zero**. It is zero because people need food, even though their income is zero.

Figure 3-1

Consumption and Disposable Income

Consumption increases with disposable income but less than one for one. A lower value of c_0 will shift the entire line down.
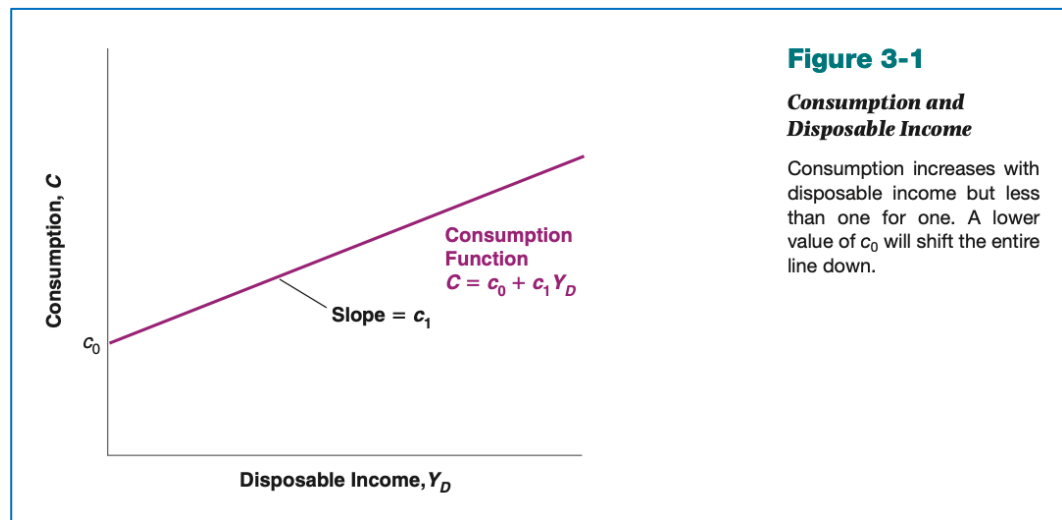
- **TAXES (T)** → taxes paid minus government transfers receives by consumers.
- **INCOME (Y)** → taxes
- **CONSUMPTION** → $C = c_0 + c_1(Y - T)$
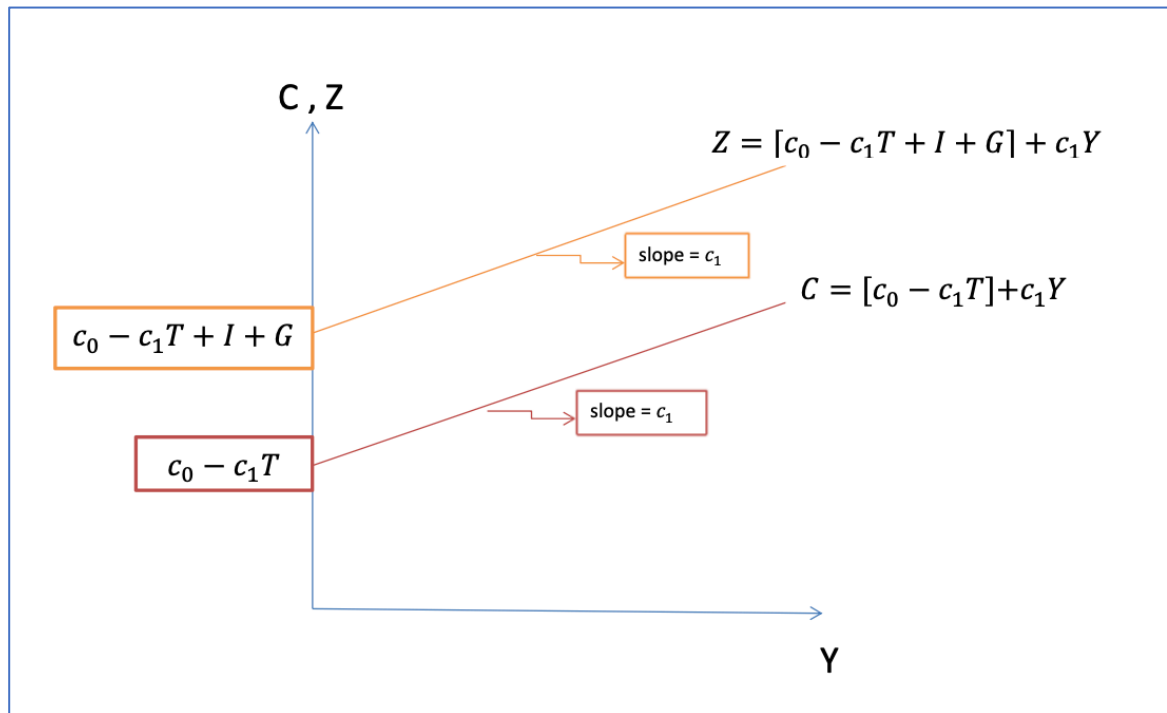
Investment (I)

- Variables that depend on other variables in the model are called **ENDOGENOUS VARIABLES**
- Variables that are not explained within the model but are instead taken as given are called **EXOGENOUS VARIABLES**
    - Investment is an exogenous variable
- **INVESTMENT (I) → $I = \bar{I}$**
    - The bare is simply to remind that investment is taken as given.

Government spending (G)

- Government spending and taxes describe **FISCAL POLICY**
    - Government spending and taxes are taken as exogenous.

3.3 THE DETERMINATION OF EQUILIBRIUM OUTPUT

- The demand for goods is the sum of consumption, investment and government spending → $Z \equiv C + I + G$ → $Z = c_0 + c_1(Y - T) + \bar{I} + G$

- **EQUILIBRIUM IN THE GOODS MARKET** requires that **PRODUCTION (Y)** is equal to the **DEMAND FOR GOODS (Z)** → $Y = Z$. This is an **EQUILIBRIUM CONDITION**. This yields now that → $Y = c_0 + c_1(Y - T) + \bar{I} + G$
- In equilibrium, production Y is equal to demand. Demand in turn depends on income Y, which is itself equal to production. [Y is used for both production and income, because GDP can be looked from the production and income side.]

Using algebra

The equilibrium equation:
$$Y = c_0 + c_1(Y - T) + \bar{I} + G$$

Moving c_1Y to the left side and reorganize the right side:
$$(1 - c_1)Y = c_0 + \bar{I} + G - c_1T$$

Dividing both sides by $(1 - c_1)$:
$$Y = \frac{1}{1 - c_1}[c_0 + \bar{I} + G - c_1T]$$

- $[c_0 + \bar{I} + G - c_1T]$ → the part of demand for goods that does not depend on output. It is **AUTONOMOUS SPENDING**. Assumably positive.
- $\frac{1}{1-c_1}$ → the **MULTIPLIER** that multiplies autonomous spending.
- Any change in autonomous spending [a change in investment, a change in government spending, a change in taxes] will change output by more than its direct effect on autonomous spending.

Using a graph

Production is on the vertical axis, and measure income is on the horizontal axis. Production as a function of income is a 45-degree line with a slope of 1 [due to them being identical].

Demand as a function of income is given by:
$$Z = (c_0 + \bar{I} + G - c_1T) + c_1Y$$

Demand depends on autonomous spending and on income. The intercept with demand when income is zero is the autonomous spending.

Figure 3-2

Equilibrium in the Goods Market

Equilibrium output is determined by the condition that production is equal to demand.
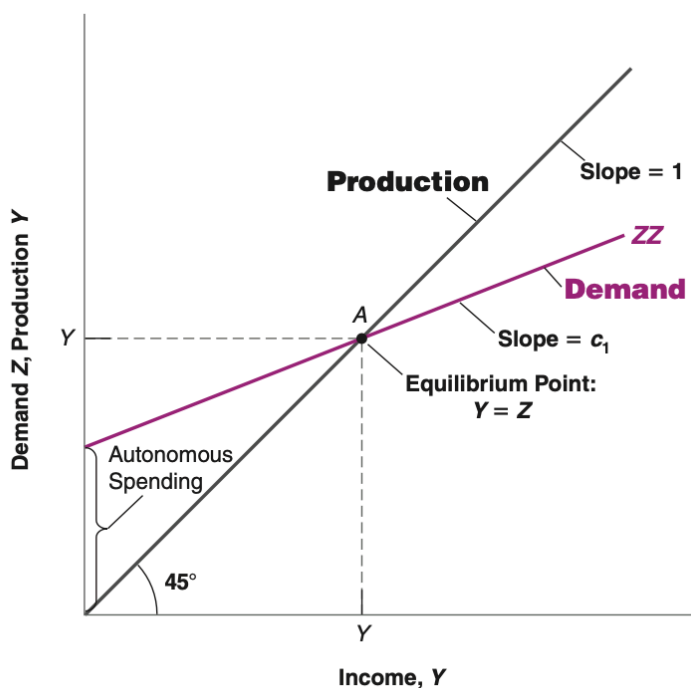
An increase of \$1 billion in c_0 would increase the demand by \$1 billion. That would shift the equilibrium as follows:

Figure 3-3

The Effects of an Increase in Autonomous Spending on Output

An increase in autonomous spending has a more than one-for-one effect on equilibrium output.
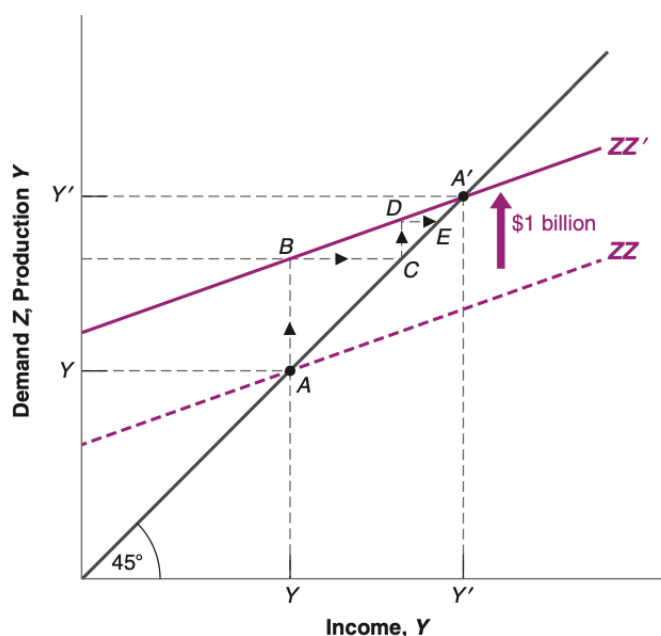
- The \$1 billion increase in demand, yields the difference from point A to point B to also be \$1 billion.

- It also leads to an equal increase in production, $1 billion, which is also the distance AB.
- It also leads to an equal increase in income, shown by the distance BC, also equal to $1 billion.
- The second-round increase in demand, shown by the distance CD, equals $1 billion [the increase in income in the first round] times the propensity to consume c_1, hence $\$c_1$ billion.
- The second-round increase in demand leads to an equal increase in production, also shown by the distance CD, and thus an equal increase in income, shown by the distance DE.
- Following this logic, the total increase in production after $n + 1$ rounds equal $1 billion times the sum: $1 + c_1 + c_1^2 + \cdots + c_1^n$ → this is called a **GEOMETRIC SERIES**.

Using words

- Production depends on demand, which depends on income, which is itself equal to production.
- An increase in demand leads to an increase in production and a corresponding increase in income, that leads to further increase in demand and so on.
- The result is **AN INCREASE IN OUTPUT THAT IS LARGER THAN THE INITIAL SHIFT IN DEMAND, BY A FACTOR EQUAL TO THE MULTIPLIER**.
- **ECONOMETRICS** is the set of statistical methods used in economics.

How long does it take for output to adjust?

- In models, right away, but in reality, there is a delay.

3.4 INVESTMENT EQUALS SAVING

- **PRIVATE SAVING (S)** → saving by consumers is equal to their disposable income minus their consumption → $S \equiv Y_D - C$. Using the definition of disposable income, it can be written as → $S \equiv Y - T - C$
- **PUBLIC SAVING ($T - G$)** → taxes [net of transfers] minus government spending.
    - If taxes exceed government spending, the government is running a **budget surplus** → **positive public saving**
    - If taxes are less than government spending, the government is running a **budget deficit** → **negative public saving**
- $Y = C + I + G$ → $Y - T - C = I + G - T$ → $S = I + G - T$ → $I = S + (T - G)$
    - **Investment is equal to the sum of private saving and public saving.**

- **SAVING $(S + (T - G))$** → Equilibrium in the goods market requires that investment equal saving [the sum of private and public saving]
- **IS-RELATION** stands for 'Investment equals saving'.
- Consumption and saving decisions are one and the same → $S = Y - T - C$ → $S = Y - c_0 - c_1(Y - T)$ → $S = -c_0 + (1 - c_1)(Y - T)$
- c_1 is the **PROPENSITY TO CONSUME**
- $(1 - c_1)$ is the **PROPENSITY TO SAVE**
- $I = -c_0 + (1 - c_1)(Y - T) + (T - G)$ and solving for output yields → $Y = \frac{1}{1-c_1}[c_0 + \bar{I} + G - c_1 T]$ which is the exact same as before, because it is the same equilibrium condition.

The larger c_1, the larger the multiplier.
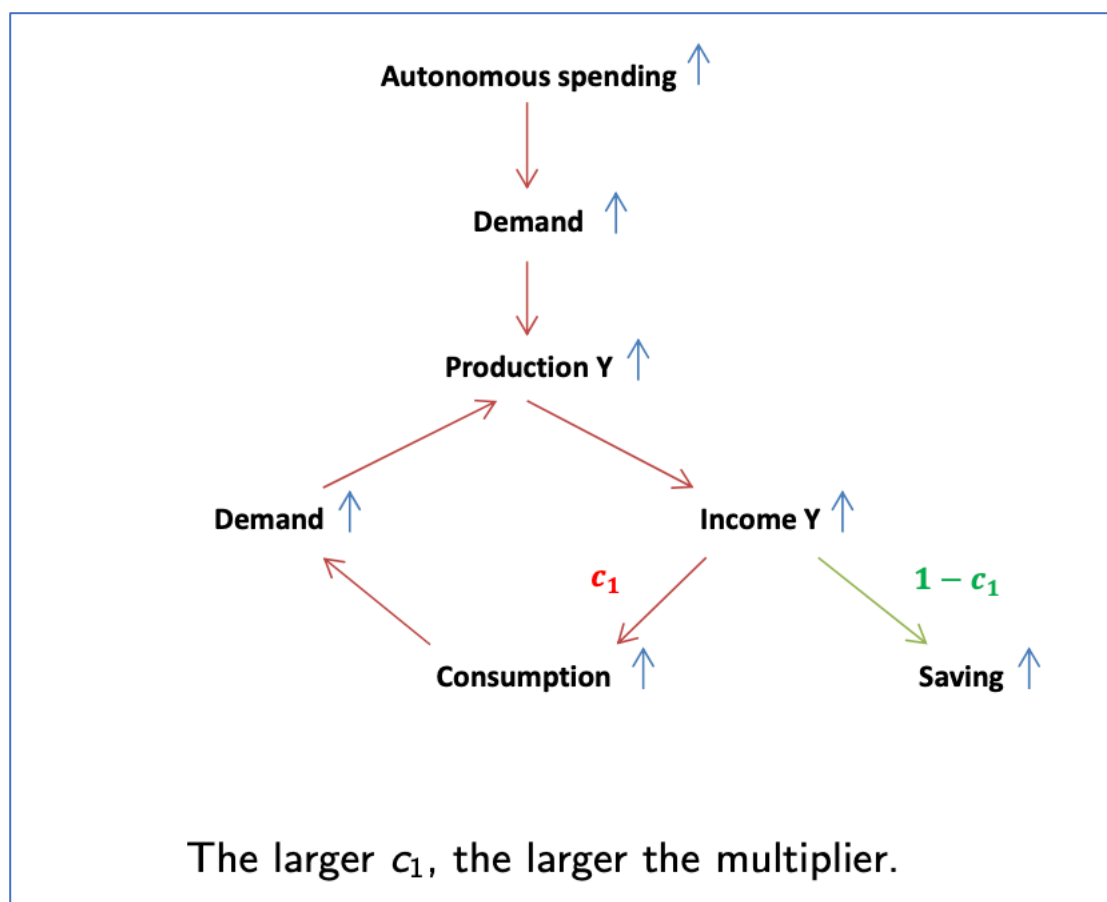
3.5 IS GOVERNMENT OMNIPOTENT? A WARNING

- The given equation implies that the government, by choosing the level of spending (G) or the level of taxes (T) can choose the level of output it wants.
- Changing government spending or taxes is not easy.
- Investment will likely respond in a variety of ways.

STIMULUS, WITHOUT MORE DEBT

- A concept known as **BALANCED-BUDGET MULTIPLIER THEOREM** states that national income is raised, dollar for dollar, with any increase in government expenditure on goods and services that is matched by a tax increase.
- A few years of higher taxes and government expenditures could fix weak economy and provide benefits like better highways and schools - without increasing the national debt.

Topic 3: The financial markets

Chapter 4

4.1 THE DEMAND FOR MONEY

- **MONEY** that can be used for transactions pays no interest.
- **CURRENCY** is coins and bills
- **CHECKABLE DEPOSITS** is bank deposits where you can write checks or use a debit card.
- **BONDS** pay a positive interest rate, but they cannot be used for transactions.
- The proportion of money and bonds rely on two variables:
    - **Level of transactions** → you need to have enough money on hand to avoid having to sell bonds
    - **Interest rate on bonds** → the higher the interest rate, the more you will be willing to deal with the hassle and costs associated with buying and selling bonds.
- **MONEY MARKET FUNDS** pool together the funds of many people.

Deriving the demand for money

- **THE DEMAND FOR MONEY (M^d)** → the sum of all the individual demands for money by the people and firms in the economy → $M^d = \$YL(i)$
    - $\$Y$ denotes nominal income
    - Read as: the demand for money M^d is equal to nominal income $\$Y$ times a decreasing function of the interest rate, with the function denoted by $L(i)$.
    - The interest rate has a negative effect on money demand → **an increase in the interest rate decreases the demand for money**.

Figure 4-1

The Demand for Money.

For a given level of nominal income, a lower interest rate increases the demand for money. At a given interest rate, an increase in nominal income shifts the demand for money to the right.

Interest rate, i

$M^{d'}$ (for $\$Y' > \$Y$)

M^d (for nominal income $\$Y$)

M M'
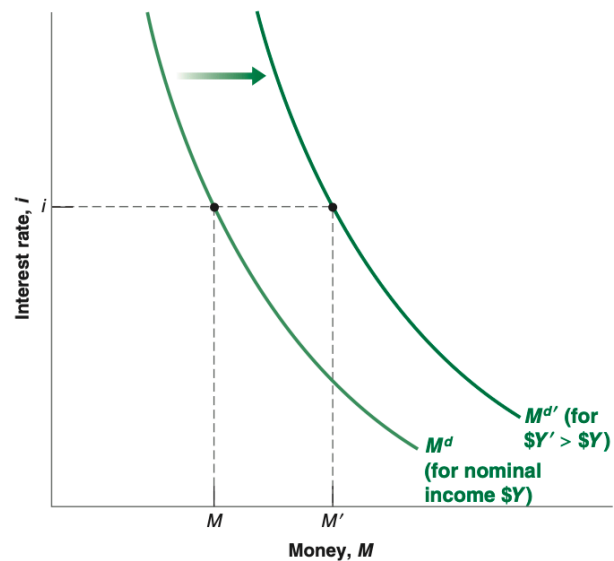
Money, *M*

4.2 DETERMINING THE INTEREST RATE: I

- This section assumes that the only money in the economy is currency, central bank money.

Money demand, money supply, and the equilibrium interest rate

- The central bank decides to supply an amount of money, so → $M^s = M$
- Equilibrium in financial markets requires that money supply is equal to money demand → $M^s = M^d$ → $M = \$YL(i)$
- Thus, the interest rate must be, given their income, people are willing to hold an amount of money equal to the existing money supply.
- The interest rate of Denmark is fixed at the Euro → prices should be stable, and often at 2%.
- **HIGH POWERED MONEY/MONETARY MONEY** is denoted by H, and is the supply of the central bank money.

Figure 4-2

The Determination of the Interest Rate.

The interest rate must be such that the supply of money is equal to the demand for money.

Money Supply M^s

Interest rate, i

i ------ A

Money Demand M^d

M
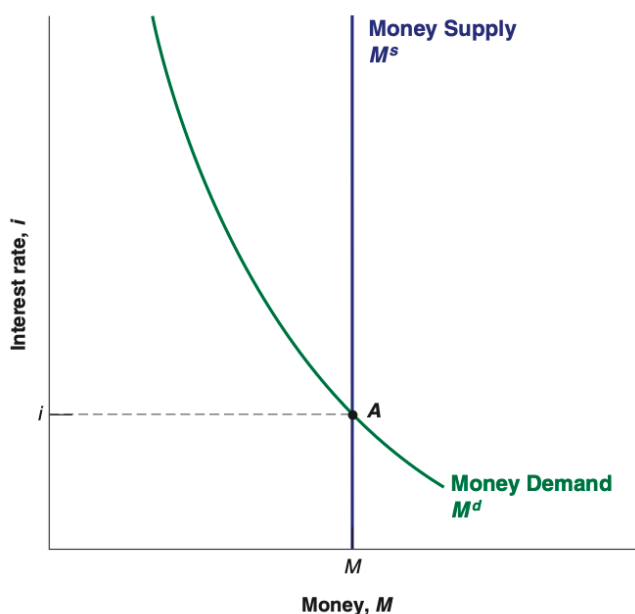
Money, M

- It is downward sloping, because a lower interest rate implies a higher demand for money.

  An increase in the supply of money by the central bank leads to a decrease in the interest rate:

M^s $M^{s'}$

Interest rate, i

i ------ A

i' ------ A'

M^d

M M'
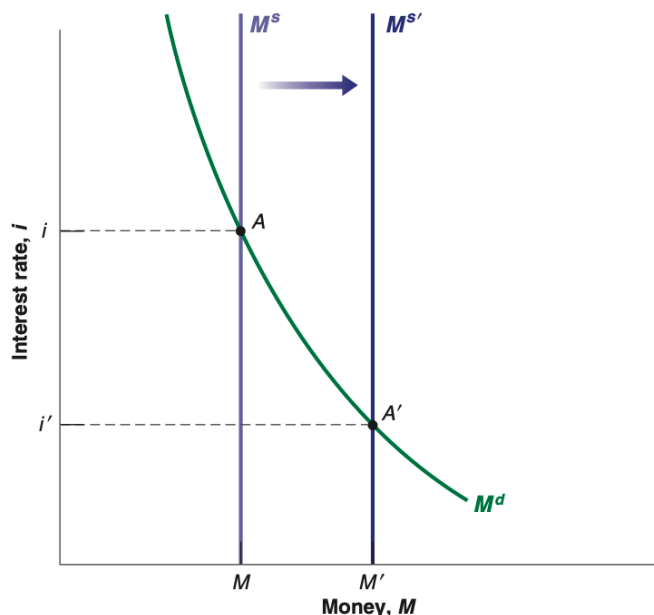
Money, M

Figure 4-3

The Effects of an Increase in the Money Supply on the Interest Rate.

An increase in the supply of money leads to a decrease in the interest rate.

An increase in nominal income leads to an increase in the interest rate:

Figure 4-4

The Effects of an Increase in Nominal Income on the Interest Rate.

Given the money supply, an increase in nominal income leads to an increase in the interest rate.
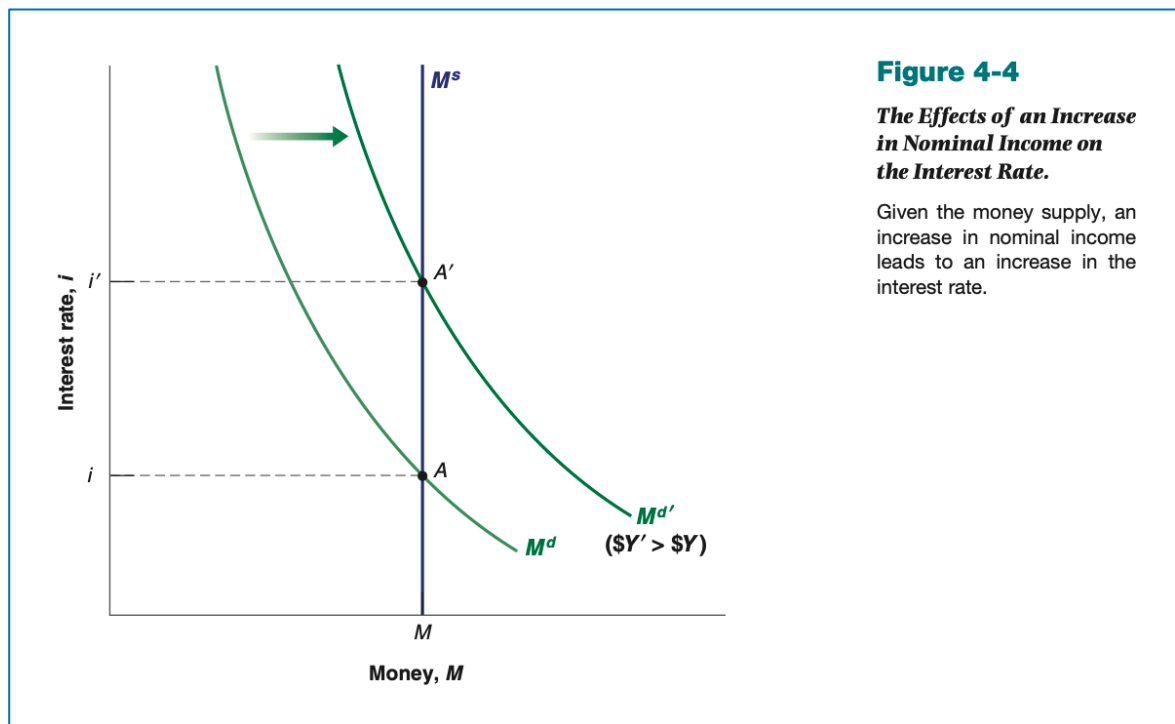
Monetary policy and open market operations

- Central bank typically buys or sells bond to change the supply of money.
- Buying bonds → increases the amount of money
- Selling bonds → decreases the amount of money
- These are called **OPEN MARKET OPERATIONS**

The balance sheet of the Central Bank

- The assets of the central bank are the bonds it holds in its portfolio.
- Its liabilities are the stock of money in the economy.
- **EXPANSIONARY OPEN MARKET OPERATION** → increasing the supply of money by buying bonds.
- **CONTRACTIONARY OPEN MARKET OPERATION** → decreasing the supply of money by selling bonds.

Bond prices and bond yields

- Bonds issued by the government promising payment in a year or less are called **TREASURY BILLS** or **T-BILLS**.
  - The higher the price of the bond, the lower the interest rate.
  - The higher the interest rate, the lower the price today.

Back to open market operations

- As the central bank buys bonds, the demand for bonds goes up, increasing their prices → the interest rate goes down.

Choosing money or choosing the interest rate?

- Shifting the money supply, will shift the interest rate.

4.3 DETERMINING THE INTEREST RATE: II

- This section now also includes checkable deposits [supplied by private banks]
- Even in this case, changing the amount of central bank money the central bank still can, and does, control the interest rate.

What banks do

- There are many **FINANCIAL INTERMEDIARIES** in modern economies
- **BANKS** are financial intermediaries
  - They receive funds from people and firms who either **deposit** funds directly or have funds sent to their checking account. The liabilities of banks are equal to the value of **checkable deposits**.
  - Banks keep as **reserves** some of the funds they receive.
  - Due to transfer of money, banks also need to keep reserves.
  - They buy financial assets in form of **bonds**.
  - They make loans to individuals and firms.

The demand for and supply of Central Bank money

- Equilibrium is in terms of the demand for and supply of central bank money.
  - Demand for central bank money is equal to demand for currency by people plus the demand for reserves by banks.
  - The supply of central bank money is under direct control of the central bank.
  - The equilibrium interest rate is such that the demand and the supply for central bank money are equal.

The demand for Central Bank money

- The larger the amount of checkable deposits, the larger the amount of reserves the banks must hold.
- θ represents the **RESERVE RATIO** → the amount of reserves banks hold per dollar of checkable deposits.
- The demand for reserve banks → $H^\theta = \theta M^d = \theta \$ Y L(i)$
- The supply of money is: $M^s = \frac{1}{\theta} H^S$
  - When assumed that people hold only deposits
  - And that the amount of reserves that banks hold is a proportion θ of deposits
- The demand for central bank money, equivalent to the demand for reserves by banks, is equal to θ times the demand for money by people.

Equilibrium in the market for central bank money

- The equilibrium condition is that supply of and demand for central bank money should be equal → $H = H^d$ → $H = \theta \$ Y L(i)$
- To get the demand for money in real term [not nominal], the nominal demand is divided by the price level → $\frac{M^d}{P} = YL(i)$ **where** $\frac{\$Y}{P}$ **is real income**
- Real money supply: $\frac{M^s}{P}$
- Equilibrium on the money market: $\frac{M^s}{P} = YL(i)$

Figure 4-7

Equilibrium in the Market for Central Bank Money and the Determination of the Interest Rate.

The equilibrium interest rate is such that the supply of central bank money is equal to the demand for central bank money.
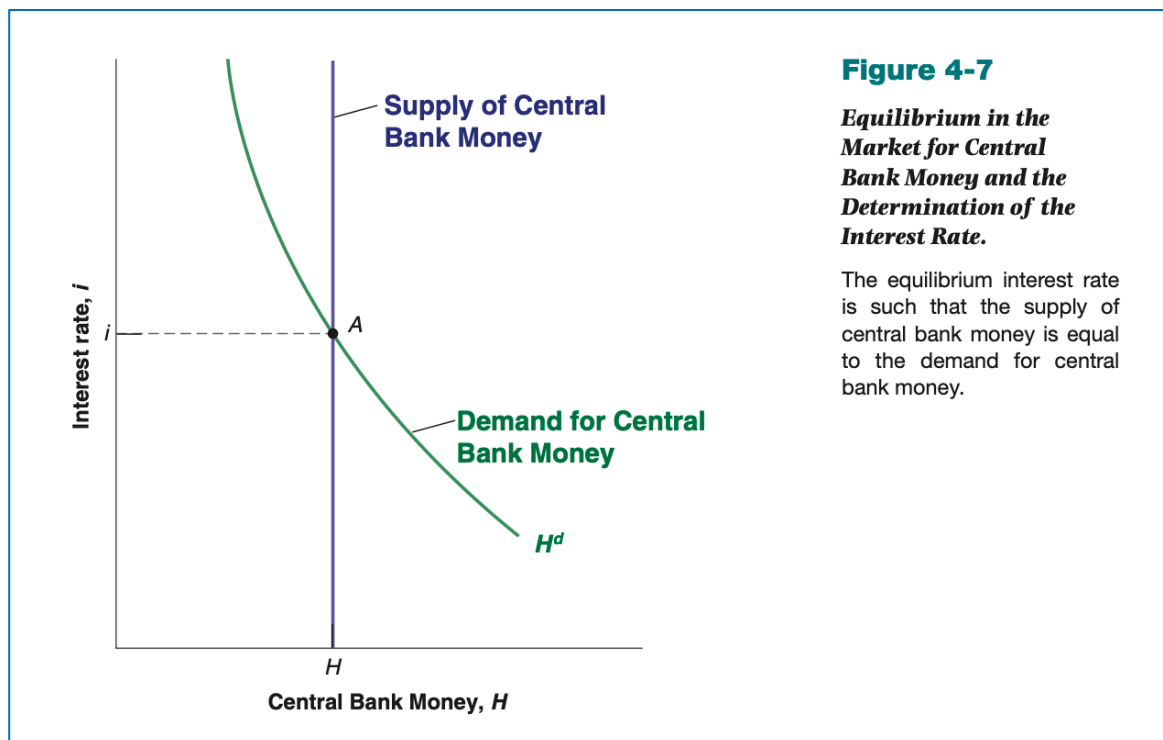
- A higher interest rate implies a lower demand for central bank money as the demand for checkable deposits by people, and thus the demand for reserves by banks, goes down.
- By selling bonds, the supply of money is decreasing, and therefore the interest rate is increasing.

The Federal Funds market and the Federal Funds rate

- **FEDERAL FUNDS MARKET** → market where the interest rate adjust to balance the supply and demand for reserves.
- The interest rate in the market is called the **FEDERAL FUNDS RATE**.

4.4 THE LIQUIDITY TRAP

- The interest rate cannot go below zero → the constraint of the **ZERO LOWER BOUND**
- If interest rate is down to zero, monetary policy cannot decrease it further, and does no longer work, and the economy is then in a **LIQUIDITY TRAP**
- When interest rate on bonds is down to zero, and once people hold enough money for transaction purposes, they are then indifferent between holding the rest of their financial wealth in the form of money or in the form of bonds.

Figure 4-8

Money Demand, Money Supply, and the Liquidity Trap.

When the interest rate is equal to zero, and once people have enough money for transaction purposes, they become indifferent between holding money and holding bonds. The demand for money becomes horizontal. When the interest rate is equal to zero, increases in the money supply have no effect on the interest rate and it remains equal to zero.

MONETARY POLICY - STABILIZING PRICES AND OUTPUT

- In the short run, because prices and wages usually do not adjust immediately, changes in the money supply can affect the actual production of goods and services.

Topic 4: The IS-LM model

5.1 THE GOODS MARKET AND THE IS RELATION

- In chapter 3, the equilibrium in the goods market was characterized by the condition that production is equal to demand for goods. This is the **IS RELATION**.
- The demand is the sum of consumption, investment, and government spending.

Investment, sales, and the interest rate

- **INVESTMENT DEPENDS** primarily on two factors:
  - The level of sales: An **increase in sales** → **increase in production** [investment]
  - The interest rate: the higher the interest rate, the less attractive it is to borrow and buy the machine.
  - Investment relation → $I = I(Y, i)$ → Investment depends on production and the interest rate.

Determining output

- The condition for equilibrium in the goods market is then → $Y = C(Y - T) + I(Y, i) + G$ → this is the **EXPANDED IS RELATION**

Figure 5-1

Equilibrium in the Goods Market

The demand for goods is an increasing function of output. Equilibrium requires that the demand for goods be equal to output.
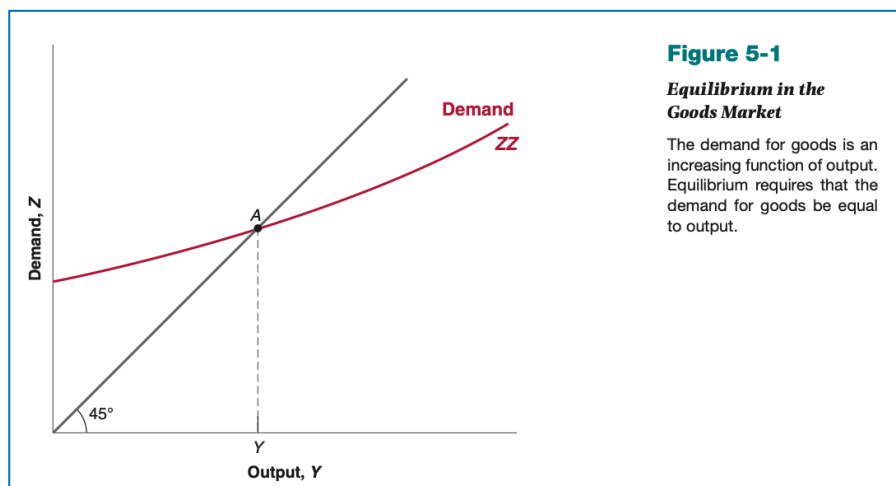
Deriving the IS curve

- At any level of output, the higher interest rate leads to lower investment and lower demand. The new equilibrium of output is now lower.
- An increase in interest rate will decrease the investment, which decreases the demand, which then decreases the equilibrium output.
- The decrease in investment leads to a decrease in output, which further decreases consumption and investment, through the multiplier effect.
- **THE RELATION BETWEEN THE INTEREST RATE AND OUTPUT** are represented by the downward-sloping curve, and this is the **IS CURVE**.

Figure 5-2

The IS Curve

(a) An increase in the interest rate decreases the demand for goods at any level of output, leading to a decrease in the equilibrium level of output.
(b) Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. The IS curve, which gives the relation between the interest rate and output, is therefore downward sloping.

Shifts of the IS curve

- Changes in either taxes or government spendings will shift the IS curve.
- If taxes increase, disposable income decreases → decrease in consumption → decrease in the demand → decrease in equilibrium output → the IS curve shifts to the left.
- **AN INCREASE/DECREASE IN ANY CHACTERISTIC FOR A GIVEN INTEREST RATE, INCREASES/DECREASES THE EQUILIBRIUM OUPUT LEVEL**.

Figure 5-3

Shifts of the IS Curve

An increase in taxes shifts the IS curve to the left.
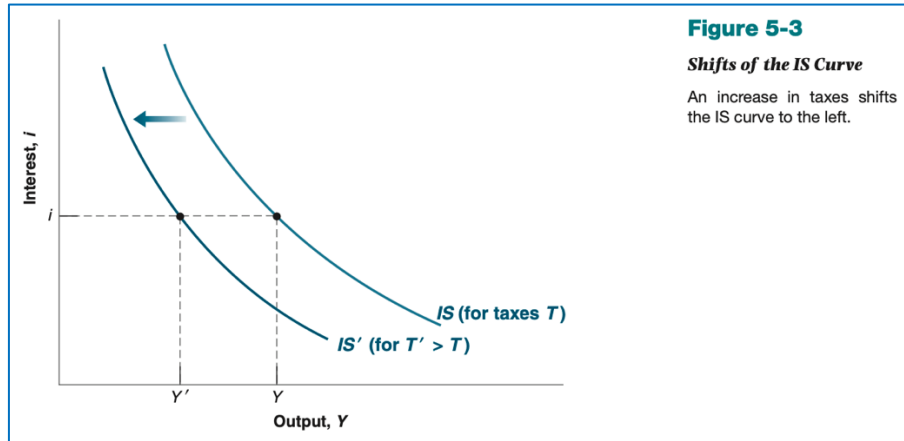
5.2 FINANCIAL MARKETS AND THE LM RELATION

- Interest rate is determined by the equality of the supply of and demand for money → $M = \$Y\ L(i)$
- An increase in the interest rate decreases the demand for money.
- Equilibrium requires that money supply is equal to money demand.

Real money, real income, and the interest rate

- The equilibrium condition can be restated as **REAL MONEY SUPPLY** [the money stock in terms of goods, not dollars] **IS EQUAL TO REAL MONEY DEMAND** [depends on real income] **AND THE INTEREST RATE** → $\frac{M}{P} = Y\ L(i)$ → **LM RELATION**

Deriving the LM curve

- If real income increases, money demand increases, the interest rate must increase [so that money demand remains equal to the given money supply].
- **AN INCREASE IN INCOME → INCREASE IN THE INTEREST RATE.**
- The central bank chooses the interest rate and adjust the money supply so as to achieve it.

Figure 5-4

The LM Curve

The central bank chooses the interest rate (and adjusts the money supply so as to achieve it).
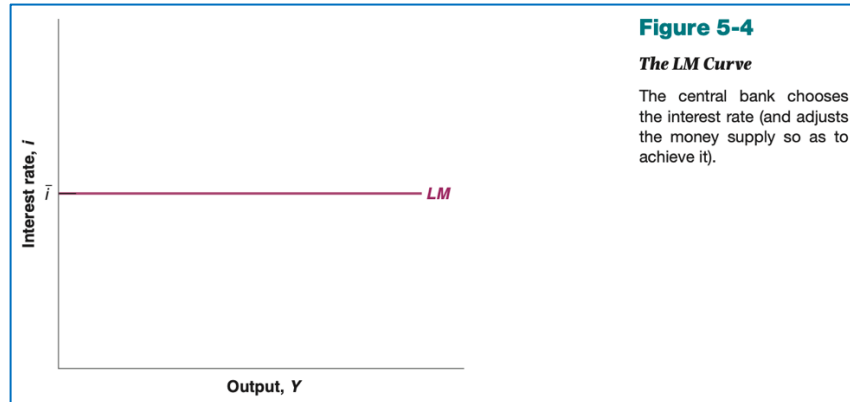
5.3 PUTTING THE IS AND LM RELATIONS TOGETHER

- The IS relation follows from goods market equilibrium → $Y = C(Y - T) + I(Y, i) + G$
- The LM relation follows from financial market equilibrium → $i = \bar{\imath}$
- Together they determine output.
- Any point on the IS-curve corresponds to equilibrium in the goods market.
- Any point on the LM curve corresponds to equilibrium in financial.
- **ONLY AT A POINT A** are both equilibrium conditions satisfied. Therefore, there is both an equilibrium in financial and the goods market.

Figure 5-5

The IS-LM Model

Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. This is represented by the IS curve. Equilibrium in financial markets is represented by the horizontal LM curve. Only at point A, which is on both curves, are both goods and financial markets in equilibrium.
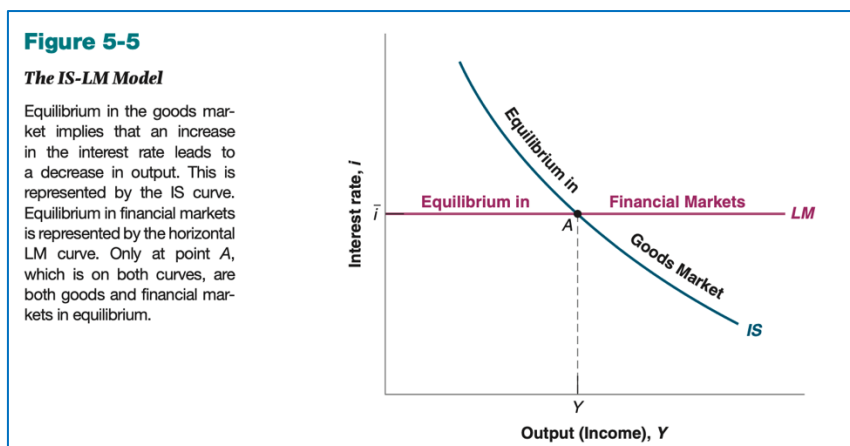
Fiscal policy

- A reduction in the budget deficit, achieves either by increasing taxes, or by decreasing spending [or both] is called **FISCAL CONTRACTION** or **CONSOLIDATION**. Increases are called **FISCAL EXPANSION**.
  - Increase in taxes affects equilibrium in the goods market [IS relation] → the IS curve shifts to the left. The LM curve does not shift.
  - This shifts the IS curve and makes a movement along the LM curve.

- o At any given interest rate, the **increase in taxes leads** to **lower disposable income**, which causes people to **decrease their consumption**. This **decrease in demand** leads to a **decrease in output** and income and, by implication, a **decrease in investment**, which further decreases output trough the multiplier.
- o Government increases government spendings or decreases taxes → **the demand curve shifts up**.
- o Government decreases government spendings or increases taxes → **the demand curve shifts down**.

Figure 5-6

The Effects of an Increase in Taxes

An increase in taxes shifts the IS curve to the left. This leads to a decrease in the equilibrium level of output.
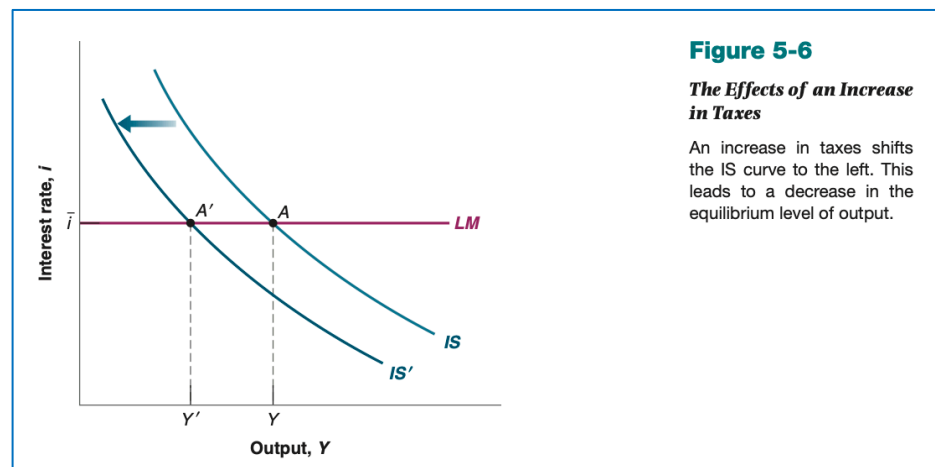
Monetary policy

- If the central bank decreases the interest rate, it increases the money supply → **MONETARY EXPANSION**.
- An increase in interest rate → **MONETARY CONTRACTION** or **MONETRAY TIGHTENING**.
  - o The change in interest rate does not change the relation between output and the interest rate, so it does not shift the IS curve. It does shift the LM curve down.
  - o The economy moves along the IS curve, and the equilibrium moves to the right.
  - o The **lower interest rate** leads to an **increase in investment** and **increase in demand** and **output**. The increase in output and decrease in the interest rate lead to an **increase in investment**, which leads to an **increase in disposable income**, and **consumption**

Figure 5-7

The Effects of a Decrease in the Interest Rate

A monetary expansion shifts the LM curve down and leads to higher output.
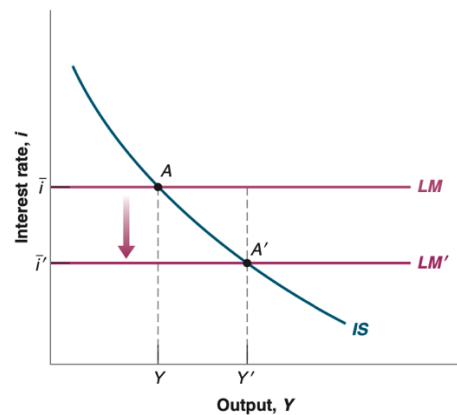
5.4 USING A POLICY MIX

- The combination of monetary and fiscal policy is called the **MONETARY-FISCAL POL-ICY MIX**.
- There is a number of reasons why policymakers use a policy mix:
  - Increase in government spending or a decrease in taxes means an increase in the budget deficit. Running a large deficit and increasing government debt could be dangerous.
  - If the interest rate is low, then the room for using monetary policy may be limited.
  - Fiscal and monetary have different effects on the composition of output. A decrease in the interest rate affects investment more than consumption, so policymakers may want to rely more on fiscal or more on monetary policy depending on the situation.
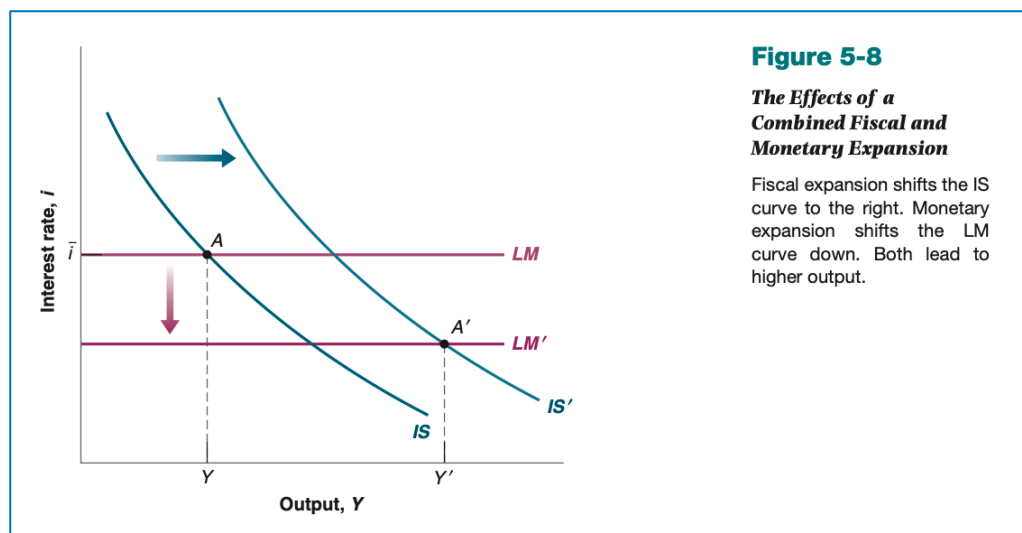
Figure 5-8

The Effects of a Combined Fiscal and Monetary Expansion

Fiscal expansion shifts the IS curve to the right. Monetary expansion shifts the LM curve down. Both lead to higher output.

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- The combination of both policies can be used to **AVOID RECISSION** when government wants to decrease the budget deficit:
  - If **government spending is decreased income is unchanged** and **consumption** is unchanged.
  - If an **increase in income taxes** is introduced, then **disposable income is lower** and **so is consumption**.
- Whether deficit reduction leads to an increase in investment may or may not depend on the response of monetary policy [example in Figure 5-9].

Figure 5-9

The Effects of a Combined Fiscal Consolidation and a Monetary Expansion

The fiscal consolidation shifts the IS curve to the left. A monetary expansion shifts the LM curve down. Together, they leave output unchanged while the budget deficit is reduced.
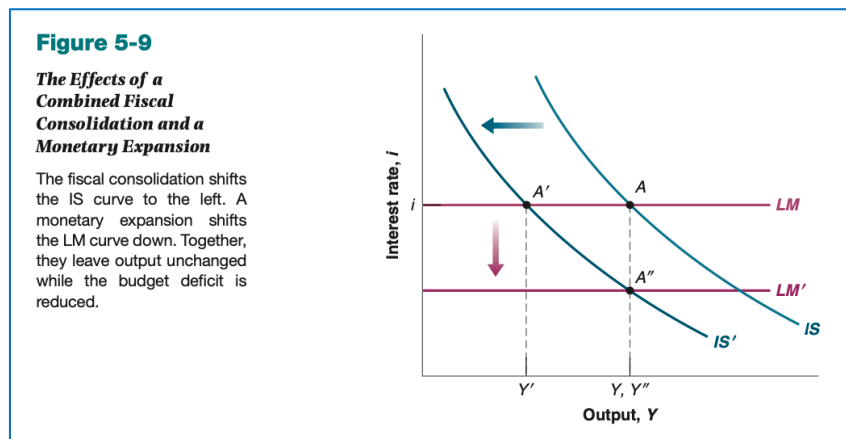
5.5 HOW DOES THE IS-LM MODEL FIT THE FACTS?

- **IN RESPONSE TO AN INCREASE IN TAXES, IT TAKES SOME TIME** for consumption spending **TO RESPOND** to the decrease in disposable income, production, consumption spending, and investment to lower sales etc.
- In Figure 5-10a it is shown that an increase in the federal funds leads to a decline in retail sales.
- Figure 5-10b shows that lower sales lead to lower output.
  - **Monetary policy first has its full effect on output after two years**.
- Figure 5-10c shows that lower output leads to lower employment.
- Figure 5-10d shows that decline in employment leads to an increase in the unemployment rate.
- Figure 5-10e shows that the price level is nearly unchanged for the first six quarters, and then it declines.
  - **The IS-LM model become less reliable in the medium run**.

Figure 5-10

The Empirical Effects of an Increase in the Federal Funds Rate

In the short run, an increase in the federal funds rate leads to a decrease in sales, output, and employment and an increase in unemployment, but it has little effect on the price level.

Source: Lawrence Christiano, Martin Eichenbaum, and Charles Evans, "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds," *Review of Economics and Statistics*, 1996, 78 (February): pp. 16–34.

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Topic 5: The extended IS-LM model

Chapter 6 and 22*

6.1 NOMINAL VERSUS REAL INTEREST RATES

- The interest rate tells how many dollars to be paid in the future in exchange for having one more dollar today.
- The presence of inflation makes the distinction between amount of goods and amount of dollars important.
- Inflation can be so high that the return of the interest rates will not make it possible to buy more goods.
- **NOMINAL INTEREST RATES** is the interest rates expressed in terms of dollars [units of the national currency].
    - o The nominal interest rate for year t is i_t and borrowing 1 dollar today then requires paying $1 + i_t$ dollars in a year.
- **REAL INTEREST RATES** is when the real interest rate for year t by r_t then borrowing equivalent of one basket of goods today requires payment of $1 + r_t$ baskets of goods next year.
- The nominal interest rate must be adjusted with respect to expected inflation.
- How much is expected to repay next year, in terms of pounds of bread, is equal to the number of dollars that must be repaid divided by the price of bread in terms of dollars expected for next year.

    - o

      Figure 6-1

      Definition and Derivation of the Real Interest Rate
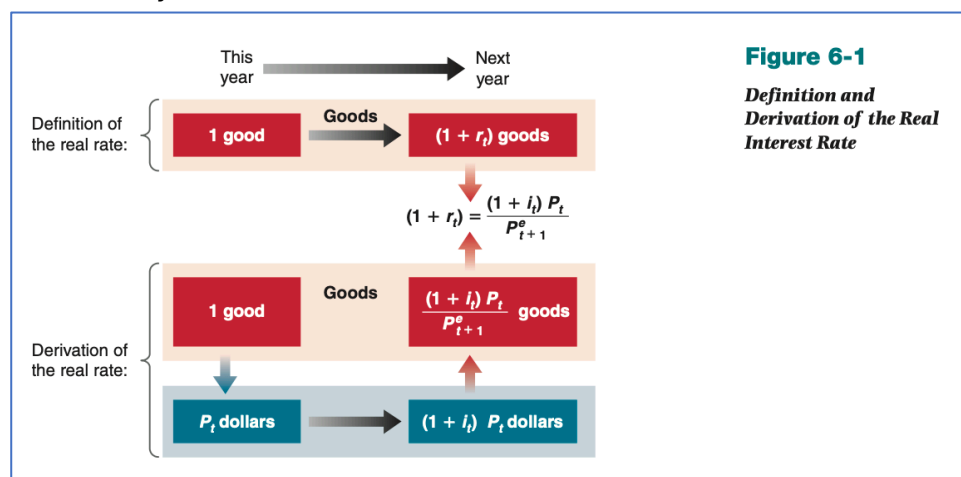
- **ONE-YEAR REAL INTEREST RATE** → $1 + r_t = (1 + i_t)\frac{P_t}{P_{t+1}^e}$. The expression can be made simpler:
    - o Expected inflation between today and in a year is denoted by π_{t+1}^e. The expected rate of inflation equals the expected change in the dollar price divided by the dollar price today → $\pi_{t+1}^e = (P_{t+1}^e - P_t)/P_t$

o This yields that a close approximation is given by: $r_t \approx i_t - \pi_{t+1}^e$

- **Real interest rate is approximately equal to the nominal interest rate minus expected inflation.**

o Some implications are:

- When expected inflation is zero, the nominal and real interest rates are equal.

- Because inflation is typically positive, the real interest rate is typically lower than the nominal interest rate.

- For a given nominal interest rate, the higher the expected rate of inflation, the lower the real interest rate.

Nominal and real interest rates in the United States since 1978

- The forecast of the inflation rate is based on the GDP deflator
- The real interest rate is based on the expected inflation, and if the actual inflation turns out to be different from the expected inflation, the realized interest rate will be different from the real interest rate.
- The real interest rate is therefore sometimes called the **EX-ANTE REAL INTEREST RATE** [ex-ante refers to before inflation is known].
- The realized real interest rate is called **EX-POST INTEREST RATE** [after inflation is known].
- **INFLATION HURTS SAVERS** but **BENEFITS BORROWERS**.
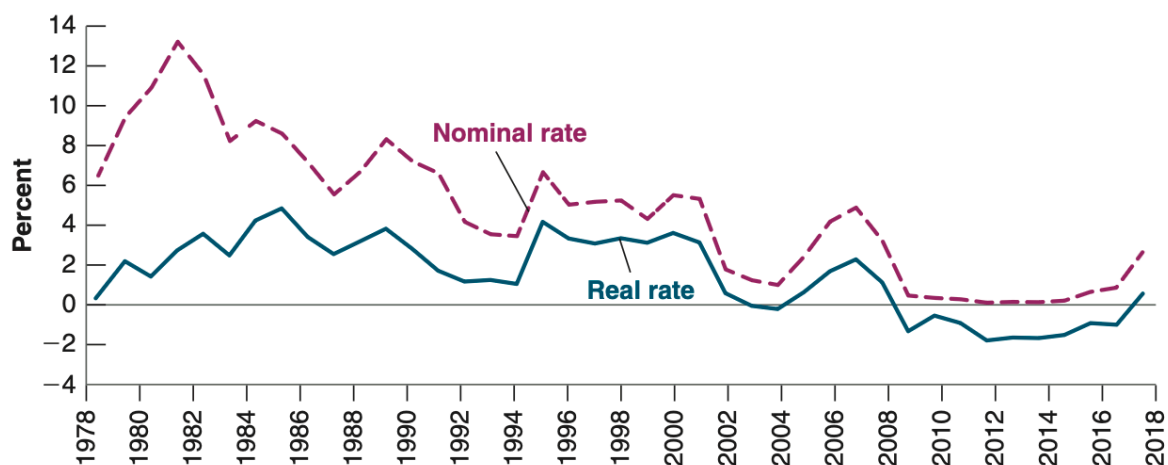
Figure 6-2

Nominal and Real One-Year T-Bill Rates in the United States, since 1978

The nominal rate has declined considerably since the early 1980s, but because expected inflation has declined as well, the real rate has declined much less than the nominal rate.

Nominal and real interest rates: The zero lower bound and deflation

- Banks decide the nominal rate, but they care about the real interest rate, because this is the rate that affects spending decisions.
    - If they want the real interest rate to be 4%, and the expected inflation is 2%, then the nominal rate is 6%.
- Real interest rate cannot be lower than the negative of the rate of inflation [due to the zero lower bound].
    - If expected inflation is 2%, then the lowest real interest rate can be -2%.

6.2 RISK AND RISK PREMIA

- Bonds differ in several ways: **MATURITY** [length of time over which they promise payments], terms of **RISK** [some are nearly riskless, other are risks].
    - The higher the risk, the higher the interest rate.
- Bond holders require a **RISK PREMIUM** which is the difference between the nominal interest rate on a riskless bond and a risky bond (compensates the lender for the risk she takes)
    - The higher the **probability of default**, the higher the interest rate investors will ask for.
    - i is the nominal interest rate on a riskless bond, and $i + x$ is the nominal interest rate on a risky bond, which has probability p of defaulting, and x is the risk premium.
    - If investors are risk neutral, they want to have the same expected return on a riskless and a risky bond, and then the following relation must hold → $(1 + i) = (1 - p)(1 + i + x) + p(0)$
    - Reorganizing → $x = \frac{(1+i)p}{1-p}$
    - If the interest rate on a riskless bond is 4% and the probability of default on the risky bond is 2%, then the risk premium requires to give the same expected rate of returns as on the riskless bond is 2.1%.
    - The **risk aversion** of the bond holders also is a factor. Therefore, the premium is required to be even higher due to compensate for the risk.
    - Corporate bonds are rated as safe [AAA] and less safe [BBB]

Figure 6-3

Yields on 10-Year US Government Treasury, AAA, and BBB Corporate Bonds, since 2000

In September 2008, the financial crisis led to a sharp increase in the rates at which firms could borrow.
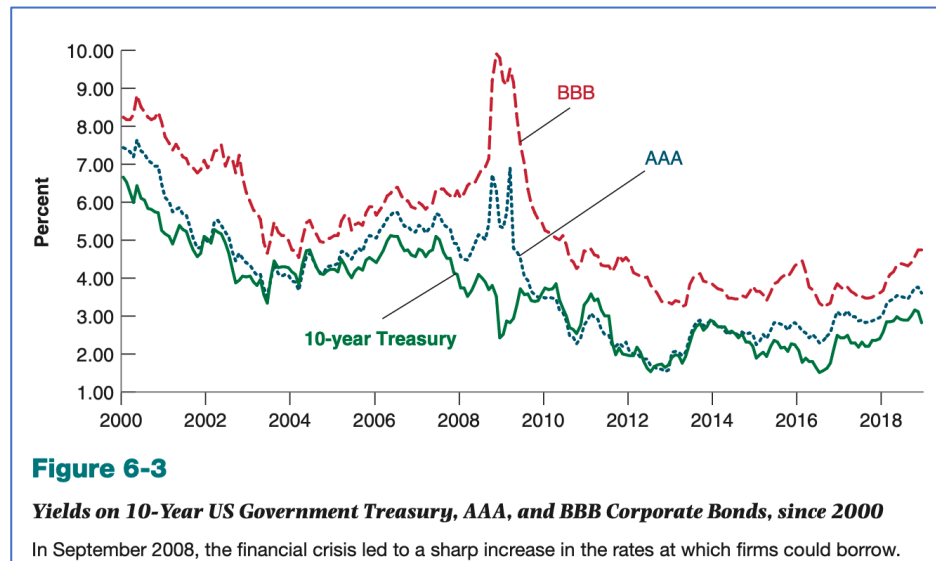
- o   The rate on the highly rated [AAA] corporate bonds is higher than the rate on US government bonds, by a premium of about 1% on average.
- o   The rate on the lower-rated [BBB] corporate bonds is higher than the rate on the most highly rated bonds by a premium often exceeding 2%.
- o   The way at which many borrowers can borrow may be much higher than the **POLICY RATE** [the interest rate on riskless assets].
- o   The **BORROWING RATE** is the interest rate on risky assets.
   - ▪   Firms and households

6.3 THE ROLE OF FINANCIAL INTERMEDIARIES

- •   Much of borrowing and lending takes place through financial intermediaries which are financial institutions that receive funds from some investors and then lend these funds to others.

The choice of leverage

- •   The **CAPITAL RATIO** of a bank is defined as the ratio of its capital to its assets.
- •   The **LEVERAGE RATIO** of a bank is defined as the ratio of assets to capital, so as the inverse capital ratio.
- •   A higher leverage ratio implies a higher expected profit rate, but it also implies a higher risk of bankruptcy.
- •   By increasing its leverage, and decreasing its own funds, the bank would increase its expected profit per unit of capital.
- •   Higher leverage also implies a higher risk that the value of the assets becomes less than the value of liabilities, implying a higher risk of **INSOLVENCY**.

o A banak is solvent if the value of its assets exceeds the value of its liabilities. It is insolvent otherwise.

Leverage and lending

- If there is a big decline in the value of a bank's assets, then the bank will become insolvent and go bankrupt.

Liquidity

- When bank assets decline in value, the bank reduces lending.
- If a bank thinks its assets may have come down, leverage can have disastrous effects.
- If banks are doubtful about the value of assets, the safe thing to do is to take their funds out of the bank. This created serious problems for the bank, because they need to repay the investors.
- The harder it is for others to assess the value of a bank's assets, the more likely the bank is to be unable to sell them or to have to do it at **FIRE SALE PRICES** which is far below the true value of the loan. This can also make the bank insolvent.
- The problem is worse if investors can ask for their funds on short notice as with **CHECKABLE DEPOSITS** or **DEMAND DEPOSITS**.
- The lower the **LIQUIDITY** of assets and liabilities, the higher risk of fire sales and the risk that the bank goes bankrupt. The higher liquidity, the higher risk of fire sales as well.

6.4 EXTENDING THE IS-LM MODEL

- First, it must be distinguished between real and normal interest rate.
- Second, the policy rate set by the central bank and the interest rates faced by borrowers must be distinguished.
- Rewriting the **IS-LM MODEL**:
  - **IS-relation**: $Y = C(Y - T) + I(Y, i - \pi^e + x) + G$
    - Capital investments is a function of the borrowing rate rather than the nominal policy rate.
    - The expected inflation rate term reflects that spending decisions depend on the real interest rate [not the nominal]
    - The risk premium captures the probability of default and level of risk aversion.
  - **LM-relation**: $i = \bar{\imath}$
- The interest rate in the LM-relation is no longer the same as the interest rate in the IS relation.

- The interest rate in the LM equation is the [nominal] **POLICY RATE** [because it is determined by monetary policy], and the IS equation is the [real] **BORROWING RATE**.
- Then it is further rewritten:
  - **IS-relation**: $Y = C(Y - T) + I(Y, r + x) + G$
  - **LM-relation**: $r = \bar{r}$
- The central bank chooses the real policy rate, r, but the real interest rate relevant for spending decisions is the borrowing rate $r + x$.
- In the Great Recession from '08 to '09, the risk premium went up, and it became expensive for firms to borrow → investment went down → the IS curve shifted to the left → output went down through the multiplier.
  - To lower the borrowing rate, central banks lowered their policy rate, but many countries hit the zero lower bound.

Figure 6-5

Financial Shocks and Output

An increase in the risk premium *x* leads to a shift of the IS curve to the left and a decrease in equilibrium output.
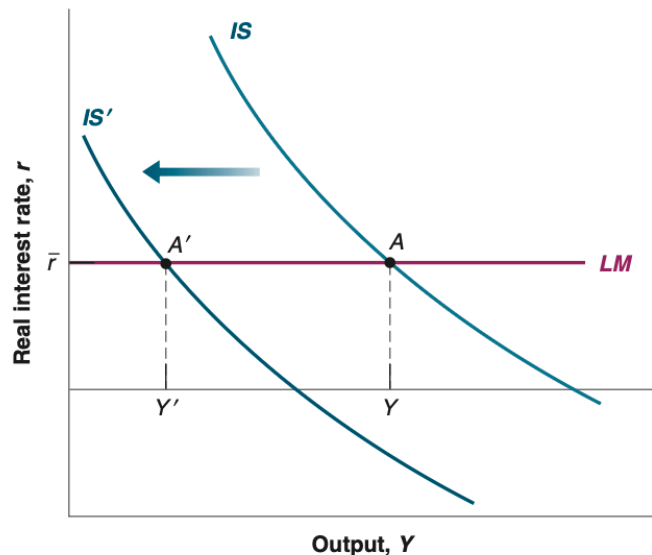
Financial shocks and policies

- If the risk premium increases [maybe due to investors becoming more risk averse, or because one financial institution has gone bankrupt, and investors are worried], it shifts the IS-curve inwards [shown on figure 6-5].
  - At the same policy rate, the borrowing rate increases, leading to a decrease in demand and output due to less investment.
- To fix this, a sufficient decrease in the policy rate can be enough to take economy to the initial output.
  - Due to the zero lower bound, the **lowest real policy rate** the central bank can achieve is the **negative of the inflation**.

Figure 6-6

Financial Shocks, Monetary Policy, and Output

If sufficiently large, a decrease in the policy rate can in principle offset the increase in the risk premium. The zero lower bound may, however, put a limit on the decrease in the real policy rate.
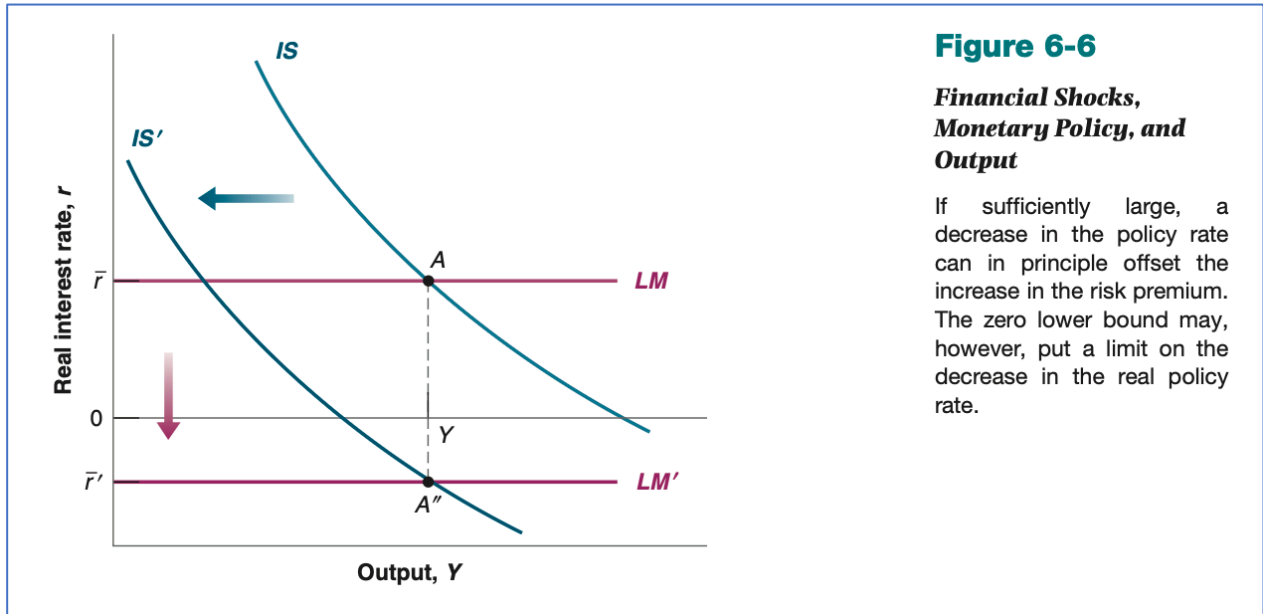
6.5 FROM A HOUSING PROBLEM TO A FINANCIAL CRISIS

Housing prices and subprime mortgages

- There was a large increase in housing prices in the early 2000s followed be a large decrease from mid-2006. At the start of the financial crises to 2012 it was low and then increased again.

  Figure 6-7

  US Housing Prices since 2000

  The increase in housing prices from 2000 to 2006 was followed by a sharp decline.
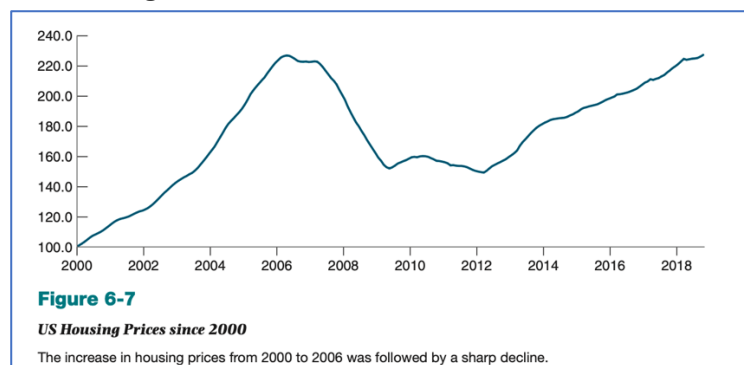
- The 2000s were a period of unusually low interest rates and low mortgage rates, which increased the demand for hounding and thus the price.
- Another factor was that mortgage lenders become increasingly willing to make loans to more risky borrowers [called **SUBPRIME MORTGAGES**].
- In mid-2008 losses on mortgages were estimated to be around $300 billion.

The role of financial intermediaries

- Both high leverage, illiquidity of assets, and liquidity of liabilities all increased the risk of trouble in the financial system during the financial crisis.

Leverage

- Banks were highly leveraged during 2008
  - They probably underestimated the risk they were taking, because times were good.
  - The compensation and bonus system gave incentives to managers to go for high expected returns without fully taking the risk of bankruptcy into account.
  - On the liability side, **structured investment vehicles [SIVs]** borrowed from investors, and on the asset side, SIVs held various forms of securities.
  - By setting up SIVs, banks were not required to put down capital, and they could increase leverage and increase expected profits.

Securitization and illiquidity of assets

- In the 1990s and 2000s there were a big growth in **SECURITIZATION**.
- The idea behind securitization is to create securities based on a bundle of assets [loans or mortgages].
- **MORTGAGE-BACKED SECURITY [MBS]** is a title to the returns from a bundle of mortgages, with the number often in the tens of thousands.
- **COLLATERALIZED DEBT OBLIGATIONS [CDOs]:** Banks can issue different types of securities: **SENIOR SECURITIES** [first priority] and **JUNIOR SECURITIES** [comes after and pay only if anything remains after the senior securities].
- Securitization was a good idea, but also came with two large costs:
  - A bank had fewer incentives to make sure that the borrower could repay, if a bank sold mortgage as a part of a securitization bundle.
  - When underlying mortgages went bad, assessing their value in an MBS or CDO was extremely hard to do. These become **TOXIC ASSETS** which led investors to assume the worst and be reluctant to hold and lending.

Wholesale funding and liquidity of liabilities

- In the 1990s and 2000s banks relied more on borrowing from other banks or investors in the form of short-term debt to finance the purchase of their assets [earlier just checkable deposits] → **WHOLESALE FUNDING**.
- Holders of checkable deposits were protected by insurance, but investors were not, so when they were worried, they asked for their funds back.

Macroeconomic implication

- Macroeconomic effects of the financial crisis:

- A large increase in the interest rate at which firms could borrow
  - For some it became impossible
- A dramatic decrease in confidence
  - In combination with lower housing and stock prices, consumption decreased sharply.

Figure 6-8

US Consumer and Business Confidence, 2007–2011

The financial crisis led to a sharp drop in confidence, which bottomed in early 2009.

Source: Bloomberg L.P.
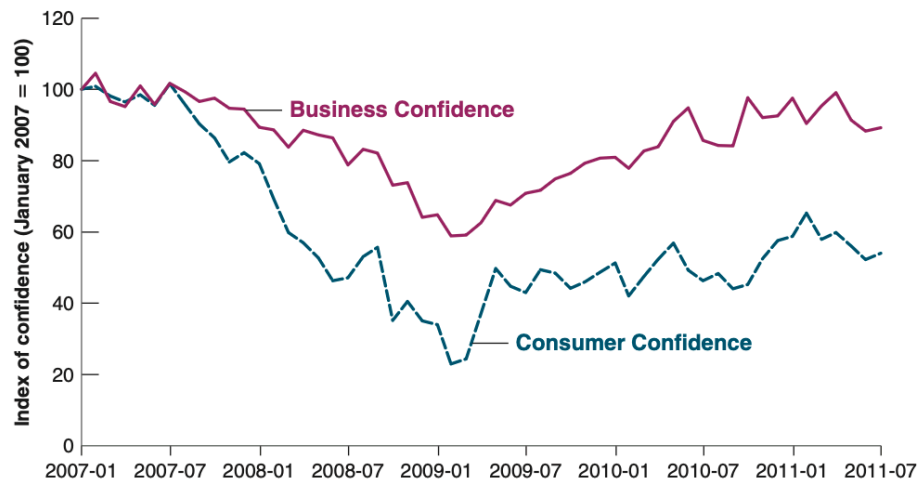
Policy responses

- The high cost of borrowing, lower stock prices, and lower confidence decreased the demand for goods. This shifted the IS curve, and policymakers did not remain passive.

Financial policies

- To prevent a run by depositors, federal deposit insurance was increased from $100,000 to $250,000 per account. The federal government also offered a program guaranteeing new debt issues by bank.
- To avoid banks selling assets at fire sale price causing bankruptcy, the Fed put in place a number of **LIQUIDITY FACILITIES** to make it easier for banks and other financial intermediaries to borrow from the Fed.
- The government introduces the **TROUBLED ASSET RELIEF PROGRAM [TARP]** which goal was to remove complex assets from banks to decrease uncertainty and reassuring investors. This was not realistic, and the new goal became to increase the capital of banks.

Monetary policy

- In the summer of 2007, the Fed had begun to decrease the policy rate - first slow, and later fast. By December 2008, it was down to zero, and monetary policy was therefore constrained by the zero lower bound.
- They turned to **UNCONVENTIONAL MONETARY POLICY** which is buying other assets to directly affect the rate faced by borrowers.

Fiscal policy

- The **AMERICAN RECOVERY AND REINVESTMENT ACT** was passed in February 2009 and had both tax reductions and spending increases over 2009 and 2010.

Figure 6-9

The Financial Crisis and the Use of Financial, Fiscal, and Monetary Policies

The financial crisis led to a shift of the IS to the left. Financial and fiscal policies led to some shift of the IS back to the right. Monetary policy led to a shift of the LM curve down. Policies were not enough, however, to avoid a major recession.
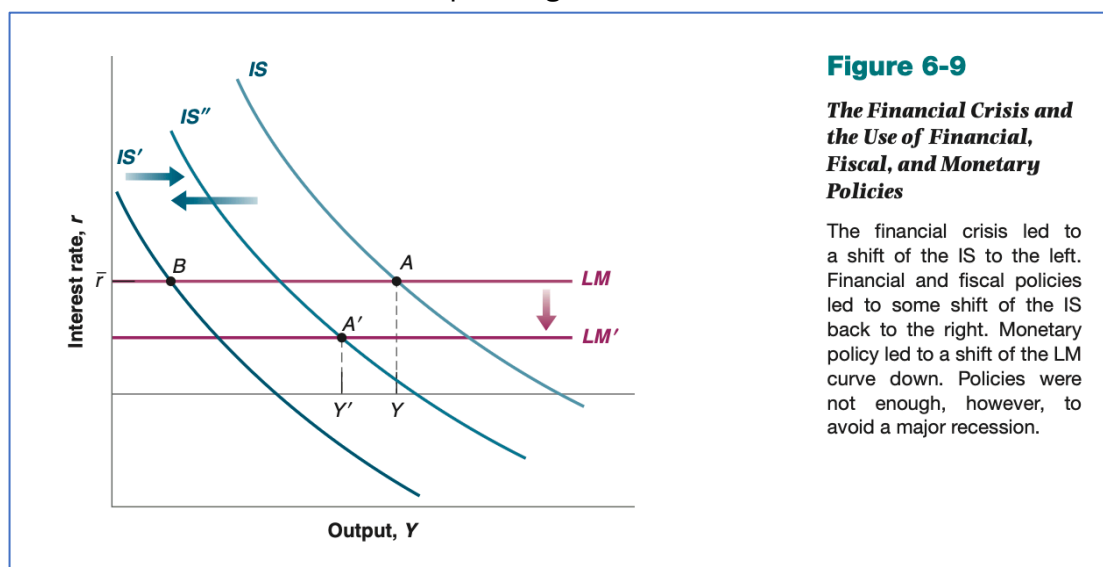
- Without changes in policy, the equilibrium would have moved from point A to point B. Financial and fiscal policies shifted the IS curve to IS'' instead of IS', and monetary policy shifted the LM to LM'.

22.2 THE GOVERNMENT BUDGET CONSTRAINT

- This section focuses on: *Suppose that, starting from a balanced budget, the government decreases taxes, creating a budget deficit. What will happen to the debt over time? Will the government need to increase taxes later? If so, by how much?*

The arithmetic of deficits and debt

- The budget deficit in year t is → $\text{deficit}_t = rB_{t-1} + G_t - T_t$
  - B_{t-1} is government debt at the end of year $t-1$ or beginning of year t
  - r is the real interest rate
  - rB_{t-1} is thus the real interest payments on the government debt in year t

- o G_t is government spending on goods and services during year t
- o T_t is taxes minus transfers during year t
  - rB_{t-1} is the interest payments.
  - $G_t - T_t$ is the primary deficit.
- In words: the budget deficit equals spending, including interest payments on the debt, minus taxes net of transfers.
- When using the real interest payments, the deficit is called the **INFALTION-ADJUSTED DEFICIT**.
- The **GOVERNMENT BUDGET CONSTRAINT** states that change in government debt during year t is equal to the deficit during year t:
  - o $B_t - B_{t-1} = \text{deficit}_t$
- If the government runs a deficit, government debt increases as the government borrows to fund the part of spending in excess of revenues.
- If the government runs a surplus, government debt decreases.
- The government budget constraint is rewritten as:
  - o $B_t - B_{t-1} = rB_{t-1} + G_t - T_t$
- The deficit can be the sum of two terms:
  - o The interest payments on the debt rB_{t-1}
  - o The difference between spending and taxes $G_t - T_t$ [called the **primary deficit** - in different order, it is the **primary surplus**].

Current versus future taxes

- A decrease in taxes leads to a current debt for the government.

Full repayment in year 2

- If the government decides to fully repay the debt during year 2, then the debt at the end of year 2 is equal to zero, then the government must run a primary surplus equal to $(1 + r)$.
  - o It can decrease in spending or increase taxes.
    - In this section, it is assumed that adjustment comes through taxes.

Figure 22-1

Tax Cuts, Debt Repayment, and Debt Stabilization

(a) If the debt is fully repaid during year 2, the decrease in taxes of 1 in year 1 requires an increase in taxes equal to $(1 + r)$ in year 2. (b) If the debt is fully repaid during year 5, the decrease in taxes of 1 in year 1 requires an increase in taxes equal to $(1 + r)^4$ during year 5. (c) If the debt is stabilized from year 2 on, then taxes must be permanently higher by r from year 2 on.

(a) **Debt Reimbursement in Year 2**

Year	0	1	2	3	4	5
Taxes	0	-1	$(1+r)$	0	0	0
End-of-year debt	0	1	0	0	0	0

(b) **Debt Reimbursement in Year 5**

Year	0	1	2	3	4	5
Taxes	0	-1	0	0	0	$(1+r)^4$
End-of-year debt	0	1	$(1+r)$	$(1+r)^2$	$(1+r)^3$	0

(c) **Debt Stabilization in Year 2**

Year	0	1	2	3	4	5
Taxes	0	-1	r	r	r	r
End-of-year debt	0	1	1	1	1	1
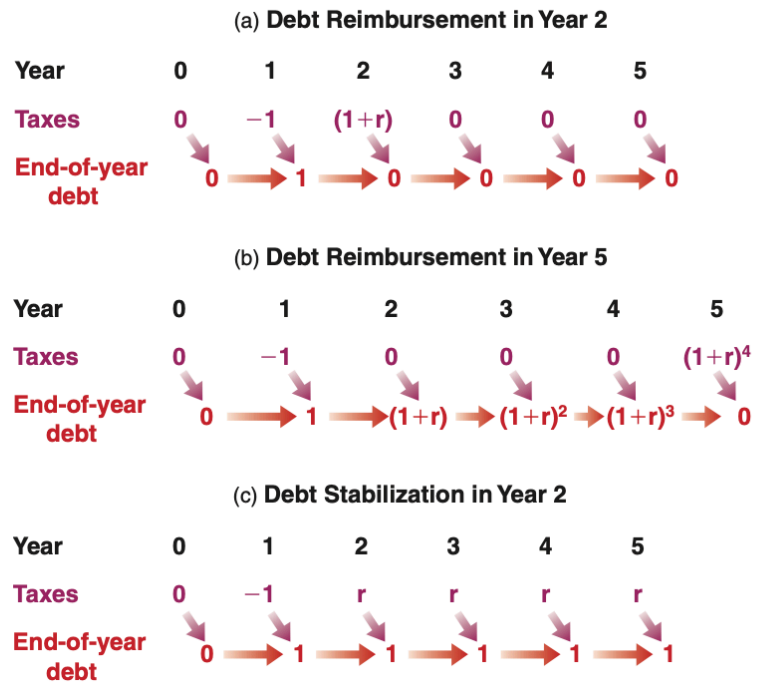
Full repayment in year t

- If the government decides to wait until year t to repay the debt, from year 2 to $t-1$ the primary deficit is equal to zero; taxes are equal to spending, not including interest payments on the debt.
- During year 2, the primary deficit is zero, so → $B_2 = (1+r)B_1 + 0 = (1+r)1 = (1+r)$ → the second equality uses the fact that $B_1 = 1$.
- The primary deficit is still equal to zero during year 3, debt at the end of year 3 is: $B_3 = (1+r)B_2 + 0 = (1+r)(1+r)1 = (1+r)^2$
- As long as the government keeps a primary deficit equal to zero, debt grows at a rate equal to the interest rate, and the debt at the end of year $t-1$ is then → $B_{t-1} = (1+r)^{t-2}$
- Even though taxes are cut inly in year 1, debt keeps increasing over time, at a rate equal to the interest rate.
- In year t, the year in which the government decides to repay the debt, the budget constraint is → $B_t = (1+r)B_{t-1} + (G_t - T_t)$
- To repay the debt, the government must run a primary surplus equal to $(1+r)^{t-1}$ during year t.
- **IF GOVERNMENT SPENDING IS UNCHANGED, A DECREASE IN TAXES MUST EVENTUALLY BE OFFSET BY AN INCREASE IN TAXES IN THE FUTURE.**

- **THE LONGER THE GOVERNMENT WAITS TO INCREASE TAXES, OR THE HIGHER THE REAL INTEREST RATE IS, THE HIGHER THE EVENTUAL INCREASE IN TAXES MUST BE.**

Debt stabilization in year 2

- Stabilizing means changing taxes or spending so that debt remains constant from then on.
- If $B_2 = B_1 = 1$ → $B_2 = (1+r)B_1 + (G_2 - T_2)$ → $1 = (1+r) + (G_2 - T_2)$ → $T_2 - G_2 = (1+r) - 1 = r$
- To avoid a further increase in debt during year 2, the government must run a primary surplus equal to real interest payments on the existing debt.
- The legacy of past deficits is higher government debt today.
- To stabilize the debt, the government must eliminate the deficit.
- To eliminate the deficit, and if the interest rate is positive, the government must run a primary surplus equal to the interest payments on the existing debt. This requires higher taxes forever.

The evolution of the debt-to-GDP ratio

- The **EVOLUTION OF DEBT-TO-GDP RATIO** → $\frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = (r-g)\frac{B_{t-1}}{Y_{t-1}} + \frac{G_t - T_t}{Y_t}$ [both sides of the budget constraint divided by real output].
  - Interest rate minus growth rate → $r - g$
  - The change in the debt ratio over time is equal to the sum of:
    - The difference between the real interest rate and the growth rate times the initial debt ratio.
    - The ratio of the primary deficit to GDP.
- The increase in the ratio of debt to GDP will be larger:
  - The higher the real interest rate
  - The lower the growth rate of output
  - The higher the initial debt ratio
  - The higher the ratio of the primary deficit to GDP.

22.3 RICARDIAN EQUIVALENCE

Ricardian Equivalence

- **RICARDIAN EQUIVALENCE PROPOSITION** [also **RICARDO-BARRO**]: Once the government budget constraint is taken into account, neither deficits nor debt have an effect on economic activity.
- Consumption does not change, because consumers know that a decrease now will yield and increase later.
- The private saving increases one-for-one with the deficit.
- A long sequence of deficits and the associated increase in government debt are no cause for worry.

22.4 THE DANGERS OF HIGH DEBT

High debt, default risk, and vicious cycles

- High debt can also lead to vicious cycles, making the conduct of fiscal policy extremely difficult.
- [Equation from HERE] With a real interest rate of 3%, growth rate of 2%, debt ration of 100%, and primary surplus of 1% → $(3\% - 2\%) \cdot 100\% + (-1\%) = 0\%$
- If interest rate increases to 8% (due to financial investors asking to compensate for higher risk), then to stabilize the debt, the government needs to run a primary surplus of 6% of output → $(8\% - 2\%) \cdot 100\% + (-6\%) = 0\%$

Debt default

- When debt is high, countries can default.
- Investors get a "haircut" and will not get all their investment payments back.
- This comes with severe consequences no matter who holds the funds.

NEGATIVE INTEREST RATES

QUANTITATIVE EASING

Topic 6: The IS-LM model in an open economy

Chapter 17, 18 & 19

17.1 OPENNESS IN GOODS MARKETS

- **OPENNESS IN GOODS MARKETS** is the ability of consumers of firms to choose between domestic and foreign goods. This can be affected by **TARIFFS** and **QUOTAS**.
- **OPENNESS IN FINANCIAL MARKETS** is the ability of financial investors to choose between domestic assets and foreign assets.
- **OPENNESS IN FACTOR MARKETS** is the ability of firms to choose where to locate production and of workers to choose where to work.

Exports and imports

- The US economy is becoming more open over time. It trades roughly three times as much [relative to its GDP] with the rest of the world than it did 50 years ago.
- Imports have since 1970s exceeded exports.
- The US have run a trade deficit.
- The better index [than import and export] of openness is the proportion of aggregate output composed of **TRADABLE GOODS** [goods that compete with foreign goods in either domestic or foreign markets].

The choice between domestic goods and foreign goods

- When goods markets re open, the consumer must decide between domestic or foreign consumption.
- The price of domestic goods relative to foreign goods is called the **REAL EXCHANGE RATE**.

Nominal exchange rates

- Nominal exchange rates between two currencies can be put in two ways:
  - *As the price of domestic currency in terms of the foreign currency → one dollar is 0.79 pounds*.
    - Used in the book forwards. E will denote the price of a dollar in terms of pounds.
  - As the price of the foreign currency in terms of the domestic currency → one pound is 1.26 dollars.

- Changes in exchange rates happen every minute of the day.
  - An **appreciation** of the domestic currency is an increase in the price of domestic currency in terms of a foreign currency.
  - A **depreciation** of the domestic currency is a decrease in the price of the domestic currency in terms of a foreign currency.
- **FIXED EXCHANGE RATES** is a system where two or more countries maintain a constant exchange rate between their currencies.
  - **Revaluations** → appreciations
  - **Devaluation** → depreciations

From nominal to real exchange rates

- The **REAL EXCHANGE RATE** is the price of one country's goods in terms of another country's goods.
- The **GDP DEFLATOR** is a price index for the set of final goods and services produced in the economy, and it can be used to construct the real exchange rate.
- The **REAL EXCHANGE RATE** is constructed by:

Figure 17-4

The Construction of the Real Exchange Rate

Price of US goods in dollars: P → Price of US goods in pounds: EP

Price of UK goods in pounds: P^*

Price of US goods in terms of UK goods: $\varepsilon = EP/P^*$

$$\varepsilon = \frac{EP}{P^*} \qquad (17.1)$$
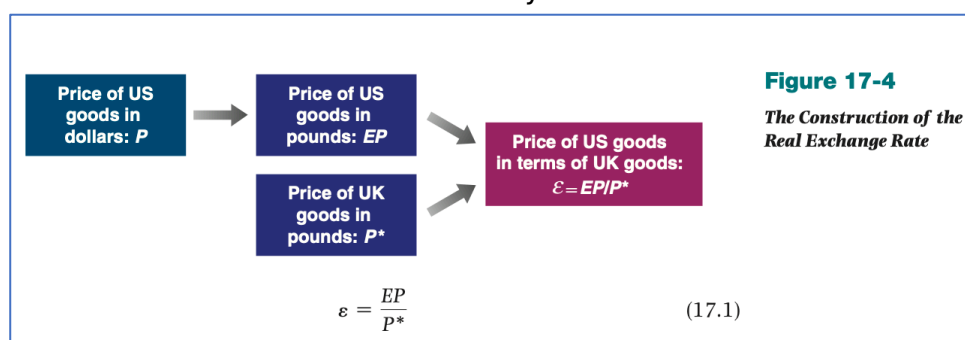
  - Multiplying the domestic price level by the nominal exchange rate → dividing by the foreign price level.
  - $\varepsilon = E\dfrac{P}{P^*}$
- It is only an index [because the GDP deflator is also just an index].
- The rate of change of the real exchange rate is informative. If the real exchange rate increases by 10%, then the good of the domestic country is now 10% more expensive relative to the foreign country than before.
- **CHANGES IN REAL EXCHANGE RATES:**
  - **Real appreciation** → an increase in the real exchange rate.
  - **Real depreciation** → a decrease in the real exchange rate.
- Differences in inflation rates across countries can lead to very different movements in nominal and real exchange rates.

From bilateral to multilateral exchange rates

- **THE MULTILATERAL REAL US EXCHANGE RATE** is the price of US goods in terms of foreign goods.

Figure 17-6

The US Multilateral Real Exchange Rate, since 1973

Since 1973 there have been two large real appreciations of the US dollar and two large real depreciations.

Source: FRED, TWEXBPA
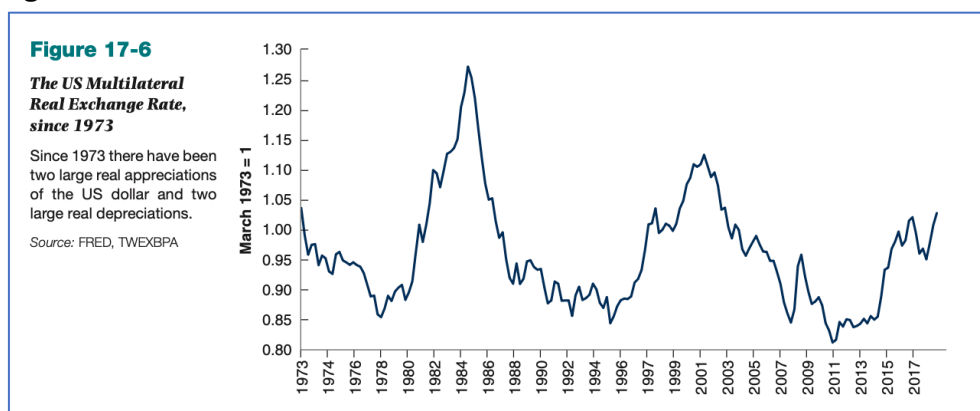
17.2 OPENNESS IN FINANCIAL MARKETS

- Openness in financial markets allows financial investors to hold both domestic and foreign assets.
- Buying or selling foreign assets implies buying or selling foreign currency, which is called **FOREIGN EXCHANGE**.
- Most transactions are made with sales of financial assets, and not through trade.
- A country's openness in financial markets allows the country to run trade surpluses and trade deficits.

The balance of payments

- A country's transactions with the rest of the world, including trade and financial flows, are summarized in **BALANCE OF PAYMENTS**.
- Transactions can be either **ABOVE THE LINE** or **BELOW THE LINE**.

The current account

- The transaction above the line record payments to and from the world → **CURRENT ACCOUNT TRANSACTIONS**.
  - o **Exports** and **imports** of goods and services.
    - ▪ The difference between these is the **trade balance**.
  - o US residents receive **income** on their holdings of foreign assets, and foreign residents receive income on their holdings of US assets.
    - ▪ Net **income balance** is the difference between these two.

- o The sum of net payments to and from the rest of the world is the **CURRENT ACCOUNT BALANCE** → current account surplus or deficit.

The financial account

- From table 17-3 it is shown that the US had a current account deficit of $489 billion, which means it had to borrow $489 billion from the rest of the world → net foreign holdings of US assets had to increase by $489 billion.
- The numbers below the line is the **FINANCIAL ACCOUNT TRANSACTIONS**.
- Financing the deficit can be done by:
  - o Receiving gifts from countries such as cancelation of debt → **net capital transfers**.
  - o **Increase in foreign holdings of US assets** could be investors, governments or central banks that buys stocks, bonds and other assets.
  - o **Increase in US holdings of foreign assets** is then when the US invests in foreign stocks, bonds and other assets.
  - o **Net capital flows** are the sum of net capital transfers and foreign holdings minus US holdings → financial account surplus or deficit.
  - o **The statistical discrepancy** is the difference between the current account and the financial account.

Table 17-3	The US Balance of Payments, 2018, in Billions of US Dollars		
Current Account			
Exports		2,500	
Imports		3,122	
Trade balance (deficit = minus sign) (1)			− 622
Income received		1,200	
Income paid		1,067	
Net income (2)			133
Current account balance (1) + (2) (deficit = minus sign)			− 489
Financial Account			
Net capital transfers (3)		9	
Increase in foreign holdings of US assets (4)		811	
Increase in US holdings of foreign assets (5)		301	
Financial account balance (7) = (3) + (4) − (5)			519
Statistical discrepancy: financial account − current account balance			30

Source: US Bureau of Economic Analysis, US International Transactions, Table. 17.1.

- **GROSS DOMESTIC PRODUCT [GDP]** and **GROSS NATIONAL PRODUCT [GNP]** is both a measure of aggregate output.
    - **GDP** measure **value added domestically**.
    - **GNP** measure **value added by domestic factors of production**.
    - When the economy is closed, the two measures are the same.
    - To go from GDP to GNP, start with GDP → add income received from the rest of the world → subtract income paid to the rest of the world.
        - GNP is equal to GDP plus payments from the rest of the world [net income] → $GNP = GDP + NI$

The choice between domestic and foreign assets

- With openness, the issue of holding domestic money or foreign money, and **DOMESTIC OR FOREIGN INTEREST-PAYING ASSETS**.
    - Foreign currency is not much worth in domestic transactions, so the first dilemma can be looked away from.

Figure 17-7

Expected Returns from Holding One-Year US Bonds versus One-Year UK Bonds
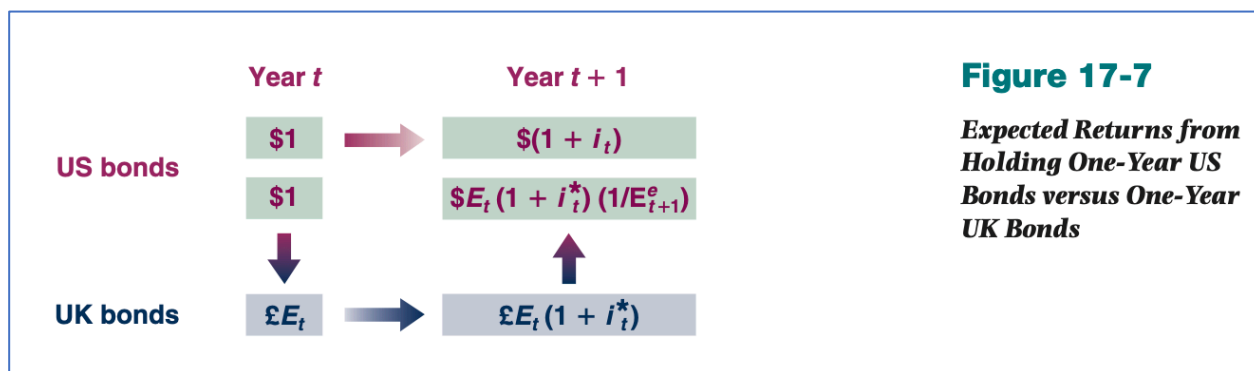
- Ignoring the differences in risk, the only incentive is to hold the asset with the highest expected rate of return. If both UK and US bonds are to be held, they must have the same expected rate of return. This must hold:
  - $(1 + i_t) = (E_t)(1 + i_t^*)\left(\frac{1}{E_{t+1}^e}\right)$ → $(1 + i_t) = (1 + i_t^*)\left(\frac{E_t}{E_{t+1}^e}\right)$ → **UNCOVERED INTEREST PARITY RELATION**.
  - Expected return for domestic must be equal to foreign.
- Investors will not only hold the bonds with the highest expected rate of return, because of transaction costs and risk.
- For rich countries, the arbitrage assumption of only choosing based on return is a good approximation of reality.

Interest rates and exchange rates

- $\left(\frac{E_t}{E_{t+1}^e}\right)$ is rewritten as $\frac{1}{(1+(E_{t+1}^e-E_t)/E\_t)}$ which yields a rewriting of the **UNCOVERED INTEREST PARITY RELATION** → $(1 + i_t) = \frac{(1+i_t^*)}{(1+(E_{t+1}^e-E_t)/E\_t)}$
- As long as the interest rate of appreciation of the domestic currency are not too large [e.g. 20% a year] then the relation between the domestic nominal interest rate, the foreign interest rate, and the expected rate of appreciation is → $i_t \approx i_t^* - \frac{E_{t+1}^e-E_t}{E_t}$
- **THE DOMESTIC INTEREST RATE MUST BE EQUAL TO THE FOREIGN INTEREST RATE MINUS THE EXPECTED APPRECIATION RATE OF THE DOMESTIC CURRENCY.**
- If you expect the currency to depreciate more than the difference in interest rate, then the domestic bonds are more attractive.

18.1 THE IS RELATION IN THE OPEN ECONOMY

- When the market is open, some of the domestic demand [from closed economy] falls on foreign goods - and the opposite.

The demand for domestic goods

- In an open economy, the **DEMAND FOR DOMESTIC GOODS** is given by $Z = C + I + G - \frac{IM}{\varepsilon} + X$
  - o The **domestic demand for goods** is consumption, investment and government.
  - o **Imports** are subtracted, but not directly; they are subtracted and divided by the real exchange rate [so it becomes the value of imports in terms of domestic goods].
  - o **Exports** are added.

The determinants of C, I, and G

- The same as in closed economy: Domestic demand: $C(Y - T) + I(Y, r) + G$
- Consumption depends positively on disposable income, and investment depends positively on production, and negatively on real policy rate.

The determinants of imports

- Imports are the part of domestic demand that falls on foreign goods.
- They depend positively on domestic income and the real exchange rate [the price of domestic goods in terms of foreign goods] → $IM = IM(Y, \varepsilon)$

The determinants of exports

- Exports are the part of foreign demand that falls on domestic goods.
- They depend positively on foreign income and negatively on the real exchange rate → $X = X(Y^*, \varepsilon)$

Putting the components together

- An increase in income [output] increases the demand but less than one-for-one
- Imports is then subtracted → the line AA is flatter than DD because as income increases, the domestic demand for domestic goods increases less than total domestic demand.
- Exports is added [this is the distance between ZZ and AA] → the distance is constant, because it does not depend on domestic income.

Figure 18-1

The Demand for Domestic Goods and Net Exports

(a) The domestic demand for goods is an increasing function of income (output).

(b) and *(c)* The demand for domestic goods is obtained by subtracting the value of imports from domestic demand and then adding exports.

(d) The trade balance is a decreasing function of output.
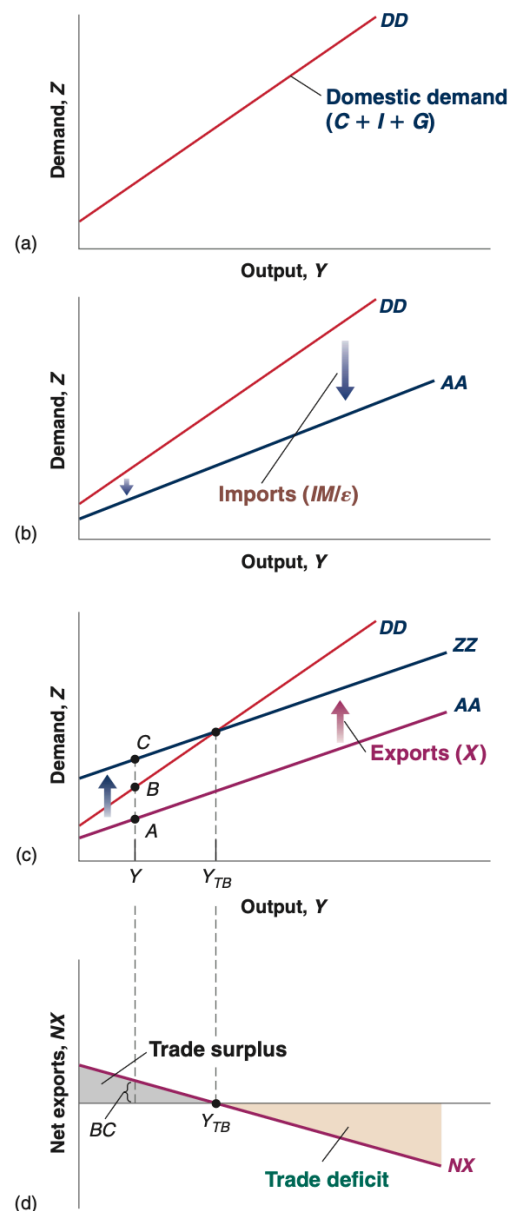
18.2 EQUILIBRIUM OUTPUT AND THE TRADE BALANCE

- The goods market is in equilibrium when domestic output equals the demand for domestic goods → $Y = C(Y - T) + I(Y, r) + G - \dfrac{IM(Y,\varepsilon)}{\varepsilon} + X(Y^*, \varepsilon)$

- The equilibrium level of output is not [always] at the same level of output as when trade is balanced.

Figure 18-2

Equilibrium Output and Net Exports

The goods market is in equilibrium when domestic output is equal to the demand for domestic goods. At the equilibrium level of output, the trade balance may show a deficit or a surplus.
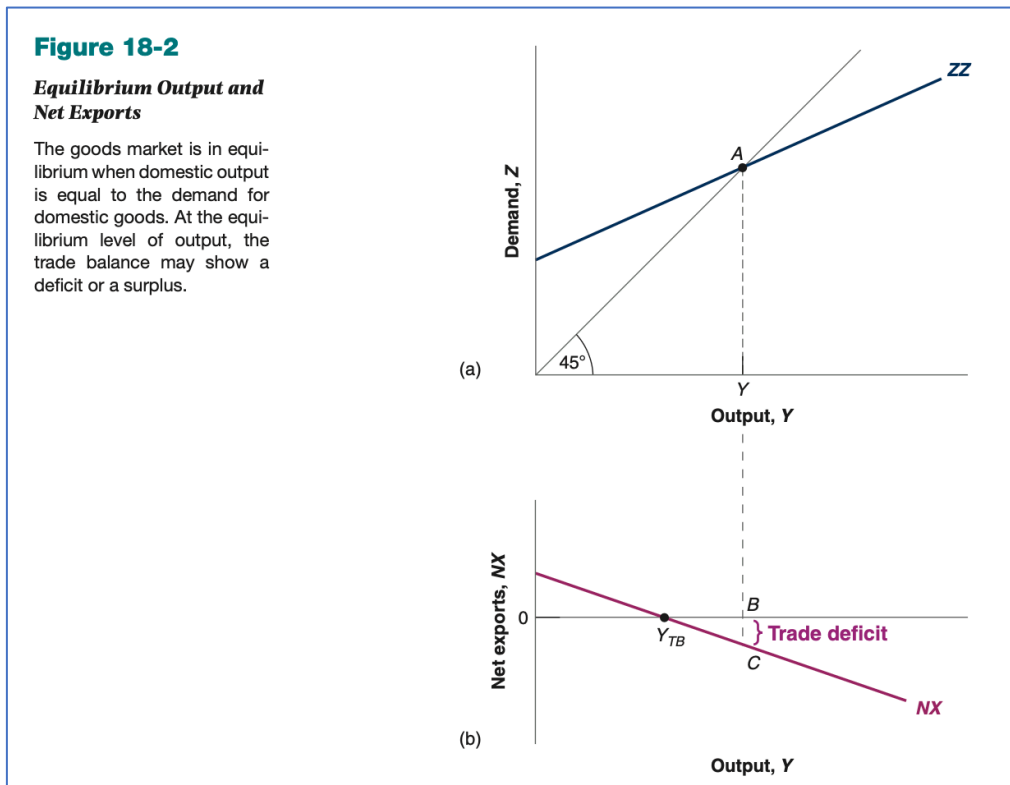
18.3 INCREASES IN DEMAND - DOMESTIC OR FOREIGN

Increases in domestic demand

- If government is increasing spendings in order to increase domestic demand and output, then the increase in output is higher than government spending [due to multiplier effect] → this creates trade deficit [because import goes up and exports do not change].
- The **MULTIPLIER IS SMALLER IN THE OPEN ECONOMY**.

Increases in foreign demand

- An increase in foreign income increases the domestic demand and increases exports [demand and output for domestic goods].
- This yields an improvement in trade balance.

Figure 18-4

The Effects of an Increase in Foreign Demand

An increase in foreign demand leads to an increase in output and a trade surplus.
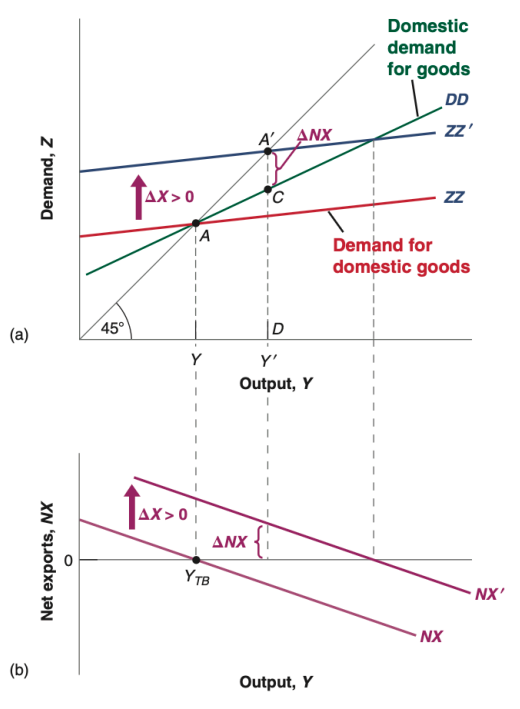
Fiscal policy revisited

- Shocks to demand in one country affect other countries. The stronger the trade links between countries, the stronger the interactions, and the more countries will move together.
- Governments do not like to run trade deficits, because if they continue, then they accumulate debt in relation to the rest of the world and should pay higher interest rates.
- Coordinated increase in demand leads to increases in both exports and imports in each country, but this is not easy to achieve.

18.4 DEPRECIATION, THE TRADE BALANCE, AND OUTPUT

- The **REAL EXCHANGE RATE** is given by $\varepsilon = \frac{EP}{P^*}$
- If the US government depreciates the dollar [a decrease in the nominal exchange rate] by 10% and price levels do not change, then US goods will be 10% cheaper.

Depreciation and the trade balance: the Marshall-Lerner condition

- **NET EXPORTS** → $NX = X - \frac{IM}{\varepsilon}$ → $NX = X(Y^*, \varepsilon) - \frac{IM(Y, \varepsilon)}{\varepsilon}$
- Depreciation affects the trade balance through three channels:
  - Exports increases
  - Imports decreases

o The relative price of foreign goods in terms of domestic goods increases.

- Exports must increase enough, and imports must decrease enough to compensate for the increase in the price of imports for a trade balance to improve following a depreciation.
- **MARSHALL-LERNER CONDITION** is the condition under which a real depreciation leads to an increase in net exports.

The effects of a real depreciation

- The change in net exports changes domestic output, which further affects net exports.
- The effect of a real depreciation is like those of an increase in foreign output, Figure 18-4 shows the effects.
    o Both demand and net exports shift up, and the trade balance improves.

Combining exchange rate and fiscal policies

- If output is at its natural level, but the economy is running a large trade deficit, and the government would like to reduce the trade deficit while leaving output unchanged, it needs to both use **DEPRECIATION** and **FISCAL CONTRACTION**.

Figure 18-5

Reducing the Trade Deficit without Changing Output

To reduce the trade deficit without changing output, the government must both achieve a depreciation and decrease government spending.
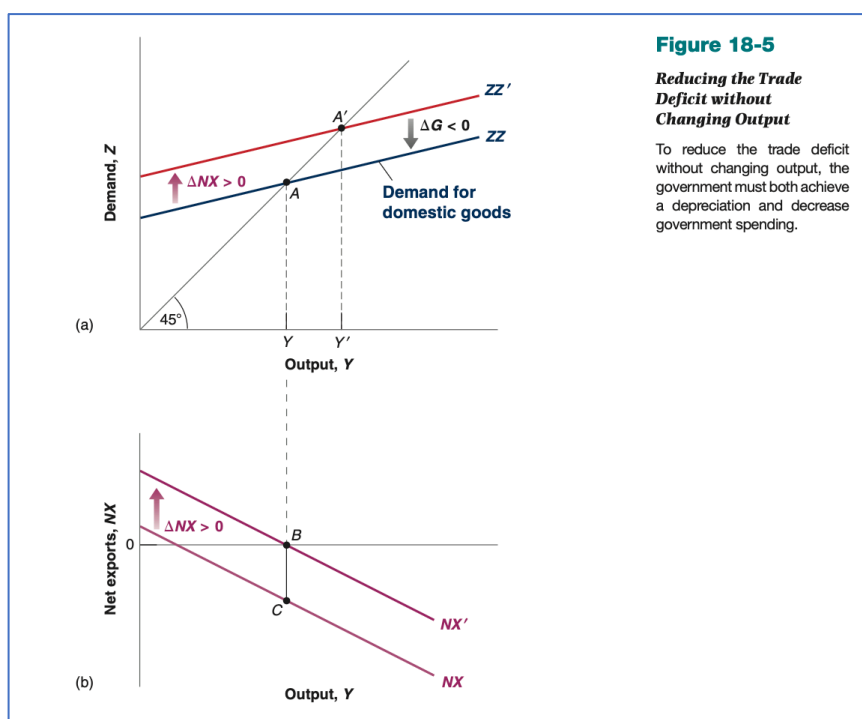
- The depreciation shifts the net exports relation from NX to NX', so there is no trade deficit, but this will shift demand from ZZ to ZZ'. Government must decrease government spending to shift demand back to ZZ.

Table 18-1	Exchange Rate and Fiscal Policy Combinations	
Initial Conditions	**Trade Surplus**	**Trade Deficit**
Low output	ε? G$\uparrow$	$\varepsilon\downarrow$ G?
High output	$\varepsilon\uparrow$ G?	ε? G$\downarrow$

18.5 SAVING, INVESTMENT, AND THE CURRENT ACCOUNT BALANCE

- Rewriting the equilibrium condition in the goods market as the condition that investment is equal to saving.
  - $Y = C + I + G - \dfrac{IM}{\varepsilon} + X \rightarrow CA = S + (T - G) - I$
    - CA is the current account balance. Therefore, the current account balance is equal to saving minus investment.
    - Surplus $\rightarrow$ country saves more than it invests, deficit $\rightarrow$ country saves less than it invests.
  - An **increase in investment** must be reflected in either an **increase in private** or **public saving** or a **deterioration of the current account balance**.
  - A **deterioration in the government budget balance** [smaller budget surplus or larger budget deficit] must be reflected either in an **increase in private saving** or a **decrease in investment**.
- A depreciation affects saving and investment by affecting the demand for domestic goods and thereby increasing output.

19.1 EQUILIBRIUM IN THE GOODS MARKET

- For the goods market to be in equilibrium, output must be equal to demand for domestic goods.
- Net exports depend on domestic output, foreign output, and the real exchange rate.
- The equilibrium with net exports can be written as $\rightarrow Y = C(Y - T) + I(Y, r) + G + NX(Y, Y^*, \varepsilon)$
  - An **increase in the real interest rate** leads to a **decrease in investment** spending resulting in a **decrease in the demand for domestic goods**, and through the multiplier to a **decrease in output**.

- o An **increase in the real interest rate** leads to a **shift in demand toward foreign goods** resulting in a **decrease in net exports**, which further **decreases the demand for domestic good**, and this **decreases output**.
- Assuming the short run, so nominal and real interest rate is the same and that nominal and real exchange rate is the same, the new equilibrium is → $Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, E)$

19.2 EQUILIBRIUM IN FINANCIAL MARKET

Domestic bonds versus foreign bonds

- In equilibrium, both domestic and foreign bonds must have the same expected rate of return otherwise investors would only hold one or the other.
- The future exchange rate is taken as given and denoted by $\overline{E}^e$. The **INTEREST PARITY CONDITION** then becomes → $E = \frac{1+i}{1+i^*} \overline{E}^e$.
  - o An increase in the domestic interest rate leads to an increase in the exchange rate.
  - o An increase in the foreign interest rate leads to a decrease in the exchange rate.
  - o An increase in the expected future exchange rate leads to an increase in the current exchange rate.
  - o An increase in the domestic interest rate relative to the foreign interest rate leads to an appreciation of the domestic currency.

Figure 19-1

The Relation between the Interest Rate and the Exchange Rate Implied by Interest Parity

A higher domestic interest rate leads to a higher exchange rate—an appreciation.
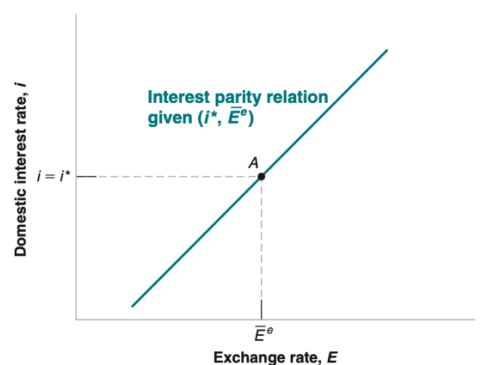
19.3 PUTTING GOODS AND FINANCIAL MARKETS TOGETHER

- The open economy **IS RELATION** → $Y = C(Y - T) + I(Y, i) + G + NX\left(Y, Y^*, \frac{1+i}{1+i^*} \overline{E}^e\right)$
- The open economy **LM RELATION** → $i = \bar{\imath}$
- A higher interest rate leads to a decrease in investment, a decrease in the demand for domestic goods, and a decrease in output.

- A higher interest rate increases exchange rate, which makes domestic goods more expensive relative to foreign goods, leading to a decrease in net exports, and a decrease in demand for domestic goods and output.

(a)

(b)

Figure 19-2

The IS-LM Model in an Open Economy

An increase in the interest rate reduces output both directly and indirectly (through the exchange rate). The IS curve is downward sloping, for both reasons. The LM curve is horizontal, as in Chapter 6.
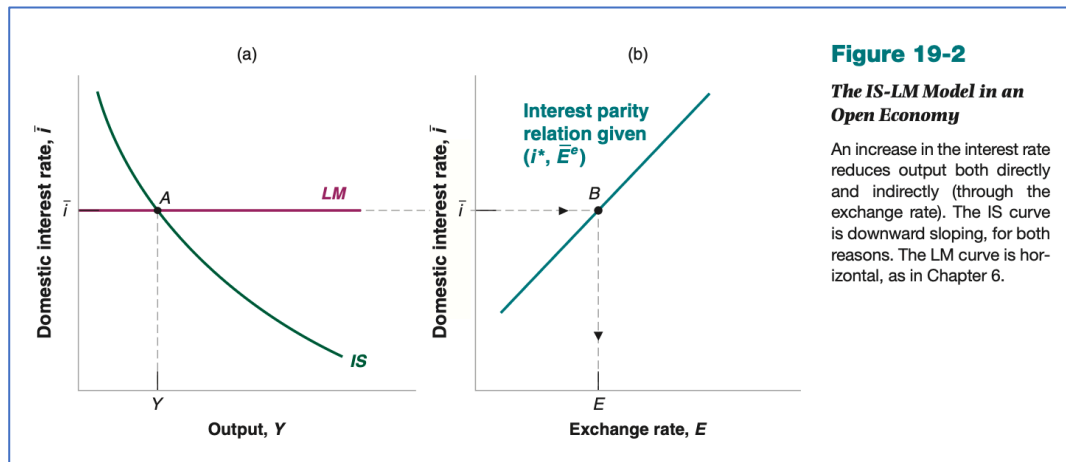
19.4 THE EFFFECTS OF POLICY IN AN OPEN ECONOMY

The effects of monetary policy in an open economy

- If the central bank increases the domestic interest rate, the LM curve shifts up, and the IS curve does not shift → the increase in interest rate leads to an appreciation. Both effects work in the same direction [same with opposite].

Figure 19-3

The Effects of an Increase in the Interest Rate

An increase in the interest rate leads to a decrease in output and an appreciation.
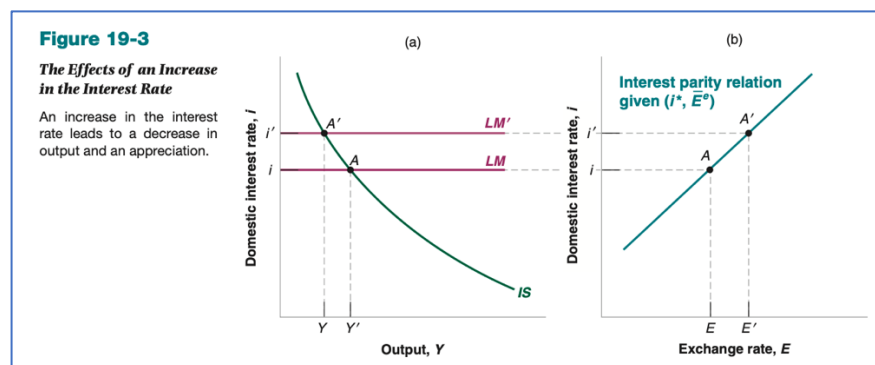
The effects of fiscal policy in an open economy

- If government decides to increase defense spending without raising taxes, so they run a budget deficit then...
  - If output was **below potential** and **stays below potential**, inflation might not increase, and the **interest rate stays the same**.
  - This shifts the IS curve outwards, and there is a **higher output**.

- o Due to same interest rate, the **exchange rate** also **stays unmoved**.
- o **Consumption** and **government** spending **increases**. **Investment** also **rises** because it depends on output and interest rate.
- o **Foreign output** and the **exchange rate** are **unchanged**, but domestic output increases, so **net exports also increase**. The budget deficit leads to a deterioration of the trade balance. If trade was balanced to start, then the budget deficit leads to a trade deficit.

Figure 19-4

The Effects of an Increase in Government Spending with an Unchanged Interest Rate

An increase in government spending leads to an increase in output. If the central bank keeps the interest rate unchanged, the exchange rate also remains unchanged.
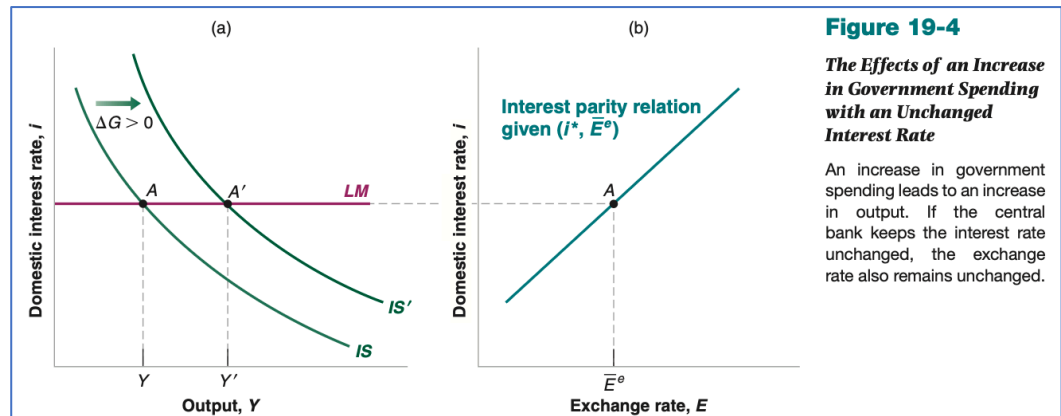
- • If the economy was instead close to potential output, then the central bank would increase interest rate in response to fear of inflation due to too high output.
  - o At an **unchanged interest rate**, **output would increase**, and the **exchange rate would not change**.
  - o If **interest rate increases**, **output will decrease**.
  - o **Consumption** and **government spending increases**.
  - o **Investment** is **ambiguous** due to both **output** and **interest rate being affected**.
  - o **Net exports decreases** because **output goes up** [and therefore imports] and the **exchange rate appreciated** which **increases imports** and **decreases exports**.
  - o The **budget deficit leads to a trade deficit**.

Figure 19-5

The Effects of an Increase in Government Spending When the Central Bank Responds by Raising the Interest Rate

An increase in government spending leads to an increase in output. If the central bank responds by raising the interest rate, the exchange rate will appreciate.
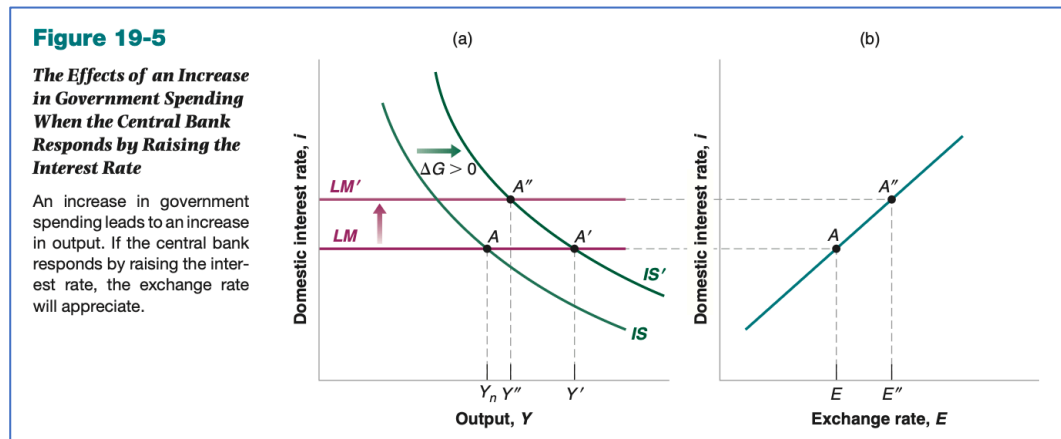
19.5 FIXED EXCHANGE RATES

- Central banks act under implicit or explicit exchange rate targets.

Pegs, crawling pegs, bands, the EMS, and the Euro

- **FLEXIBLE EXCHANGE RATES** → United States, UK, Japan, and Canada with no explicit exchange rate targets.
- **FIXED EXCHANGE RATES** → Maintain a fixed exchange rates in terms of some foreign country, and **PEG** their currency to that.
    o A decrease is called a devaluation instead of depreciation.
    o An increase is called a revaluation instead of appreciation.
- **CRAWLING PEG** → Countries with typically higher inflation rate than the US dollar, so they choose a predetermined rate of depreciation.
- **EUROPEAN MONETARY SYSTEM [EMS]** → Determined the movements of exchange rates in the European Union from 1978 to 1998.

Monetary policy when the exchange rate is fixed

- If a country pegs its exchange rate at some chosen value, the government must take measures so that its chosen exchange rate will prevail in the foreign exchange market.
- Under a fixed exchange rate and perfect capital mobility, the domestic interest rate must be equal to the interest rate of the foreign country the country is pegging to.
- Under fixed exchange rates, the central bank gives up monetary policy as a policy instrument.

Fiscal policy when the exchange rate is fixed

- The effects of an increase in government spending with pegged exchange rate is the same as in Figure 19-4.

RUSSIAN CENTRAL BANK HIKES RATE TO 20%

Topic 7: Inflation and unemployment

Chapter 7 & 8

7.1 A TOUR OF THE LABOR MARKET

- The US population was 327.2 million in 2018, but only 257.7 million was the **NONIN-STITUTIONAL CIVILIAN POPULATION**.
- The **LABOR FORCE** was only 162 million.
- The **PARTICIPATION RATE** was 62%.
- The **UNEMPLOYMENT RATE** was 3.9%

Figure 7-1

Population, Labor Force, Employment, and Unemployment in the United States (in Millions), 2018

Source: Current Population Survey www.bls.gov/cps/.

Total population: 327.2 million

Non-institutional civilian population: 257.7 million

Civilian labor force 162.0 million

Out of the labor force 95.7 million

Employed 155.7 million

Unemployed 6.3 million
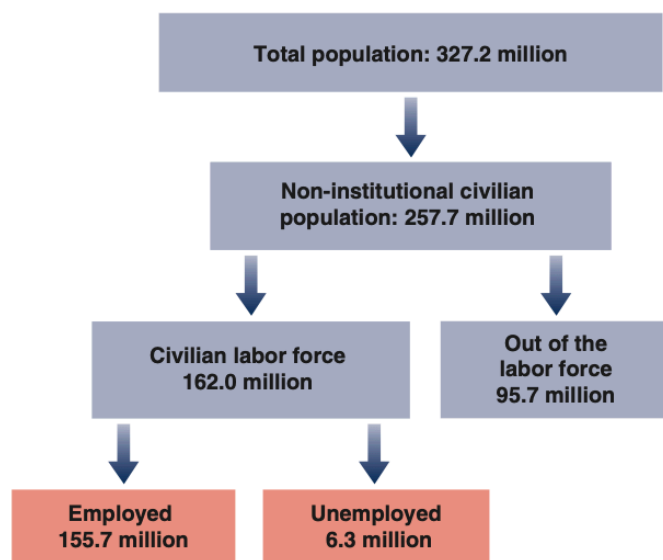
- When demand increases → production increases → employment increases → unemployment decreases → wages increase → costs increase → prices increase.

Demand ↑ → output/production ↑: from the IS-LM model

Production ↑ → employment ↑: from the production function. Labor is needed to produce. Very simple production function: $Y = N$, where N is labor/employment

Employment ↑ → unemployment ↓: straightforward

Unemployment ↓ → wages ↑: wage determination

Wages ↑ → costs ↑ → prices ↑ (inflation): price determination

The large flows of workers

- An unemployment rate can reflect two realities.
  - An active labor market with many separations and many hires.
  - A sclerotic labor market, with few separations.
- To find out what is the reason behind, the US uses the **CURRENT POPULATION SURVEY**.

Figure 7-2

Average Monthly Flows between Employment, Unemployment, and Nonparticipation in the United States, 1994 to 2018 (Millions)

(1) The flows of workers in and out of employment are large. (2) The flows in and out of unemployment are large relative to the number of unemployed. (3) There are also large flows in and out of the labor force, much of it directly to and from employment.

Source: Calculated from the series constructed by Fleischman and Fallick, www.federalreserve.gov/econresdata/researchdata/feds200434.xls.

7.2 MOVEMENTS IN UNEMPLOYMENT

- Year-to-year movements in the unemployment rate are closely associated with recessions and expansions.

- Firms can decrease their employment in response to a decrease in demand. Higher unemployment is associated with both a lower chance of finding a job if one is unemployed and a higher chance of losing it if one is employed.

7.3 WAGE DETERMINATION

- Wages are set in many ways - sometimes by **COLLECTIVE BARGAINING**.
  - **Non-competitive feature:** Unions can be bargaining on behalf of workers. Bargaining power is high (low) when unemployment is low (high), so there is a **negative relationship** between wages and the unemployment rate.
- The higher the skills needed to do the job, the more likely there is to be bargaining.
- Workers are typically paid a wage that exceeds their reservation wage [the wage that would make them indifferent between working or being unemployed].
- Wages typically depend on labor market conditions. The lower the unemployment rate, the higher the wages.

Bargaining

- How much **BARGAINING POWER** workers have depended on 1) how costly if would be for the firm to find other workers, and 2) how hard it would be for them to find another job.

Efficiency wages

- Firms may want to pay **MORE THAN THE RESERVATION WAGE**, because they want workers to be productive, which a higher wage can help with.
- The link between productivity and the wage is called **EFFICIENCY WAGE THEORIES**.
- Firms will pay higher for employee morale and commitment.
- A low unemployment rate makes it more attractive for employed workers to quit, so a firm increases wages to induce worker to stay with the firm.

Wages, prices, and unemployment

- Wages is determined by: $W = P^e F(u, z)$
  - P^e → The expected price level (positive relation)
  - u → the unemployment rate (negative relation)
  - z → other variables that may affect the outcome of wage setting (positive relation).

The expected price level

- Workers care about how many goods they can buy with the dollars they get.
  - Workers care about the nominal wages they receive relative to the price of the goods they buy → $\frac{W}{P}$
  - Firms care about the nominal wages they pay relative to the price of the goods they sell → $\frac{W}{P}$
- Wages depend on the expected price level [and not the actual price level] because wages are set in nominal dollars.

The unemployment rate

- An increase in the unemployment rate decreases wages.
- Higher unemployment weakens workers' bargaining power.

The other factors

- An increase in the other factors implies an increase in the wage.
- Unemployment insurance is the payment of unemployment benefits to workers who lose their jobs.
- Could also be in increase in minimum wage or employment protection.

7.4 PRICE DETERMINATION

- Prices set by firms depend on the costs they face, which depend on the nature of the **PRODUCTION FUNCTION** [the relation between inputs and output].
- If firms produce goods using labor force as the only factor → $Y = AN$
  - Y → output
  - A → labor productivity [output per worker]
  - N → employment
- In reality, firms use other factors of production.
- If it is assumed that labor productivity is constant → $Y = N$
  - The cost of producing one more unit of output is equal to wages.
- If there was perfect competition in the goods market, the price of a unit of output would be equal to marginal cost.
- Many firms charge a higher price than marginal cost → $P = (1 + m)W$
  - Here the markup of the price over the cost is included.
  - The markup is low in a competitive market.

7.5 THE NATURAL RATE OF UNEMPLOYMENT

- Under the assumption that nominal wages depend on the actual price level, wage setting and price setting determine the equilibrium rate of unemployment → **NATURAL RATE OF UNEMPLOYMENT** → $F(u_n, z) = \frac{1}{1+m}$
    - o Natural rate of unemployment is affected by the markup and **z**.

The wage-setting relation

- New equation with actual price level → $W = PF(u, z)$ → $\frac{W}{P} = F(u, z)$
- Wage determination implies a negative relation between the real wage and the unemployment rate.
- **WAGE-SETTING RELATION** [Figure 7-6].

Figure 7-6

Wages, Prices, and the Natural Rate of Unemployment

The natural rate of unemployment is the unemployment rate such that the real wage chosen in wage setting is equal to the real wage implied by price setting.
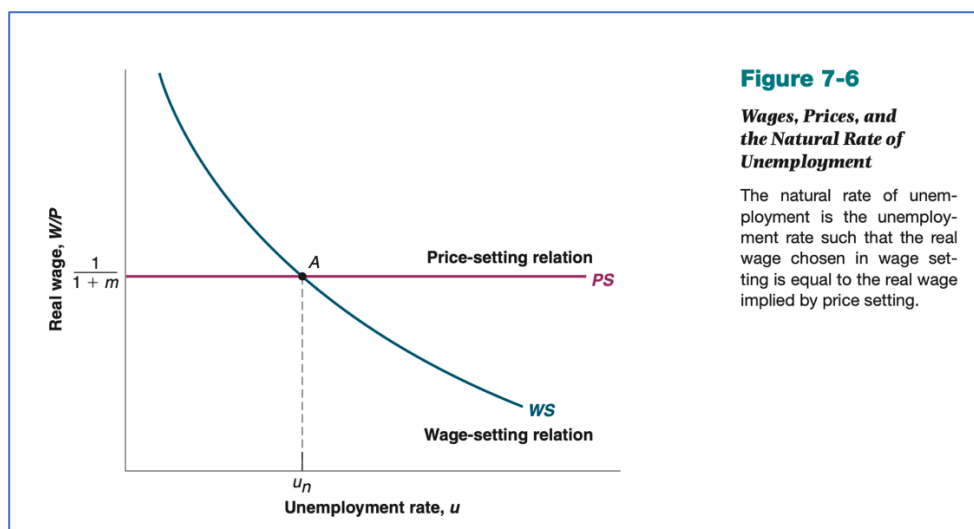
The price-setting relation

- The implied **REAL WAGE** → $\frac{W}{P} = \frac{1}{1+m}$
    - o Price-setting decisions determine the real wage paid by firms.
    - o An increase in the markup leads firms to increase their prices given the wage they have to pay, which leads to a decrease in the real wage.
    - o The real wage implied by price setting does not depend on the unemployment rate.

Equilibrium real wages and unemployment

- Equilibrium in the labor market requires that the real wage chosen in wage setting is equal to the real wage implied by price setting.
- The equilibrium unemployment rate is called the **NATURAL RATE OF UNEMPLOYMENT**.
- At a given unemployment rate, higher unemployment benefits lead to a higher real wage. A higher unemployment rate brings the real wage back to what firms are willing to pay.
- An increase in markups decreases the real wage and leads to an increase in the natural rate of unemployment.

Figure 7-7

Unemployment Benefits and the Natural Rate of Unemployment

An increase in unemployment benefits leads to an increase in the natural rate of unemployment.

Figure 7-8

Markups and the Natural Rate of Unemployment

An increase in the markup leads to an increase in the natural rate of unemployment.
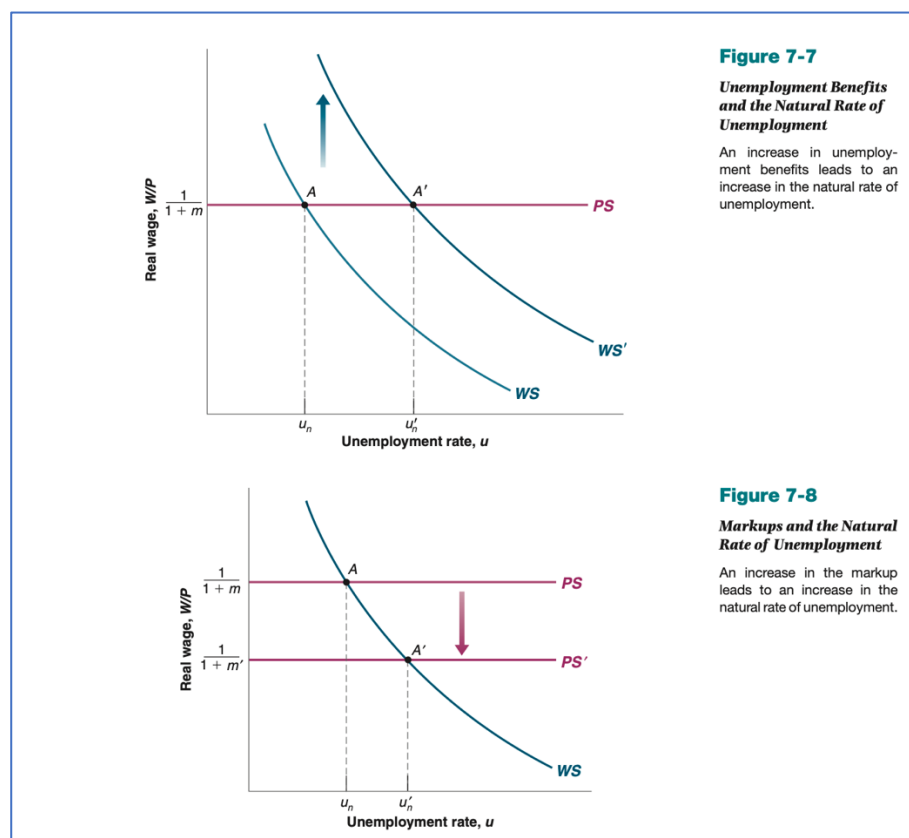
8.1 INFLATION, EXPECTED INFLATION, AND UNEMPLOYMENT

- The function of F → $F(u, z) = 1 - \alpha u + z$
  - The parameter α captures the strength of the effect of unemployment on the wage.
- The wage determination is now → $W = P^e(1 - \alpha u + z)$
- The price determination is now → $P = P^e(1 + m)(1 - \alpha u + z)$

- This is a relation between the price level, the expected price level, and the unemployment rate.
- The relation between inflation, expected inflation, and the unemployment rate $\rightarrow \pi = \pi^e + (m + z) - \alpha u$
    - An increase in expected inflation leads to an increase in actual inflation.
    - Given expected inflation, an increase in the markup, or an increase in the factors that affect wage determination leads to an increase in actual inflation.
    - Given expected inflation, a decrease in the unemployment rate leads to an increase in actual inflation.
- Treating markup and the other factors as constants and the others as time movements $\rightarrow \pi_t = \pi_t^e + (m + z) - \alpha u_t$
    - Keeping markup, other factors and unemployment constant, and increase in expected inflation leads to an increase in inflation: $\pi_t^e = \frac{P_t^e - P_{t-1}}{P_{t-1}}$
- There is a **POSITIVE RELATION** between **EXPECTED INFLATION** and **INFLATION**.
- There is also a **POSITIVE RELATION** between the **MARKUP** and **INFLATION**.
- Also, a **POSITIVE RELATION** between **OTHER FACTORS** and **INFLATION**.
- As unemployment falls, workers are empowered to push for higher wages. Firms try to pass these higher wage costs on to consumers, resulting in higher prices and an inflationary buildup in the economy.

8.2 THE PHILLIPS CURVE AND ITS MUTATIONS

The original Phillips curve

- Assume that inflation varies from year to year $\bar{\pi}$ and that inflation this year is not a good predictor of inflation next year.
- It is assumed that whatever inflation was last year, inflation this year will be equal to $\bar{\pi} \rightarrow \pi_t = \bar{\pi} + (m + z) - \alpha u_t$
    - There is a negative relation between unemployment and inflation.
    - When unemployment was high, inflation was low, and sometimes negative.

The de-anchoring of expectations

- The original Phillips curve [low unemployment = high inflation] vanished because wage setters changed the way they formed their expectations about inflation.
    - The rate of inflation became more persistent.
- When inflation increases, workers and firms start to change the way they formed expectations.

- When the expectations based on last year's inflation is 0, then the original Phillips curve is met.
- When it is positive, the inflation rate depends on unemployment AND last year's inflation rate.
- When is equals to one, the unemployment rate does not affect the inflation rate, but the change in the inflation rate.
  - High unemployment leads to decreasing inflation.
  - Low unemployment leads to increasing inflation.
- The **ACCELERATIONSIST PHILLIPS CURVE** shows the relation between the **CHANGE IN THE INFLATION RATE** and the **UNEMPLOYMENT RATE**.

Figure 8-4

Change in Inflation versus Unemployment in the United States, 1970–1995

From 1970 to 1995, there was a negative relation between the unemployment rate and the change in the inflation rate in the United States.

Source: FRED: CPIAUCSL, UNRATE
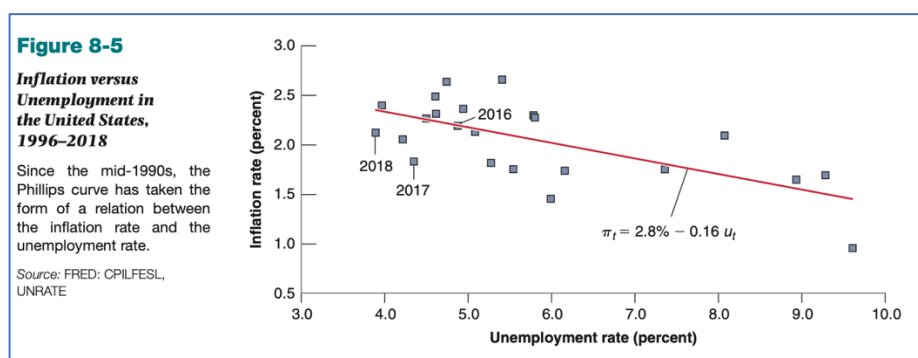
$$\pi_t - \pi_{t-1} = 7.4\% - 1.2\, u_t$$
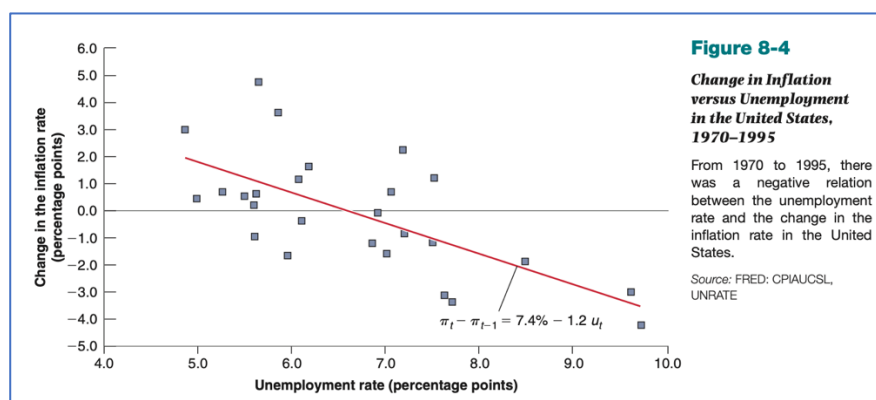
The re-anchoring of expectations

- Expectations of inflation had become de-anchored during the 1970's and re-anchored in the 1980's.

Figure 8-5

Inflation versus Unemployment in the United States, 1996–2018

Since the mid-1990s, the Phillips curve has taken the form of a relation between the inflation rate and the unemployment rate.

Source: FRED: CPILFESL, UNRATE

$$\pi_t = 2.8\% - 0.16\, u_t$$

8.3 THE PHILLIPS CURVE AND THE NATURAL RATE OF UNEMPLOYMENT

- The natural rate of unemployment is the unemployment rate at which the actual price level is equal to the expected price level.

- The natural rate of unemployment is the unemployment rate such that the actual inflation rate is equal to the expected inflation rate.
- The **NATURAL RATE OF UNEMPLOYMENT** → $u_n = \frac{m+z}{\alpha}$
- Link between the inflation rate, the expected inflation rate, and the deviation of the unemployment rate from the natural rate → $\pi_t - \pi_t^e = -\alpha(u_t - u_n)$
  - If unemployment is at the natural rate, then inflation will be equal to expected inflation.
  - If it is under, inflation will be higher than expected.
  - If it is above, inflation will be lower than expected.

8.4 A SUMMARY AND MANY WARNINGS

- The relation between inflation and unemployment depends on how wage setters form expectations of inflation.
- If expectations are anchored, then the Phillips curve takes the form of a relation between inflation and unemployment.
- If expectations are unanchored, the Philips curve becomes a relation between the change in inflation and unemployment.

Variations in the natural rate over time

- Markup and other factors can change over time.

Variations in the natural unemployment rate across countries

- If factors differ across countries, countries have different natural rates.

High inflation and the Phillips curve

- When the inflation rate is high, inflation tends to become more variable, and workers and firms become more reluctant to enter into labor contracts that set nominal wages for a long period of time.
- Wage indexation increases the effect of unemployment on inflation.

Deflation and the Phillips curve

- When the economy experiences deflation, the Phillips curve relation breaks down.
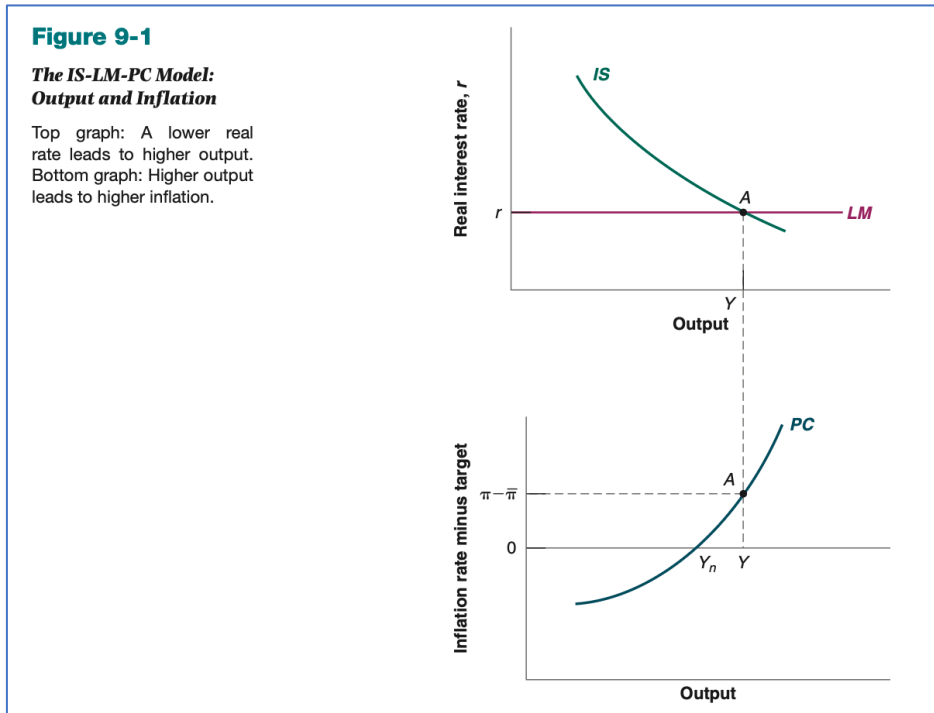
Topic 8: The IS-LM-PC model

9.1 IS-LM-PC MODEL

- The **EQUILIBRIUM IN THE GOODS MARKET** tells that: $Y = C(Y - T) + I(Y, r + x) + G$
- **IN THE SHORT RUN, OUTPUT IS DETERMINED** by demand, which is the sum of consumption, investment, and government spending.
    - **Consumption** depends on disposable income, which is equal to income net of taxes.
    - **Investment** depends on output and on the real borrowing rate.
        - Real borrowing rate is the sum of real rate [chosen by the central bank] and a risk premium.
    - **Government spending** is exogenous.
- The lower the real rate, the higher the equilibrium level of output.
    - Due to higher investment → leads to higher demand → leads to higher output → further increases consumption and investment → leading to an increase in demand.
- The **EQUILIBRIUM IN FINANCIAL MARKETS** shows the real rate chosen by the central bank.
- The **EQUILIBRIUM IN LABOR MARKETS** is the relation between inflation and unemployment [the Phillips curve] → $\pi - \pi^e = -\alpha(u - u_n)$
    - When the unemployment rate is lower than the natural rate, inflation is higher than expected, and the opposite.
- Because the equilibrium in the goods market is given by output, the Phillips curve must be put in relation in terms of output and inflation.
- Unemployment rate is equal to unemployment divided by the labor force → $N = L(1 - u)$.
- When output is equal to employment → $Y = N = L(1 - u)$
- **NATURAL LEVEL OF OUTPUT** → $Y_n = L(1 - u_n)$
- **POTENTIAL OUTPUT** → $Y - Y_n = -L(u - u_n)$
- **OUTPUT GAB** is the difference between output and potential output → $\pi - \pi^e = \left(\frac{\alpha}{L}\right)(Y - Y_n)$
- **OKUN COEFFICIENT** → the coefficient giving the effect of output growth on the change in the unemployment rate.
- The **RELATION BETWEEN INFLATION AND OUTPUT** is → $\pi - \bar{\pi} = \left(\frac{\alpha}{L}\right)(Y - Y_n)$

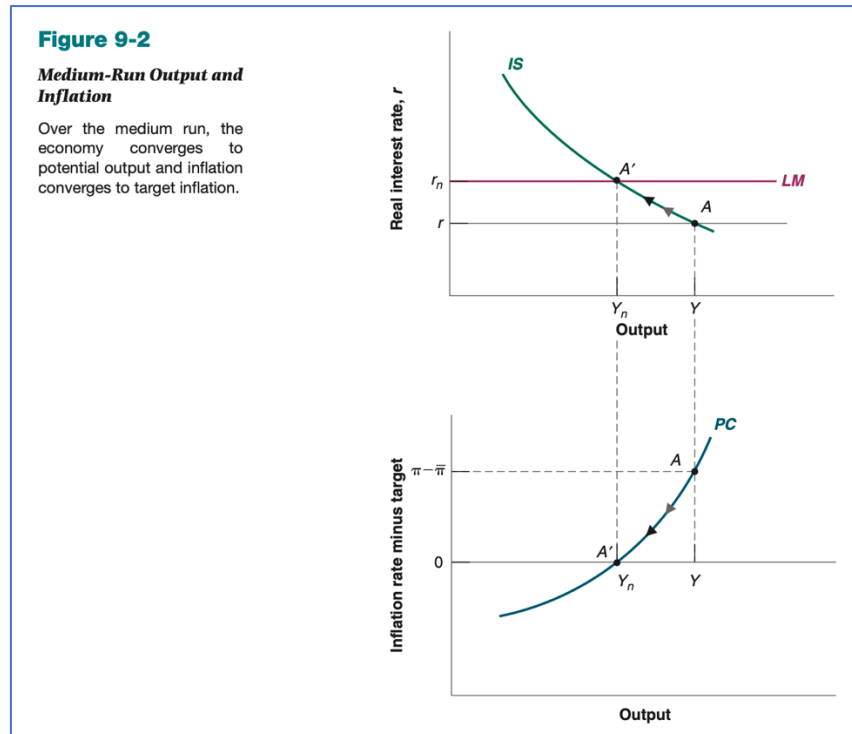o Under the assumption that inflation is credibly targeted by central banks.

Figure 9-1

The IS-LM-PC Model:
Output and Inflation

Top graph: A lower real rate leads to higher output. Bottom graph: Higher output leads to higher inflation.

Top graph axes: Real interest rate, r (vertical); Output (horizontal). Curves: IS (downward sloping), LM (horizontal at level r), intersection at point A above output Y.

Bottom graph axes: Inflation rate minus target (vertical); Output (horizontal). Curve PC (upward sloping) passing through point A at level $\pi - \bar{\pi}$, with Y_n and Y marked on horizontal axis, 0 level marked.

Money supply decrease → interest rate increases → real interest rate increases → investment decreases → demand decreases → output decreases → employment decreases → unemployment increases → wages decrease → inflation decreases.

9.2 FROM THE SHORT TO THE MEDIUM RUN

- If output is higher than expected, then inflation is higher than the target inflation.
    - The economy is overheating, putting pressure on inflation.
    - This is the **short-run equilibrium**
- If the central banks leave the real rate unchanged, then output remains above potential, and inflation remains above target.
- The central bank will react to the positive output gap by increasing the real rate to reduce inflation and output.
- At point A' in graph 9-2, the economy reaches its medium-run equilibrium, because it reaches its natural level of output and unemployment returns to the natural unemployment rate, and inflation rate returns to the target rate.
- The interest rate will also be the natural rate of interest.
    - The real rate is equal to the nominal rate minus expected inflation, and therefore → $i = r + \pi^e$. In the medium run → $i = r + \bar{\pi}$
- The real borrowing rate is given by $r_n + x$

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- Real money supply equal real money demand, so → $\frac{M}{P} = Y_n L(r_n + \bar{\pi})$

- In the medium run, the nominal interest rate is equal to the real neutral rate plus the rate of nominal money growth.

Figure 9-2

Medium-Run Output and Inflation

Over the medium run, the economy converges to potential output and inflation converges to target inflation.
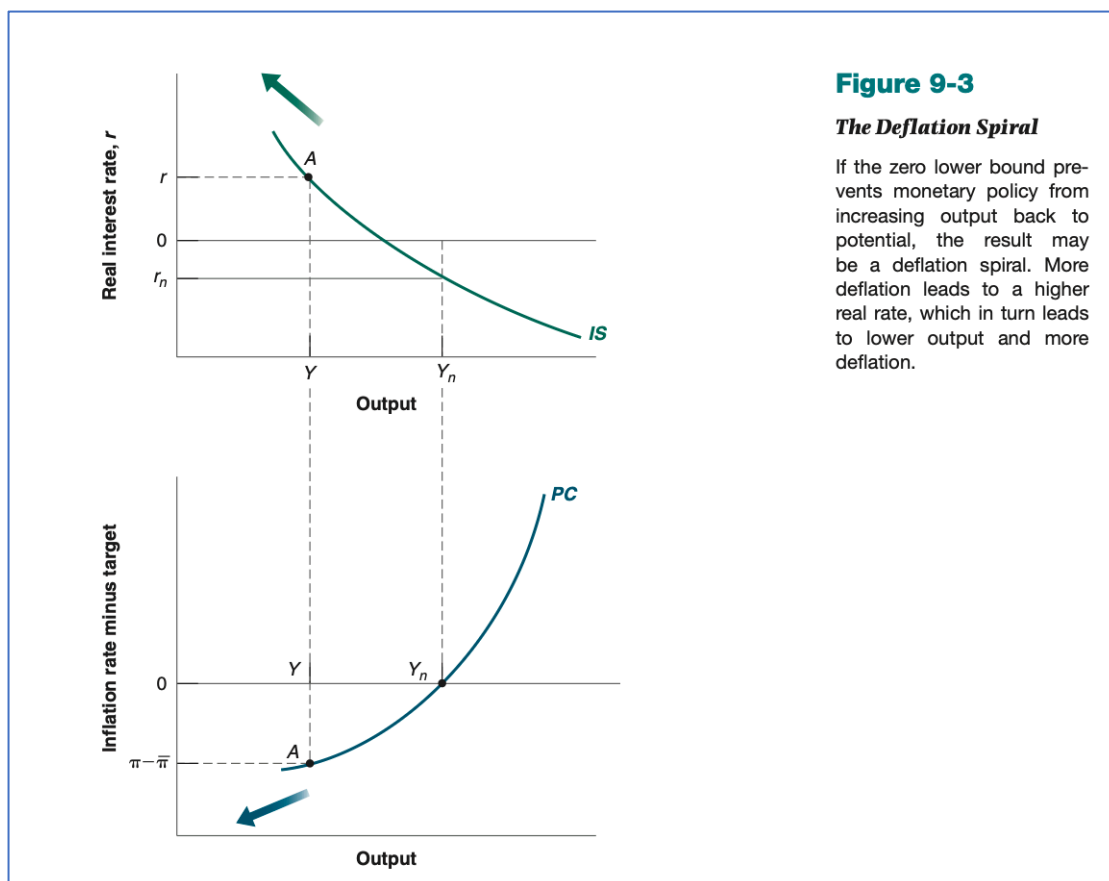
9.3 COMPLICATIONS AND HOW THINGS CAN GO WRONG

- It is difficult for the central bank to know where potential output is, and how far output is from potential.
- The change in inflation provides a signal about the output gap, but the signal is noisy.
- The central bank therefore wants to adjust the real rate slowly and see what happens.
- It takes time for the economy to respond to adjustments.

The zero lower bound and deflation spirals

- In figure 9-3, the economy is in recession, and there is a negative output gap, so inflation is lower than target inflation → it can imply negative inflation.
- The central bank should decrease the real rate.
- If the economy's is sufficiently depressed, the real rate may be very low, and even negative, but the **ZERO LOWER BOUND** make it impossible to achieve a negative real rate, because the lowest nominal rate monetary policy can achieve is 0%.
- If the central bank decreases the real rate [but not enough], thing may get worse, because the real interest rate will increase, and it will create a **DEFLATION SPIRAL**.

Figure 9-3

The Deflation Spiral

If the zero lower bound pre-vents monetary policy from increasing output back to potential, the result may be a deflation spiral. More deflation leads to a higher real rate, which in turn leads to lower output and more deflation.

9.4 FISCAL CONSOLIDATION REVISITED

- If government want to decrease deficit by implementing higher taxes, the mecha-nisms in the IS-LM-PC curve shows that the real interest rate needs to be lower to maintain potential output and expected inflation.
- Consolidation increases investment in the medium run.
- Fiscal consolidation can take place without a decrease in output in the short run.
- [The economy is in the medium run equilibrium.]
  - **Short run:** Taxes go up [or government spending goes down, or both], which decreases demand, and, through the multiplier, decreases output. The econ-omy contracts.
  - The IS curve shift to the left.
  - The policy rate is not affected in the short run.
  - The economy moves from A to A', which is a new short run equilibrium.
  - In A' both consumption and investment are lower than initially.
  - **Medium run:** Economy is below potential; inflation is below target → they need to act expansionary.
  - The central bank will react by decreasing the policy rate.

- o The policy rate will decrease the borrowing rate, a policy that will boost invest-ment, demand, and output.
- o We move along the new IS and the Phillips curves to the right. Move from A' to A''.
- o **Results:** Investment went down in the short run, but up in A'', because output is the same, but borrowing rate is lower.
- o Consumption is the same, if government spending is changed, consumption is changed, if taxes are increased.
- o If the economy is in medium run equilibrium, there is no incentive to make ex-pansionary monetary policy.

Figure 9-4

Fiscal Consolidation in the Short and the Medium Run

Fiscal consolidation leads to a decrease in output in the short run. In the medium run, output returns to potential, and the interest rate is lower.
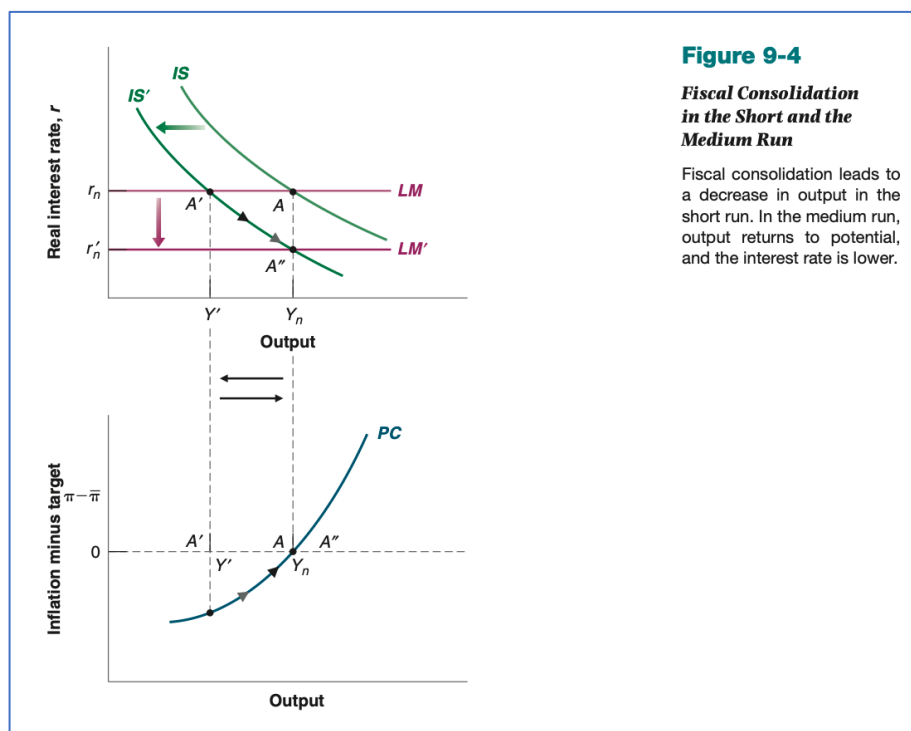
9.5 THE EFFECTS OF AN INCREASE IN THE PRICE OF OIL

- Output is produced using labor and other inputs such as energy.
- The increase of the oil price can be the markup of the price over the nominal wage.
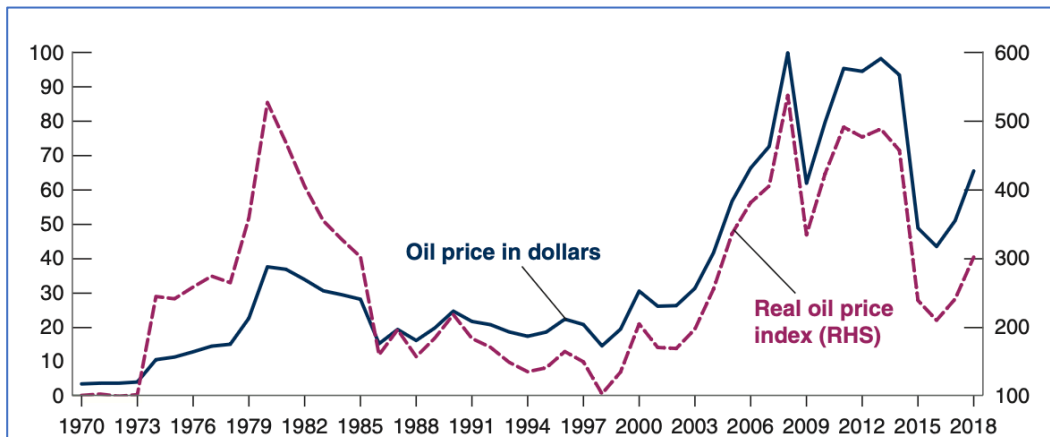
Figure 9-5

The Nominal and the Real Price of Oil, 1970–2018

Over the last 40 years, there have been two sharp increases in the real price of oil, the first in the 1970s and the second in the 2000s.

Effects on the natural rate of unemployment

- Because firms have to pay more for the oil, the wage they can pay is lower, which leads to an increase in unemployment.
- The decrease in the natural level of employment leads to an identical decrease in potential output.
- An increase in the price of oil → decrease in potential output.
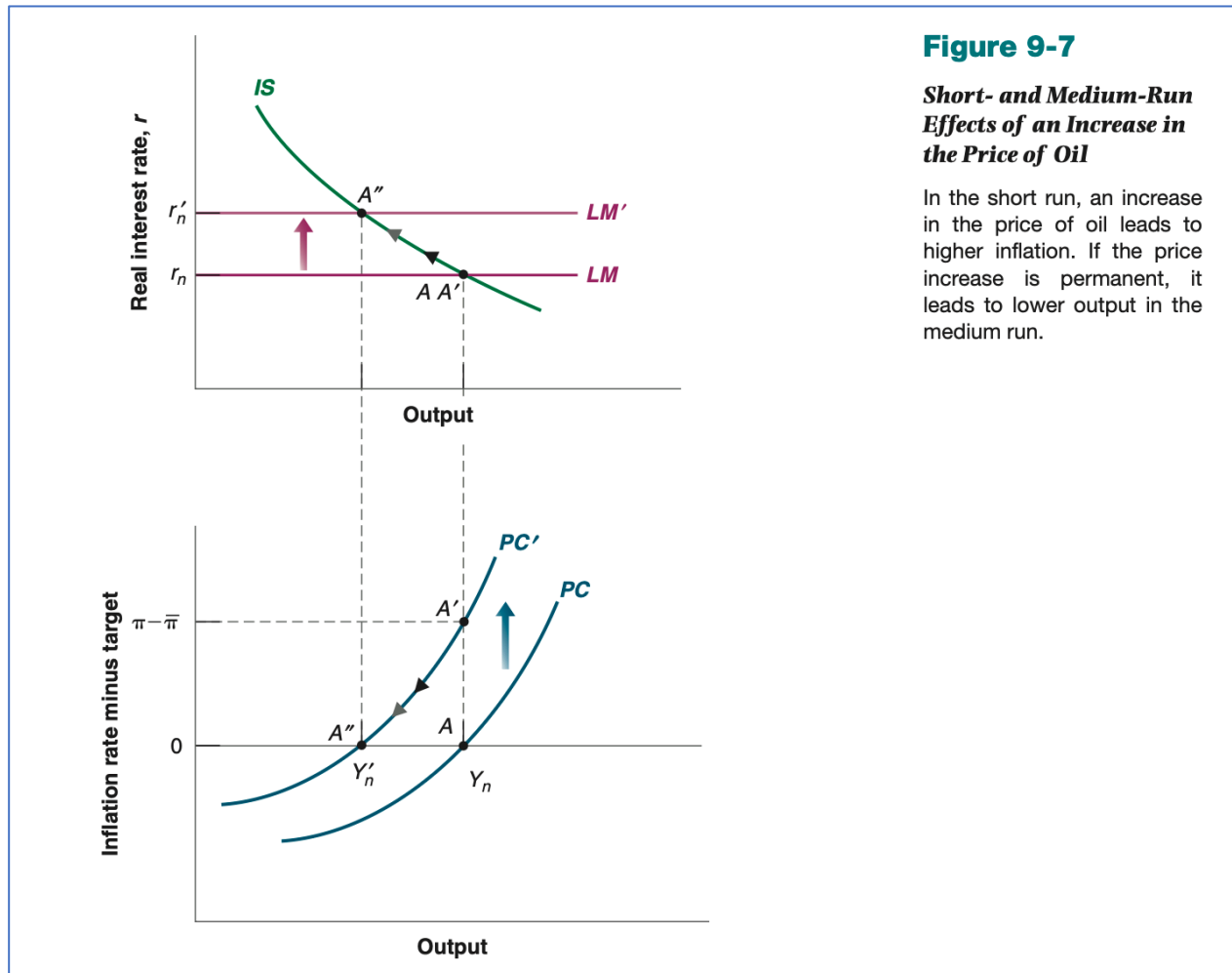

Figure 9-6

The Effects of an Increase in the Price of Oil on the Natural Rate of Unemployment

An increase in the price of oil is equivalent to an increase in the markup. It leads to lower real wages and a higher natural rate of unemployment.
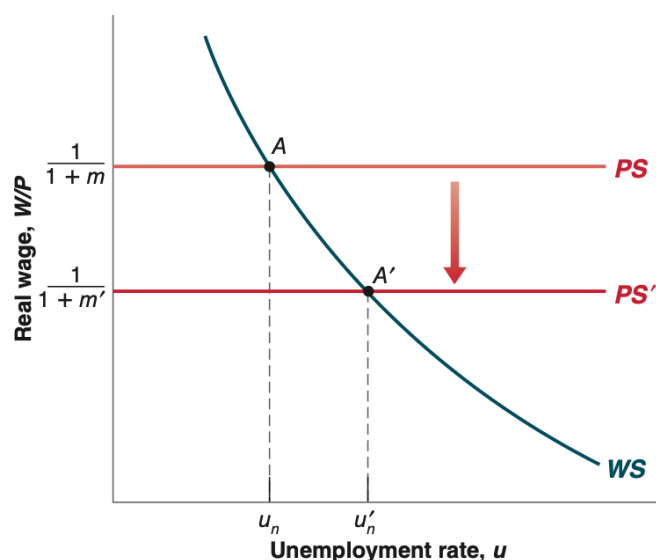
- The central bank must increase the real rate to rate to return inflation to target → A'' is the medium-run equilibrium.

- o Potential output is lower, so the increase in the price of oil is reflected as a permanent lower level of output.
- **STAGFLATION** [stagnation + inflation] means that lower output is associated with inflation higher than the target.
- A change in m or z will shift the Phillips curve → everything else is a shift in IS-LM.

Figure 9-7

Short- and Medium-Run Effects of an Increase in the Price of Oil

In the short run, an increase in the price of oil leads to higher inflation. If the price increase is permanent, it leads to lower output in the medium run.

9.6 CONCLUSIONS

The short run versus the medium run

- Shocks or changes in policy have different effects in the short run and in the medium run.
- If you worry about output and investment in the short run, you might be reluctant to proceed with fiscal consolidation.
- If the focus is on the medium and long run, consolidation is seen as helping investment and then increase output.

Shocks and propagation mechanisms

- **OUTPUT FLUCTUATIONS** [business cycles] is movements in output around its trend.
- The economy is constantly hit by **SHOCKS**.
    - Each shock has dynamic effects on output and its components, which is called **propagation mechanism** of the shock.
- **ECONOMIC FLUCTATIONS** are the result of the shocks and their dynamic effects on output.
- Typically, the economy returns over time to its medium-run equilibrium.

HOW LARGE IS RISK OF STAGFLATION IN THE EUROZONE

THE ECB'S RATE RISE DILEMMA

Topic 9: Exchange rate regimes in short and medium run

Chapter 20

20.1 THE MEDIUM RUN

- Under a **FLEXIBLE EXCHANGE RATE**, a country can rely on an expansionary monetary policy to achieve both a lower interest rate and a decrease in the exchange rate → a depreciation.
- Under a **FIXED EXCHANGE RATE**, the country has lost both instruments.
    - The exchange rate cannot be adjusted.
    - The fixed exchange rate, and the interest parity condition implies that the country could not adjust its interest either.
- In the medium run, the difference between fixed and flexible exchange rate disappears.
- In the medium run, the economy reaches the same real exchange rate and the same level of output in both fixed and flexible exchange rates.
- **THE REAL EXCHANGE RATE** is equal to the nominal exchange rate [the price of domestic currency in terms of foreign currency] times the domestic price level, divided by the foreign price level.
- The real exchange rate can adjust by:
    - A change in the nominal exchange rate [only flexible exchange rates] → only way to adjust in the short run.
    - Through a change in the domestic price level relative to the foreign price level. In the medium run, as prices adjust, the option is open to both flexible and fixed exchange rate regimes.

The IS relation under fixed exchange rates

- In an open economy with fixed exchange rates, the IS relation is written as → $Y = Y\left(\frac{\bar{E}P}{P^*}, G, T, i^* - \pi^e, Y^*\right)$
    - Output depends negatively on the real exchange rate → a higher real exchange rate implies a lower demand for domestic goods and in turn lower output.
    - Depends positively on government spending, and negatively on taxes.
    - Depends negatively on the domestic real interest rate.
    - Depends positively on foreign output through the effect on exports.

Equilibrium in the short and the medium run

- If the **EXCHANGE RATE IS TOO HIGH**, the **DEFICIT AND OUTPUT IS BELOW POTENTIAL**.
- Under a **FLEXIBLE EXCHANGE RATE**, the **CENTRAL BANK COULD SOLVE THE PROBLEM** be decreasing the interest rate, which would increase output.
- Under a **FIXED EXCHANGE RATE REGIME**, the **CENTRAL BANK CANNOT MOVE THE DOMESTIC INTEREST RATE**, and the trade deficit remains in the short run.
- **IN THE MEDIUM RUN, PRICES CAN ADJUST**.
    - When output is above potential, the inflation rate is higher than expected.
    - When output is lower than potential, the inflation rate is lower than expected.
- If domestic and foreign inflation rates are the same, when they are at potential output, then:
    - The domestic price level increases more slowly than the foreign price level, and the real exchange rate decreases, which increases net exports over time, which then increases inflation.
    - In the medium run, output is back to potential, and domestic inflation is back to foreign inflation.

The case for and against a devaluation

- If the government, while keeping the fixed exchange rate regime, allows for a **ONE-TIME DEVALUATION** [a decrease in the real exchange rate] it leads to a real depreciation in the short run, and therefore to an increase in output.
- When a country under fixed exchange rates faces either a large trade deficit or a severe recession, there is a political pressure to give up the fixed regime or to have an one-time devaluation.

20.2 EXCHANGE RATE CRISES UNDER FIXED EXCHANGE RATES

- Assumption: a country is operating under fixed exchange rate, but financial investors start believing there might soon happen either a devaluation or a shift to a flexible exchange rate and then depreciation. It might be due to:
    - The real exchange rate being too high. [The domestic currency is overvalued → large current account deficit.]
        - Overvaluation happens if a country pegs the normal exchange rate to the currency of a country with lower inflation.
    - Internal conditions may call for a decrease in the domestic interest rate

- o When financial markets believe a devaluation may be coming, then maintaining the exchange rate requires often a large increase in the domestic interest rate.
    - The government and central bank can try to convince markets that they have no intention of devaluing.
    - The central bank can increase the interest rate, but less by what is needed.
- A devaluation can happen even if the belief that a devaluation was coming was groundless.

20.3 EXCHANGE RATE MOVEMENTS UNDER FLEXIBLE EXCHANGE RATES

- The lower the interest rate, the lower the exchange rate.
- The relation between the interest rate and the exchange rate is more complicated → exchange rates often move even more in the absence of movements in interest rates.
- The exchange next year will depend on next year's one-year domestic interest rate, the one-year foreign interest rate, and the exchange rate expected for the year after.
- The level of today's exchange rate will move one-for-one with the future expected exchange rate.
- Today's exchange rate will move when future expected interest rates move in their country.
- Today's exchange rate moves with any change in expectations, so the exchange rate will be volatile, and move frequently by perhaps large amounts.

Exchange rates and the current account

- Any factor that moved the expected future exchange rate, also moves the current exchange rate.
- The effect of any change in the expected future exchange rate on the current exchange rate is one-for-one.

Exchange rates and current and future interest rates

- Any variable that causes investors to change their expectations of future leads to a change in the exchange rate today.

Exchange rate volatility

- When the central bank cuts the policy rate, financial markets have to assess whether this action signals a major shift in monetary policy and the cut in the interest rate is just the first of many cuts, or whether is just a temporary movement in interest rates.
- If the domestic interest rate is reduced, it can decrease the exchange rate by a lot or less → it depends on if the interest rate is expected to decline for one or more years.
- If the central bank decreases interest rates, and the actual decrease is smaller than anticipated, then investors will revise their expectations of future nominal interest rates **UPWARD** leading to an appreciation.

20.4 CHOOSING BETWEEN EXCHANGE RATE REGIMES

- Flexible exchange rates matter in the short run, but not in the medium run.
- In a country with fixed exchange rates, the anticipation of a devaluation leads investors to ask for high interest rates, which puts more pressure on the country to devalue.
- Flexible exchange rates are likely to fluctuate and be difficult to control through monetary policy.
- There is consensus that flexible exchange rates are preferable. But there are two exceptions:
    o When a group of countries are already tightly integrated.
    o When the central bank cannot be trusted to follow a responsible monetary policy under flexible exchange rates.

Common currency areas

- Countries that operate under a **FIXED EXCHANGE RATE REGIME** are constrained to have the **SAME INTEREST RATE**.
- If the countries face roughly the same macroeconomic problems and shocks, they would likely have chosen similar policies in the first place, so it may not be much of a constraint.
- To constitute an **OPTIMAL CURRENCY AREA [ROBERT MUNDELL]**:
    o Countries must experience **similar shocks**.
    o **Prices** and **wages** must be **very flexible**, if they do not face similar shocks, so they can regain competitiveness by decreasing prices relative to other members.
    o If they experience different shocks, they must have **high mobility**.
- Most economists believe that the common currency area composed of the 50 states of the US is close to an optimal currency area.

Hard pegs, currency boards, and dollarization

- There may be times when a country may want to limit its ability to use monetary policy.
- **HARD PEG** is when it is technical and symbolically harder to change the parity.
  - Replacing the domestic currency with a foreign currency → when it is the US dollar, it is called **dollarization**.
  - **Currency board** → central bank stands ready to exchange foreign currency for domestic currency at the official exchange rate set by the government.
    - Should only be used for a short period, until the central bank has reestablished its credibility and can return to a floating exchange rate regime.