

3 The price of Loanable Funds

Definition 19 *INTEREST RATE:*(r) Charge per dollar per period that borrowers pay or lenders receive.

What affects the interest rate:

- inflation.
- risk.
- taxes.

The real interest rate compensates lenders for delaying consumption. The lender must also be compensated for the fact that dollars that the borrower repays later buy less goods due to inflation.

$$\text{real } r = \text{nominal } r - \text{inflation rate} \quad (25)$$

The nominal rate is what is quoted in the newspapers and is in terms of dollars. The real rate measures what those dollars can buy. We care about real rates, not nominal rates.

Riskier assets receive a higher interest rate. Thus the lender demands an extra premium to account for the possibility of default.

Definition 20 *PRIME RATE:* the overnight interest rate for loans by banks to large firms.

Definition 21 *TBILL RATE:* the short term interest rate for loans by households to government.

Definition 22 *FEDERAL FUNDS RATE:* the overnight interest rate for loans by banks to other banks.

1. T-Bill rate: least risky. Low interest rate.
2. Fed Funds rate: more risky. Higher interest rate.
3. Prime rate: more risky. Higher interest rate.

Investments which are not taxed have a lower interest rate. Investors care only about the interest rate *after* taxes are paid.

$$\text{after tax rate} = r(1 - t) \quad (26)$$

Definition 23 *MUNICIPAL BOND RATE:* the interest rate for loans from households to state and local governments (tax free).

4 The market for loans

Increasing the budget deficit by cutting taxes reduces public savings but increases private savings. Overall savings and thus interest rates are unchanged.

Increasing the deficit by increasing government spending reduces public savings without affecting private savings. Overall savings fall and thus interest rates rise.

V The market for money

A What is money?

Definition 24 *MONEY is anything that fulfills 3 purposes:*

- *MEDIUM OF EXCHANGE: Members of the economy will accept money in exchange for goods and services.*
- *STORAGE OF VALUE: Can store wealth with money.*
- *UNIT OF ACCOUNT: Can use money as a numeraire good. Can give a price for all goods and services in terms of money.*

Money is best thought of as a medium of exchange rather than a store of value.

Alternative medium of exchange:

Definition 25 *BARTER: The exchange of goods for other goods.*

Money is a better medium of exchange than barter. Barter requires a double coincidence of wants. Money requires only a single coincidence.

Definition 26 *DOUBLE COINCIDENCE OF WANTS: a seller must find a buyer who wants the goods being sold, and at the same time has goods to exchange which the seller wants.*

Money is also better at providing liquidity than other assets.

Definition 27 *LIQUIDITY SERVICES: money allows a person to buy or sell on short notice.*

Other assets can be sold on short notice, but only at a bargain price.

B Types of Money

Definition 28 *FIAT MONEY has no value other than as money.*

Examples are paper money.

Definition 29 *COMMODITY MONEY has other uses.*

Examples are coins, gold, and cigarettes (in jails).

Definition 30 *IMPURE COMMODITY MONEY. Money that can be converted into something of value at a fixed price.*

Examples are currency boards and gold standard.

C Measuring the amount of money

What assets are money?

- cash and currency
- checking and savings accounts, money market accounts.
- travelers checks
- Credit cards are not money, but give you the right to spend someone else's money.

Measures of Money:

Definition 31 *M1 is the sum of all currency, travelers checks, and checkmaking accounts held by the the non bank public.*

Definition 32 *M2 is the sum of M1, savings deposits, money market accounts, and small time deposits.*

M1 is more liquid, but M2 items sometimes pay interest.

D The banking system and the creation of money

Definition 33 *The MONETARY BASE is the sum of currency held by the non bank public plus bank reserves.*

The economy creates more money from high powered money using the banking system. Banks allow depositors to write checks equal to their deposits, but at the same time loan out a fraction of the deposits. Thus the money supply exceeds the cash deposits.

Definition 34 *The REQUIRED RESERVE RATIO (rrr) is the percentage of deposits banks are required to hold by law at the Federal Reserve Bank.*

Calculate the money supply. Money supply is cash held by the public (CU) plus checking account balances (D):

$$M = CU + D \tag{27}$$

The public holds a fraction k of checking deposits as cash:

$$CU = kD \tag{28}$$

Banks are required to hold a fraction rrr of deposits in reserve:

$$BR = rrrD \tag{29}$$

The monetary base is currency held by the public plus bank reserves:

$$MB = CU + BR \tag{30}$$

Combining (27) and (28) gives:

$$M = (k + 1) D \tag{31}$$

Combining (29), (28), and (30) gives:

$$MB = (k + rrr) D \tag{32}$$

Dividing these last two equations results in:

$$\frac{M}{MB} = \frac{k + 1}{k + rrr} \tag{33}$$

The right hand side is the money multiplier:

$$\text{money multiplier} = \frac{k + 1}{k + rrr} \tag{34}$$

Definition 35 *The MONEY MULTIPLIER is the ratio of the total change in the money supply to a \$1 change in the monetary base.*

E The Federal Reserve System

Definition 36 *FEDERAL RESERVE BANK (FED): The central bank of the United States, which oversees the creation of money and regulates banks.*

The FED changes the amount of money in circulation in 3 ways:

- Required Reserve Ratio
- Discount Rate
- Open Market Operations

1 CREATING MONEY BY CHANGING THE REQUIRED RESERVE RATIO

By lowering the rrr, banks may loan out more money, which increases the money supply.

The required reserve ratio is rarely changed. Small changes in M are not possible and banks do not like daily changes in regulation.

2 CREATING MONEY BY CHANGING THE DISCOUNT RATE

Definition 37 *The DISCOUNT RATE is the interest rate paid by banks for overnight loans from the FED.*

When a bank borrows printed money from the FED, new money is added to the economy.

The FED is a lender of last resort to banks, since the Fed monitors banks it lends to very closely and will not let banks make risky loans. In addition, the FED has recently changed its policy to make the Discount rate higher than the Fed Funds rate. For these reasons, banks prefer to borrow from other banks.

The discount rate is not used for control of the money supply since it is imprecise. The discount rate is used instead by the fed as a signal of future and current monetary policies.

3 CREATING MONEY BY CONDUCTING OPEN MARKET OPERATIONS

In an open market operation, the FED buys something (usually tbills) with printed money. The printed money enters the economy. To remove money, the FED sells tbills.

This is an easy, precise, and low cost method. It is the most common method of adjusting the money supply.

4 MORE INFORMATION ON THE FED

- Somewhat politically independent, members are appointed by the president for 7 year terms.
- Monetary policy: Fed's desired M or r . LOOSE MONETARY POLICY: policy to increase M . TIGHT MONETARY POLICY: slowly growing or contracting M .
- The FED lends and borrows in the Fed funds market to control the Fed Funds rate.

F Velocity and Quantity Theory

1 Velocity

Definition 38 *Velocity (V) is the number of times a dollar is spent in a given period.*

Quantity Theory of Money: The number of dollars spent must equal the number of goods purchased.

$$MV = PY \tag{35}$$

So velocity is:

$$V = \frac{PY}{M} \tag{36}$$

2 Money and Inflation in high inflation countries

An increase in M results in some combination of an increase in P (inflation), an increase in Y , or a decrease in V .

In high inflation countries, money supply increases at a rate far in excess of Y and V . Thus M and P grow together.

Printing money is the primary cause of inflation. As more money is printed (increase in supply), the value of money falls. Equivalently, the price of money falls or equivalently more money is required to purchase goods. Thus prices are higher, or we have inflation.

Countries print large amounts of currency largely to buy goods and services.
The decrease in value of money imposes costs:

- Menu costs.
- Monetary confusion.
- Increased bating and costly credit arrangements.
- Money holders “pay” the tax.

VI Foreign Money: Foreign Exchange Market

A Trade: The exchange of goods across countries

The US pays foreigners for imports with dollars. Foreigners then use the dollars to buy US exports or US assets.

Foreigners pay for US exports with foreign currency. The US then uses foreign currency to buy US imports or foreign assets.

The process is indirect: typically the importers and exporters are different people.

If goods are exchanged for goods $X = M$ and trade is balanced. Effectively, the US has “produced” an imported good for the US consumer with the “inputs” that went into the US export.

If US assets are exchanged for US imports, $X < M$ and the US is running a trade deficit.

$$\text{Net Exports} = X - M \tag{37}$$

A TRADE DEFICIT is when $X < M$. A TRADE SURPLUS is when $X > M$.

B Savings, Investment, and trade

When $X < M$, foreigners are saving in the US. Thus the trade deficit adds to our savings pool.

$$S = Y - C - G = I + (X - M) \tag{38}$$

$$S + (M - X) = I \tag{39}$$

Definition 39 *CAPITAL INFLOWS: purchase of domestic assets by foreigners.*

Definition 40 *CAPITAL OUTFLOWS*: purchase of foreign assets by domestic investors.

Definition 41 *NET FOREIGN INVESTMENT*: purchase of foreign assets domestically less purchase of domestic assets by foreigners.

$$NFI = \text{outflows} - \text{inflows} \quad (40)$$

$$NFI = X - M \quad (41)$$

$$S - NFI = I \quad (42)$$

C The market for foreign exchange

Definition 42 *NOIMNAL EXCHANGE RATE (E)*: Price of domestic currency in terms of foreign currency.

$$E = \frac{\text{units of foreign currency}}{1 \text{ dollar}} \quad (43)$$

1 Strong versus weak currency

Definition 43 *CURRENCY APPRECIATION* the value of the currency increases in the sense that the currency buys more units of foreign currency.

Definition 44 *CURRENCY DEPRECIATION* is a decrease in the value of the currency.

As the dollar strengthens, the dollar buys more foreign currency and therefore more foreign goods. Thus M rises. Foreign currency also buys less US dollars and hence less US goods. Hence X falls. Net exports thus falls or the trade deficit rises.

A strong currency is bad for exporters and good for importers, but the increased savings in the US helps keep r down. Also low import prices help keep overall inflation down, especially in developing countries with big import sectors.

Conversely, a weak currency is good for exporters, but bad for importers, savings, interest rates, and inflation.

2 The Real Exchange Rate

Definition 45 *REAL EXCHANGE RATE* (e) is the rate at which domestic goods are exchanged for foreign goods.

$$e = \frac{P \cdot E}{P^f} = \frac{\text{Japanese baskets}}{\text{US basket}} \quad (44)$$

The real exchange rate is the value or price of US goods. What you can get in exchange for the US basket.

Definition 46 *PURCHASING POWER PARITY (PPP)*: The theory that prices of identical goods in different countries are the same when measured in the same currency.

PPP says $e = 1$, 1 US basket equals 1 foreign basket.

The nominal exchange rate adjusts to maintain equilibrium. How does the real rate appreciate?

1. Increased demand for dollars: US investments are more attractive, or US exports are more attractive.
2. Decreased supply of dollars: Imports are less attractive, Foreign investments are less attractive.

These are real effects, and so change the real exchange rate as well as the nominal rate.

Inflation causes a fall in the nominal rate but leaves the real rate unchanged.

Inflation reduces the value of the dollar in both domestic goods and foreign exchange markets.

D Trade and unemployment

Unemployment is caused by wage floors and not trade.

Employment and wages are affected by trade in several ways:

1. Moving factories overseas. Trade may cause US firms to locate factories overseas.
2. Import/Export gains. Importers and exporters may gain more jobs with increased trade.
3. Increased competitiveness. Domestic industries may become more competitive in the face of foreign competition.

4. Technological change. Technology may advance as businesses are exposed to foreign practices.
5. Intermediate goods effect. A tariff on intermediate goods may cause finished goods producers to move overseas.
 - US evidence: increased trade has resulted in lower unemployment.
 - Developing countries: liberalization is associated with lower unemployment.

PART II OF THE COURSE: AGGREGATE SUPPLY AND LONG RUN GROWTH

Long run growth in income per person is arguably the most important topic in all economics, if not all science. This is because countries with high incomes per capita have enough income to solve any important problem.

Small differences in growth rate can be the difference between a rich and poor country in a matter of two generations.

Income in some countries grows slowly or not at all.

I Determinants of Long Run Growth

Aggregate Demand is the relationship between total demand for real goods and services (real GDP) by consumers, firms, government, and foreigners and a price index.

Aggregate Supply is the relationship between the total value of all real goods and services (real GDP) produced in the economy and a price index.

Aggregate supply looks at real GDP from the production side (value added).

Aggregated demand looks at real GDP from the spending side (spending approach).

Aggregate demand is very volatile, and is thus a good place to look for explanations of booms and recessions.

Aggregate supply is less volatile, but grows steadily. Aggregate supply is thus a good place to look for causes of long run growth.

Let Y be production or real GDP or income, N be hours worked, K be capital, and T be technology. Then:

$$Y = f(N, K, T) \tag{45}$$

To increase income, N , K , or T must rise.

A Can Long Run Growth Result From Increased Hours Alone?

Hours worked on an individual basis does not change much. But populations grow and so total hours also grows. Additionally, the percent of the population working tends to grow as retirees work more and women work more.

Definition 47 Diminishing Returns to Labor: *successive increases in the use of labor input results in a decline in additional production per unit of labor.*

Therefore, population increases alone cannot account for the long run growth of output, especially output per person.

B Can Long Run Growth Result From Increases in Capital Alone?

Definition 48 Diminishing Returns to Capital: *successive increases in the use of capital input results in a decline in additional production per unit of capital.*

Therefore, capital increases alone cannot account for long run growth.

C Can Long Run Growth Result From Balanced Growth?

1 Balanced Growth

Definition 49 Balanced Growth: *Capital and Labor Inputs grow together*

Suppose capital grew at a faster rate than labor. Then after some time, many more machines would exist than workers. Adding an extra machine would not be smart, no one would be around to operate it. Starting a new business would be a mistake. Existing workers would be in such demand that wages would be really high, making it difficult to make money. So capital growth would slow until labor growth catches up.

Suppose that labor grew faster than capital. Then many more workers would exist than machines. Such workers would be willing to work for very low wages, since most would be unemployed. This would be an attractive time to add a new machine or start a new business. Labor costs are low so it would be easy to make money. In this way, capital would grow faster than labor until the capital growth caught up.

Less developed countries should have low K , high N , low wages, capital inflows, and should grow fast.

Developed countries should have high K , low N , high wages, capital outflows, immigration from less developed countries, and should grow more slowly.

Thus poor countries should grow faster than rich countries.

2 Catch up Hypothesis

Definition 50 Catch up Hypothesis: *Less developed countries should grow faster than developed countries*

3 Evidence for and against Catch up

- Japan, Germany post WWII.
- US States after Civil War.
- Developed countries since 1960.

- No global evidence.

4 Can Balanced growth account for sustained growth in GDP?

Can account for growth in income but not income per capita. To increase Y/N , must increase capital per worker or K/N .

D Technology

Definition 51 Technology *is anything that raises the amount of output that is produced from a given amount of capital and labor.*

1 Types of Technical Change

Types of technological change:

- **INVENTION:** Discovery of new knowledge. Does not exhibit diminishing returns. Computer.
- **INNOVATION:** Applications of new knowledge in a way that increases production. May exhibit diminishing returns. Faster chip.
- **LEARNING BY DOING:** By repeating a task, workers become more proficient. May exhibit diminishing returns. Learning to use a computer.

Technology can decrease.

- Bad weather decreases crop output despite same capital and labor.
- Government problems: Government may subsidize inefficient technologies (eg. airlines).

Technical change is best thought of as an increase in Y with the same K and N rather than as an invention.

2 Possible sources of growth in GDP per capita

Two possibilities: balanced growth in which capital and hours grow together, and technology growth.

E Growth Accounting

GROWTH ACCOUNTING FORMULA Tells how much of long run growth is due to increases in capital, total hours, and technology.

There are two versions:

1 Total Real GDP

$$\text{growth rate, GDP} = \frac{1}{3}(\text{growth rate, capital}) + \quad (46)$$

$$\frac{2}{3}(\text{growth rate, total hours}) + \text{growth rate, technology} \quad (47)$$

For each \$1 of capital owned by an individual in the US, we see about \$0.33 in income. Hence the coefficient.

The fractions weight the impact of changes in K , N , and T on changes in Y .

2 Real GDP per worker

$$\text{growth rate, GDP per worker} = \frac{1}{3}(\text{growth rate, capital per worker}) + \quad (48)$$

$$\text{growth rate, technology} \quad (49)$$

$$\text{Contribution: } T = \frac{g_T}{\text{growth rate, } Y} \quad (50)$$

$$\text{Contribution: } K/N = \frac{\frac{1}{3} \cdot \text{growth rate, } K/N}{\text{growth rate, } Y} \quad (51)$$

II Government Policies to Encourage Growth

Two types of technical change:

Definition 52 *Embodied technical change is technical change that occurs through improvements in labor or capital.*

Definition 53 *Disembodied technical change requires no labor or capital.*

We can encourage growth by subsidizing new capital, which increases both K/N and T since new capital embodies the latest technology or by subsidizing technology embodied in labor, or by subsidizing disembodied technical change.

A Encourage growth by subsidizing human capital

Subsidize labor-embodied technical change.

1. College loans and other school subsidies. An increase of 2.5 years of school equals a 1% increase in the economic growth rate.
2. Government sponsored training programs.
3. Improve school quality.
4. Improve life expectancy. Increasing life expectancy causes workers to invest in more training and education, since they will have many years of life to reap the benefits of their investment. An increase of 12.5 years of life expectancy equals a 1% increase in growth rate.

B Encourage growth by subsidizing new capital

Subsidize new capital embodied with the latest technology.

1. Lower or eliminate taxes on capital: profits taxes, capital gains taxes, dividend taxes.
2. Investment incentives for firms such as depreciation allowances and other tax credits.
3. Protect private property (property rights).
 - (a) Looting. Destruction or theft of business property.
 - (b) Clear Titles. Clearly owned property can be used as collateral for loans to start a new business.
 - (c) Eliminating restrictive zoning rules.
 - (d) Restrict Eminent Domain. Cannot take public property for private use without compensation.
 - (e) Reduce Crime.
4. Reduce regulation for starting a new business.
5. Eliminate subsidies for inefficient firms.

6. Improve functioning of credit markets. Make it easier to get loans to start new businesses.
7. Reduce Government Consumption. Government consumption requires taxes on productive workers and firms.

C Encourage growth by subsidizing new Disembodied Technical Change

These include:

1. Government sponsored R&D.
2. Tax credits for private R&D.
3. Patent protection. Problem: granting a monopoly may discourage innovation by the monopolist.

III Potential GDP and the Business Cycle

Definition 54 *POTENTIAL GDP is the economy's long run growth trend for real GDP.*

Definition 55 *The BUSINESS CYCLE are short term deviations of GDP from potential GDP.*

Real GDP fluctuates above and below potential. Thus N , K , and/or T must fluctuate above or below their normal growth rates.

A Total hours

The total population grows steadily, but total hours fluctuate:

- Cyclical unemployment. As we saw earlier, demand for labor rises in a boom and thus unemployment falls.
- Fluctuations in hours per person. Demand for labor can raise the real wage and thus increase hours. About 2/3 of hours fluctuations is due to the EXTENSIVE MARGIN: retirees and others not participating will jump in if wages are good enough. 1/3 is due to the INTENSIVE MARGIN. People working overtime and the like.

B Capital

The capital stock grows steadily, but utilization rates fluctuate.

Definition 56 *CAPACITY UTILIZATION is the percent of capital being used.*

Capacity rises in booms and falls in recessions.

C Technology

Technology may also rise and fall.

Definition 57 *REAL BUSINESS CYCLE THEORY (RBC) attributes booms and recessions to changes in technology.*

Criticisms of RBC:

1. 'Loss' of technology is difficult to understand. Do hurricanes really reduce output? Hurricanes might have too small of an effect to really change economy wide real GDP.
2. Technology grows too smoothly to account for all of the short run business cycle volatility.

IV Potential GDP and Inflation

A change in inflation does not affect N , K , or T and thus does not affect the long term growth rate.

Substitution effects: As the price of tomatoes rises, firms stop producing carrots and produce more tomatoes (increased supply). On the other hand, consumers demand less tomatoes and start consuming carrots. In macro, there are no substitution effects. A price increase is typically an increase in the price of all goods, one cannot substitute to another good that is lower priced.

PART III OF THE COURSE: AGGREGATE DEMAND AND BUSINESS CYCLES

I Sources of Aggregate Demand

Definition 58 *AGGREGATE DEMAND (AD): is the relationship between real GDP demanded and inflation*

Aggregate demand is different than micro demand. No substitution effects. All goods are in the GDP. Thus when the price of tomatoes goes up and we buy carrots, the GDP is unchanged and aggregate demand does not fall.

Sources of AD:

$$Y = C + I + G + X - M \quad (52)$$

A Consumption Demand

Definition 59 *CONSUMPTION: Purchase of finished goods and services by households.*

1 Income and Consumption Demand

Let us think of a as consumption of those with no income. Even broke people eat something. We consume b units for each dollar of income.

$$C = a + bY \quad (53)$$

Definition 60 *The marginal propensity to consume (MPC) is the fraction of income spent on consumption.*

The MPC may also be calculated via the slope formula:

$$MPC = b = \frac{\Delta C}{\Delta Y} \quad (54)$$

2 Taxes and Consumption Demand

In reality consumption depends on DISPOSABLE INCOME (Y^D): Income after all taxes and transfers.

$$Y^D = Y - T + TR \quad (55)$$

$$C = a + bY^D \tag{56}$$

3 Interest Rates and Consumption

The income not used for consumption is saved. As interest rates rise, consumers save more and consume less.

4 The Spending Balance

An increase in C causes an increase in income for someone via:

$$Y = C + I + G + X - M \tag{57}$$

We also know that an increase in Y generates an increase in C via the consumption function:

$$C = a + bY^D \tag{58}$$

So an increase in C results in an increase in Y which results in an increase in C

Mathematically:

$$Y = \frac{1}{1-b} (a + I + G + X - M) \tag{59}$$

So to compute the final change in income from a change in spending, multiply by $\frac{1}{1-b}$.

A change in spending generates a much bigger effect on spending, as the change in income generates further changes in spending.