ECON 101B: 00 - 06

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Contents

Chapter 1

00 - Measurement

1.1 Gross Domestic Product (GDP)

Definition 1.1.1: GDP

Market value of all final goods and services produced within a country in a given period of time.

Key Elements:

- *Market Value*: use prices for cross-good comparisons
- *Final*: no intermediate goods
- *Goods & Services*: foods and haircuts...
- *Produced*: no re-sales counted
- *Within a country*: Toyota plant in US is US GDP

$$GDP_t = P_{1,t}\, Q_{1,t} + P_{2,t}\, Q_{2,t} + \cdots + P_{N,t}\, Q_{N,t} = \sum_{j=1}^{N} P_{j,t}\, Q_{j,t}$$

GDP is also the sum of the incomes in the economy during a given period, including

- *labor* income
- *capital* income
- *indirect taxes*

But GDP can go up when either prices or output rise, so we can construct another measure that reflects only production changes: real GDP.

- ***Nominal GDP*** is GDP measures in current dollars
- ***Real GDP*** is GDP measures in constant dollars

Lemma 1.1.2: Computing Real GDP

1. Pick a base year (say 1996).
2. Calculate nominal GDP that year: $GDP_{1996,1996} = \sum_{j=1}^{N} P_{1996,j}\, Q_{1996,j}$
3. Calculate GDP for other years using 1996 prices:

$$GDP_{1997,1996} = \sum_{j=1}^{N} P_{1996,j}\, Q_{1997,j}$$

$$GDP_{1998,1996} = \sum_{j=1}^{N} P_{1996,j}\, Q_{1998,j}$$

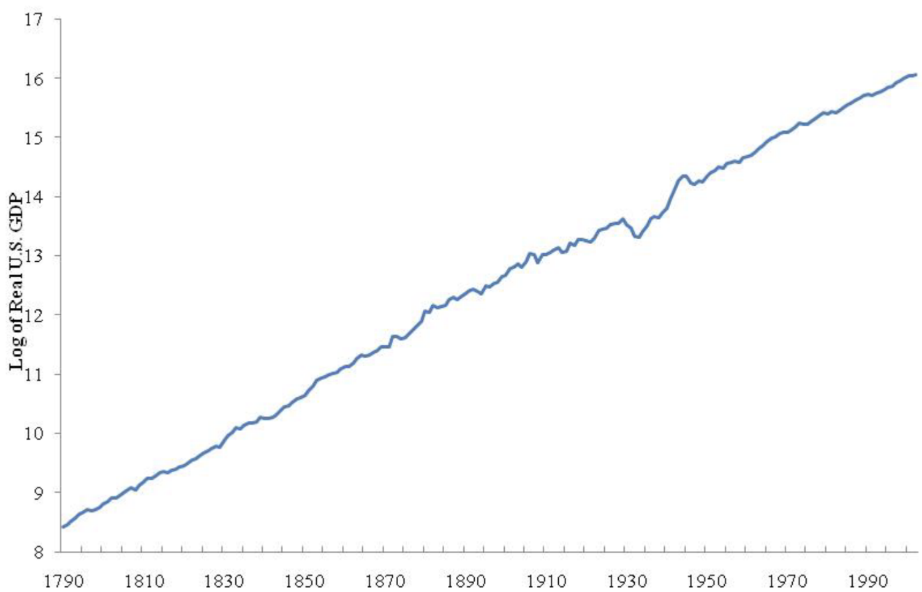


Figure 1.1: Historical U.S. Real GDP

1. **Growth Theory** addresses the fact that Real GDP keeps going up over time:
   - Average annual growth rate: 3.6% a year, 2% of which is population
   - Income today is more than **30 times** higher than in 1790.
2. **Business Cycle** analysis addresses the cyclical fluctuations in Real GDP about the long-run trend.

1.2 Unemployment

The *labor force* is the total number of workers, including both the employed and the unemployed.

The *unemployment rate* is calculated as the percentage of the labor force that is unemployed:

$$\text{Unemployment rate} = \frac{\text{Number unemployed}}{\text{Labor Force}} \times 100$$

1.2.1 Employment-Population Ratio

If we are concerned about *discouraged workers* leaving the labor force and affecting unemployment rates, we look at the employment-population ratios.

1.3 Measuring Prices

1. Approach 1: ***GDP Deflator***
   Tells us what portion of the rise in nominal GDP is attributable to a rise in prices rather than a rise in the quantities produced.

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

   The only problem with calculating with GDP Deflator is that prices change each period, so old prices will become outdated.

2. Approach 2: ***Consume Price Index (CPI)***

   Definition 1.3.1: CPI

   A measure of the overall cost of the goods and services bought by a typical consumer.

   Methodology:

   (a) *Fix the basket.* Determine what prices are most important to the typical consumer.

   (b) *Find the prices.* Find the prices of each of the goods and services in the basket for each point in time.

   (c) *Compute the basket's cost.* Use the data on prices to calculate the cost of the basket of goods and services at different times.

   (d) Choose a base year and compute the index.

   $$\text{CPI} = \frac{\text{Price of basket of goods and services}}{\text{Price of basket in base year}} \times 100$$

1.3.1 National Income Accounting Identity

Lemma 1.3.2: Computing GDP (Y)

In computing GDP itself, we use the common, well-known formula:

$$Y = C + I + G + NX$$

where

- Y is GDP
- C is Consumption
- I is Investment
- G is Government
- NX is Net Exports

1.4 Business Cycle

What is a business cycle?

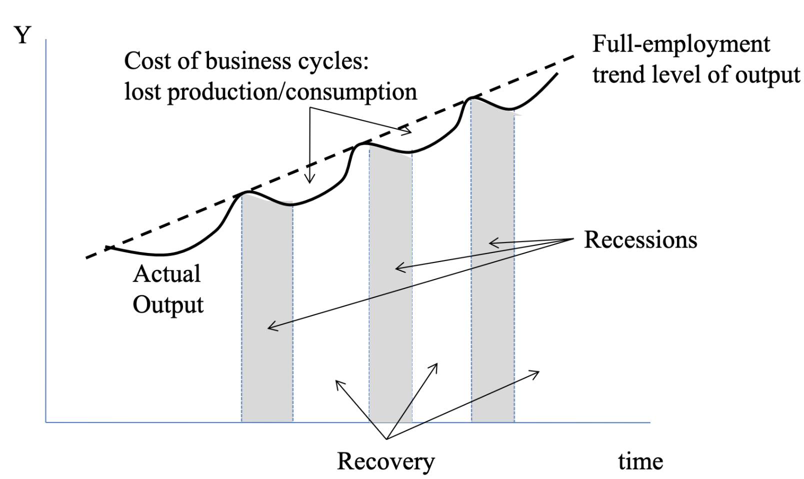


Figure 1.2: A traditional business cycle

1.5 Recessions

How the National Bureau of Economic Research (NBER) identifies U.S. recessions:

"We identify a month when the economy reached a peak of activity and a later month when the economy reached a trough. The time in between is a recession, a period when the economy is contracting. The following period is a expansion. Economic activity is below normal or diminished for some part of the recession and for some part of the following expansion as well."

Some Simple Stylized Facts:

- Recessions are varied in length and depth.
- Recessions are unpredictable.
- Recessions are becoming less frequent.

What happens during a recession?
By averaging across all post-WWII recessions, we identity several variables:
Key things to look for:

- Co-movement of variables (pro-cyclical vs. counter-cyclical)
- Lead-lag patterns

Key variables we care about:

- Real GDP
- Prices
- Unemployment
- Consumption & Investment
- Interest Rates
- Real wages

Visually, we can see this "pattern" reflected in GDP, CPI, industrial production, etc.:

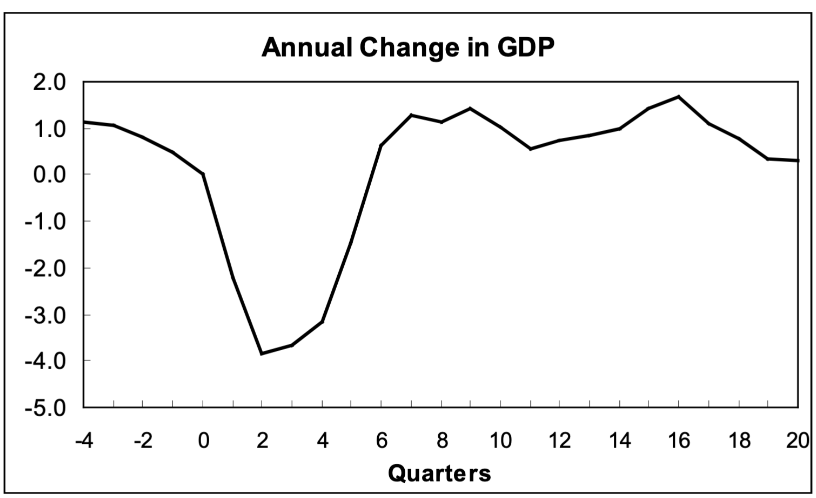


Figure 1.3: Growth rate of GDP relative to growth rate at time 0 (start of recession)

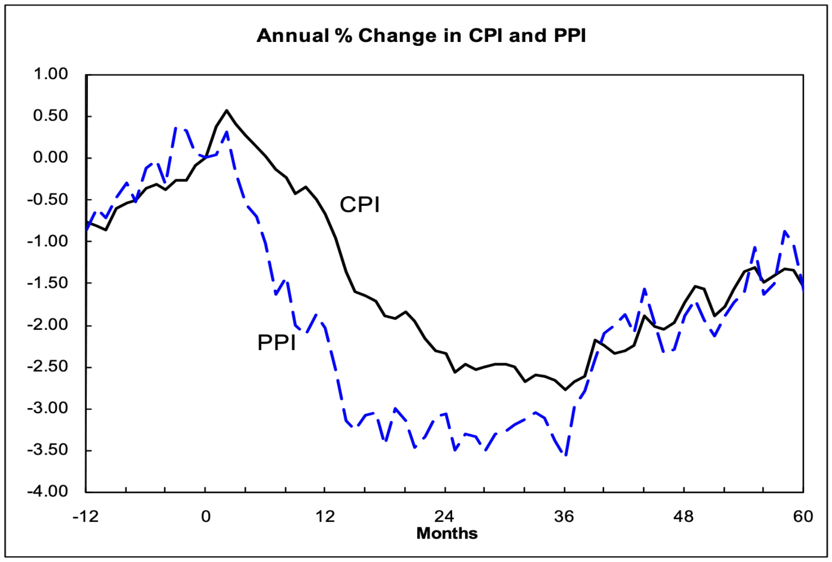


Figure 1.5: Growth rate of Prices relative to growth rate at time 0 (start of recession)

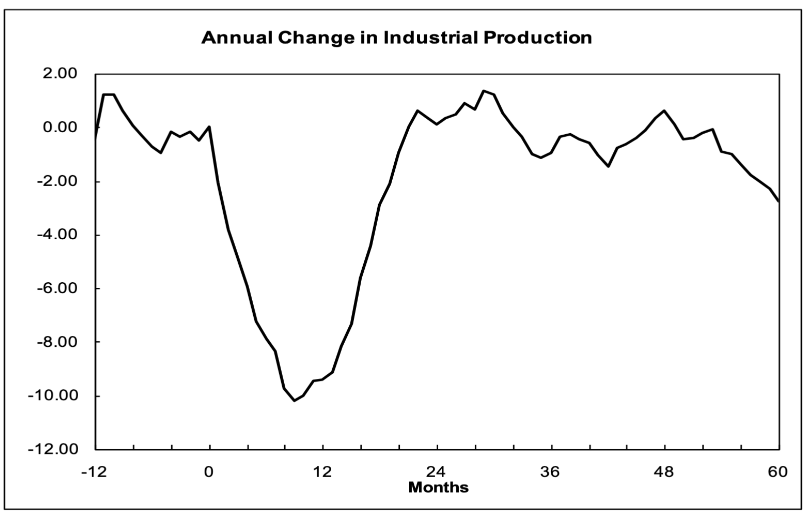


Figure 1.4: Growth rate of Industrial Production relative to growth rate at time 0 (start of recession)

Ultimately, during a recession, the following occurs:

1. Real GDP growth declines.
2. Inflation is rising before recessions, but falls rapidly during recessions.
3. Consumption and investment decline. The decline in consumption is particularly due to durables. The decline in investment begins with the residential sector.
4. Interest rates rise before the recession, but fall rapidly during a recession.
5. Unemployment goes up about 2 percentage points, and declines slowly.

6. Real wages decline.

Chapter 2

01 - Consumption Theory

2.1 Consumer's Problem

The objective is to maximize utility subject to constraints.

$$U(c_1, c_2) = \mu(c_1) + \beta\mu(c_2)$$

where

- c_t is consumption at time t
- β is the discount factor
- $\mu(c)$ is the instantaneous utility from consuming c.
- $U(c_1, c_2)$ is total utility.
- Only two periods
- Endowments (income) y_1 and y_2
- Borrow/lend freely at interest rate $1 + r$

More consumption is always better: $c_1 > c_2 \Leftrightarrow \mu(c_1) > \mu(c_2)$.
We move on to the diminishing marginal utility of consumption: $MU(c)$.

Definition 2.1.1: $MU(c)$

$MU(c)$ is the extra utility from one more unity of consumption, or $\frac{du(c)}{dc}$.

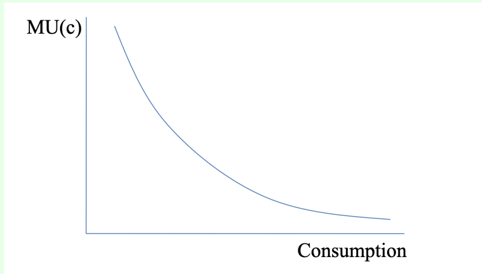


Figure 2.1: $MU(c)$ compared to Consumption

Implications of Diminishing $MU(c)$: Suppose you have three choices:

1. 2 large pizzas for lunch, none for dinner
2. 1 large pizza for lunch, one for dinner
3. Nothing for lunch, 2 large pizzas for dinner

Typically, consumers will choose 2, since consumers generally prefer mixes. How do we solve this problem?

2.1.1 Solving the Maximization Problem

1. ***Tangency Condition***
   (a) Consume one more unit at time 1 yields
   $$MU(c_1)$$
   (b) Save that unit, earn interest and consume at time 2 yields
   $$\beta(1+r) \cdot MU(c_2)$$
   $$MU(c_1) = \beta(1+r)MU(c_2)$$
2. ***Intertemporal budget constraint (ITBC)***
   Two budget constraints
   $$t = 1 : c_1 + s_1 = y_1 \tag{2.1}$$
   $$t = 2 : c_2 = y_2 + s_1(1+r) \tag{2.2}$$
   These collapse to the *Intertemporal Budget Constraint*
   $$c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r}$$

However, the present discounted sum of consumption must equal the present discounted sum of income.

2.1.2 Solving for the Consumption Function

- Assume $MU(c) = \frac{1}{c}$
- The tangency condition reduces to

$$c_2 = \beta(1 + r)c_1$$

- Plugging this into the ITBC yields the ***consumption function***

$$c_1 = \frac{1}{1+\beta}(y_1 + \frac{y_2}{1+r})$$

- If $\beta = 1$, then this simplifies to

$$c_1 = \frac{1}{2}(y_1 + \frac{y_2}{1+r})$$

2.1.3 Solving for the Saving Function

- Consumer's saving in the first period is

$$s_1 = y_1 - c_1$$

- The ***saving function*** is therefore

$$s_1 = y_1 - \frac{1}{1+\beta}(y_1 + \frac{y_2}{1+r}) \quad (2.3)$$

$$= \frac{\beta}{1+\beta}y_1 - (\frac{1}{1+\beta})\frac{y_2}{1+r} \quad (2.4)$$

Note that

$$r \uparrow \Rightarrow s \uparrow \quad (2.5)$$

$$y_1 \uparrow \Rightarrow s \uparrow \quad (2.6)$$

$$y_2 \uparrow \Rightarrow s \downarrow \quad (2.7)$$

Example.

> Endowment: $y_1 = 1, y_2 = 0$. Discount factor $\beta = 1$. Interest rate $1 + r = 1$. $MU(c) = \frac{1}{c}$.
> This means that the tangency condition is $c_2 = \beta(1 + r)c_1 = c_1$.
> The ITBC, therefore, is $c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r} \Rightarrow c_1 + c_2 = 1$
> Combining them and solving for consumption
>
> $$c_1 = c_2 = \frac{1}{2}$$
>
> The consume allocates consumption evenly over the two periods: this is also known as ***consumption smoothing***.

2.2 Permanent Income Hypothesis

Suppose income has two components:

- *permanent* component y^p
- *cyclical* (or transitory) component y^c_t.

This means that income at time t is given by

$$y_t = y^p + y^c_t$$

Then, the consumption function becomes

$$c_1 = y^p + \frac{1}{T}[y^c_1 + y^c_2 + \cdots + y^c_T]$$

An increase in permanent income rises consumption *one-for-one*: ***the marginal propensity to consume (mpc) out of a change in permanent is one.***
A temporary increase in income raises consumption very little: ***the marginal propensity to consume (mpc) out of a transitory change in income is very small(***$\frac{1}{T}$.

2.2.1 Aggregating Across Consumers

- Two types of agents: A and B
- Number of agents: N_A and N_B
- Endowments: (y^A_1, y^A_2) and (y^B_1, y^B_2)
- Total income each period: $Y_1 = N_A\, y^A_1 + N_B\, y^B_1$
- Agent i has consumption function:

$$c^i_1 = \frac{1}{1+\beta}(y^i_1 + \frac{y^i_2}{1+r}$$

- Therefore, the ***aggregate consumption function*** is:

$$C = N_A\, c_1^A + N_B\, c_1^B = \frac{1}{1+\beta}(Y_1 + \frac{Y_2}{1+r})$$

2.2.2 Implications of Permanent Income Hypo.: Effect of tax cuts

Suppose consumers have to pay taxes τ_t each period.
The ITBC (same assumptions as for PIH $(1+r=1)$) is then:

$$c_1 + c_2 + \cdots + c_T = (y_1 - \tau_1) + (y_2 - \tau_2) + \cdots + (y_T - \tau_T)$$

Given same tangency condition ($\beta = 1, 1+r = 1$, this yields:

$$c_1 = \frac{1}{T}[(y_1 - \tau_1) + (y_2 - \tau_2) + \cdots + (y_T - \tau_T)]$$

- Consider a ***temporary*** decrease in taxes of $\Delta\tau_1 < 0$, then:

$$\Delta c_1 = -\frac{1}{T}\Delta\tau_1$$

- Consider a ***permanent*** decrease in taxes of $\Delta\tau_1 < 0$ for all periods, then:

$$\Delta c_1 = \frac{1}{T}[-\Delta\tau - \Delta\tau - \cdots - \Delta\tau] = -\Delta\tau$$

2.3 Random Walk Hypothesis

Let's add uncertainty to the model:

- Income next period is a random variable, so second period consumption is not known with certainty.

- Utility is given by

$$U(c_1, c_2) = \mu(c_1) + \beta E[\mu(c_2)]$$

  where $E(x)$ is the ***expected value*** of x.

- So the tangency condition is now:

$$MU(c_1) = \beta(1+r)E[MU(c_2)]$$

- Suppose $MU(c) = \frac{1}{c}$, then the tangency condition is:

$$\frac{1}{c_1} = \beta(1+r)E[\frac{1}{c_2}]$$

- For simplicity, let $\beta(1+r) = 1$. Then,

$$\frac{1}{c_1} = E[\frac{1}{c_2}]$$

which is approximately:

$$E[c_2 - c_1] \approx 0$$

Changes in consumption should be completely unpredictable!

Testing the Theory:

- *Bob Hall (1978)*: stock prices weakly predict changes in consumption.
- *Campbell and Mankiw (1989)*: predictable changes in income are correlated with changes in consumption.
- *John Shea (1995)*: union workers increase consumption when their income rises, as previously agreed upon in contracts.
- *Johnson, Parker, and Souleles (2004)*: most people who received \$300 tax rebates from 2001 tax cut spent all the money.
- *Hsieh (2003)*: Alaskans smooth large fluctuations in income from the Alaska permanent fund

What could make the theory fail?

- Non-rational behavior: agents live "hand-to-mouth" and spend all their income.
- Some agents don't have access to credit markets: hence their consumption equals their income.
- Liquidity constraints, i.e. limited borrowing.
- Shocks have to be sufficiently large to induce agents to "re-optimize"

2.3.1 Our Aggregate Consumption Function

The theory predicts that aggregate consumption C is given by:

$$C = \frac{1}{1+\beta}\left(Y_1 + \frac{Y_2}{1+r} + \frac{Y_3}{(1+r)^2} + \cdots\right)$$

Equivalently, consumption depends on permanent income and the interest rate:

$$C = C\left(\text{PermanentIncome}, r^-\right)$$

However, empirical evidence suggests that current income has a disproportionate effect on consumption. Therefore, a more general consumption function is:

$$C = C\left(Y - T, \text{PermanentIncome}, r^-\right)$$

Permanent income is the *expected* sum of current and future income. Consumer sentiment (CS) is used as a proxy:

$$C = C\left(Y - T, CS, r\right)$$

2.4 Endowment Economics

Consider an economy with different types of agents $A, B, C, \ldots$ with endowments $(y_1^A, y_2^A, \ldots), (y_1^B, y_2^B, \ldots)$. Total income each period is:

$$Y_i = N_A y_1^A + N_B y_1^B + \ldots$$

The goal is to solve for equilibrium consumption, saving allocations, and the equilibrium interest rate. How?

1. Solve for consumption and savings functions for each type of agent, conditional on income and interest rate.
2. Use a market-clearing condition to solve for the interest rate.
3. Given the equilibrium interest rate, solve for actual equilibrium consumption allocations.

Two equivalent market-clearing conditions:

- Goods Market Clearing Condition: $Y = C$
- Savings Market Clearing Condition: $S = 0$

Example.

For one type of agent with endowment (y_1, y_2) and $MU(c) = 1/c$
Part 1: Consumption and Saving Functions:

- Tangency condition: $c_2 = \beta(1+r)c_1$
- ITBC: $c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r}$
- Consumption Function: $c_1 = \frac{1}{1+\beta}\left(y_1 + \frac{y_2}{1+r}\right)$
- Saving Function: $s_1 = y_1 - c_1 = \frac{\beta}{1+\beta} y_1 - \left(\frac{1}{1+\beta}\right)\frac{y_2}{1+r}$

Part 2: Market-Clearing Conditions:

- Goods Market: $Y = C \Rightarrow y_1 = c_1 \Rightarrow 1 + r = \frac{y_2}{\beta y_1}$
- Savings Market: $S = 0 \Rightarrow 1 + r = \frac{y_2}{\beta y_1}$

Part 3: Solve for Equilibrium Consumption/Saving Allocations: Given the equilibrium interest rate $1 + r = \frac{y_2}{\beta y_1}$:

$$c_1 = y_1, \quad s_1 = 0$$

2.5 Ricardian Equivalence

Introduce government spending G_1, G_2 and taxes T_1, T_2. The government's budget constraints are:

$$G_1 + S_1^G = T_1, \quad G_2 = T_2 + S_1^G(1+r)$$

The consumer's ITBC is:

$$c_1 + \frac{c_2}{1+r} = y_1 - T_1 + \frac{y_2 - T_2}{1+r}$$

The consumption function is independent of taxes and government borrowing. The market-clearing condition depends only on income, government spending, and consumption. Therefore, the equilibrium interest rate is also independent of taxes.

Ricardian Equivalence implies that the equilibrium consumption levels and real rate of return are independent of the choice of government financing.

Chapter 3

03 - Investment Theory

3.1 Investment Theory

3.1.1 What is Investment?

Definition 3.1.1: Investment

The purchase of physical durable items (capital) to be used in the process of production. Examples include factories, machinery, transportation equipment, electronics, and software.

3.1.2 Properties of Capital (K)

Definition 3.1.2: Capital

Capital is durable and subject to a rate of depreciation (δ). Structures have low depreciation (2-3% per year), machinery has higher depreciation (10-15% per year), and computers have very high depreciation (25% per year).

The stock of capital follows a law of motion:

$$K_t = (1 - \delta)K_{t-1} + I_{t-1}$$

3.1.3 Optimal Level of Capital for Firms

Firms decide whether to purchase an additional unit of capital based on the following:

Definition 3.1.3: User Cost of Capital

The equilibrium condition for optimal capital is given by:

$$MP_k = r + \delta$$

where MP_k is the marginal product of capital, r is the interest rate, and δ is the depreciation rate.

Example.

> Example: Firm with production function $Y = K^{-1/3}L^{2/3}$ has a marginal product of capital:
>
> $$MP_K = \frac{1}{3}K^{-2/3}L^{2/3}$$
>
> The optimal level of capital is:
>
> $$K^* = \frac{L}{[3(r+\delta)]^{3/2}}$$
>
> and the optimal level of investment is:
>
> $$I_t = K^* - (1-\delta)K_t$$

3.1.4 Investment Function

Definition 3.1.4: Investment Function

Current investment depends on the expectation of future profits ("animal spirits") and the current output. The investment function is given by:

$$I = I\left(SP, r, \overline{Y}\right)$$

where SP represents "animal spirits," r is the interest rate, and $\overline{Y}$ is the current output.

3.1.5 Borrowing Constraints for Firms

Firms may face borrowing constraints due to risks such as bankruptcy or gambling by owners. To mitigate these risks, banks require collateral, equity stakes, and regular financial reports. Firms that are borrowing-constrained must finance investment using internal funds (profits or cash flow).

Example.

> Evidence for borrowing constraints: Firms' investment is strongly related to their cash flow.

3.1.6 Fixed Costs of Capital Adjustment

Definition 3.1.5: Fixed Costs of Capital Adjustment

In practice, installing new capital is disruptive, leading to a "band of inaction." Firms adjust capital only if the distance between current capital K and optimal capital K^* exceeds a certain threshold.

Example.

> Numeric Example: If K is within the band of inaction, firms do not adjust capital. This leads to periods of inaction followed by sudden adjustments when the threshold is crossed.

3.1.7 Time-Varying Price of Capital

Definition 3.1.6: Time-Varying Price of Capital

When the price of capital varies over time, the equilibrium condition for purchasing capital becomes:

$$P_t = \left(\frac{1}{1+r}\right)[MP_{K,t+1} + (1-\delta)P_{t+1}]$$

The price of capital is forward-looking and depends on future marginal products and prices.

Example.

> Jorgenson's User Cost of Capital: The user cost of capital is given by:
>
> $$MP_k = r + \delta - \Delta P_K$$
>
> where ΔP_K is the change in the price of capital.

3.1.8 Anticipation Effects

Firms can accelerate or delay investment based on future expectations. For example, anticipation of an investment tax credit (ITC) in the future can reduce current investment.

Example.

> Example: The Bush administration's accelerated bonus depreciation in 2001 exacerbated the recession by reducing current investment.

3.1.9 Stock Prices

Definition 3.1.7: Stock Prices

The price of a stock p_t is determined by the present discounted value of future dividends:

$$p_t = \left(\frac{1}{1+r}\right)\sum_{j=0}^{\infty}\frac{D^e_{t+1+j}}{(1+r)^j}$$

This is known as the "fundamental" stock price.

Example.

> Random Walk Hypothesis: At high frequencies (e.g., daily), stock prices should follow a random walk, meaning that expected changes in stock prices are approximately zero:
>
> $$E[p_{t+1} - p_t] \approx 0$$

3.1.10 Performance of Actively Managed Funds

Most actively managed funds cannot outperform stock indices, consistent with the random walk hypothesis.

Example.

> Example: Over a 10-year period, most US large-cap equity funds underperformed the S&P 500 index.

Chapter 4

04 - IS-LM Model of Aggregate Demand

4.1 Loanable Funds Market

- This is the market for Savings & Investment.
- Saving is the supply in loanable funds market.
- Investment is the demand for loanable funds market.

Sources of Saving in the Economy include:

- Private Saving: $S_p = Y - T - C$
- Public Saving: $S_g = T - G$
- Total Saving: $S = S_p + S_g = Y - C - G$

4.1.1 Supply of Saving

- Total saving in the economy $S = Y - C - G$
- Recall our aggregate consumption function:

$$C = C(Y - T, CS, r)$$

- So, aggregate savings is

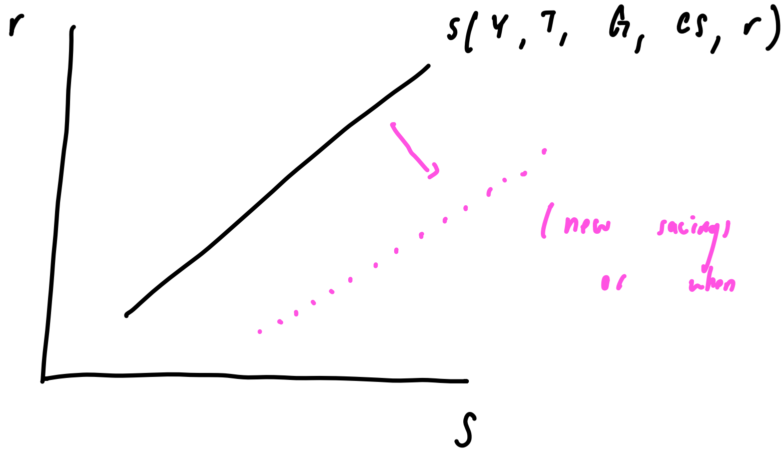
$$S = Y - C(Y - T, CS, r) - G$$

  or in functional form

$$S = S(Y(+), T(+), G(-), CS(-), r(+))$$

Supply of Saving

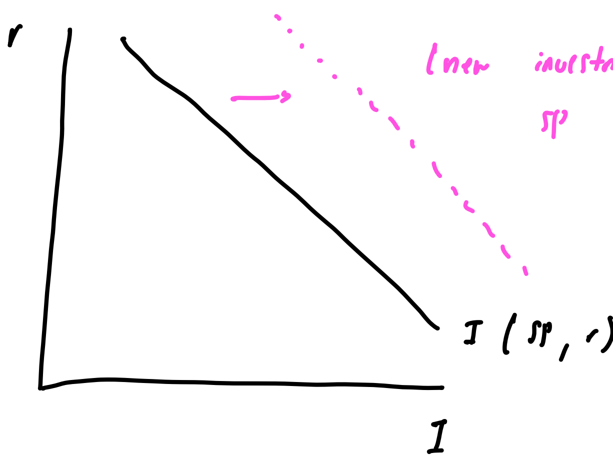
$$S = S(\overset{+}{Y}, \overset{+}{T}, \overset{-}{G}, \overset{-}{CS}, \overset{+}{r})$$



(new savings curve when Y or T rise, or when G or CS fall)

Demand in Saving : Investment

- Recall our investment function : $I = I(\overset{+}{SP}, \overset{-}{r})$



(new investment demand when SP rises)

Equilibrium in the Savings Market

Recall the National Income Accounting Identity :

$$Y = C + I + G + NX$$

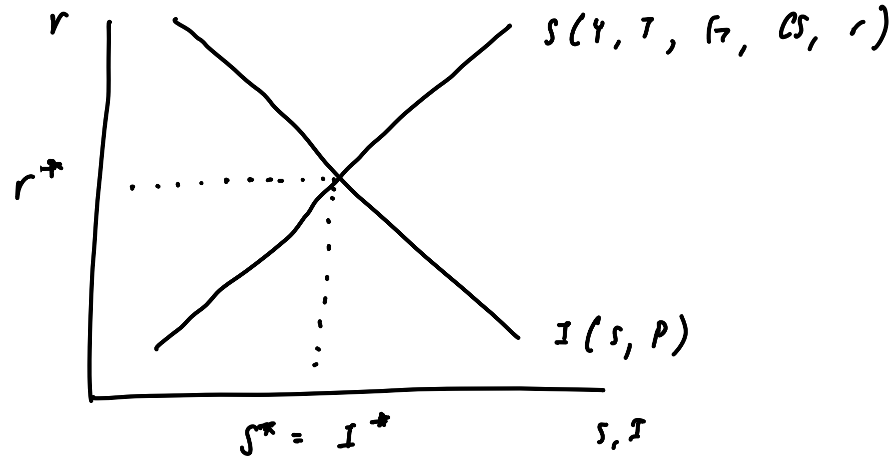
$$Y - C - G = I + NX$$

$$S = I + NX$$

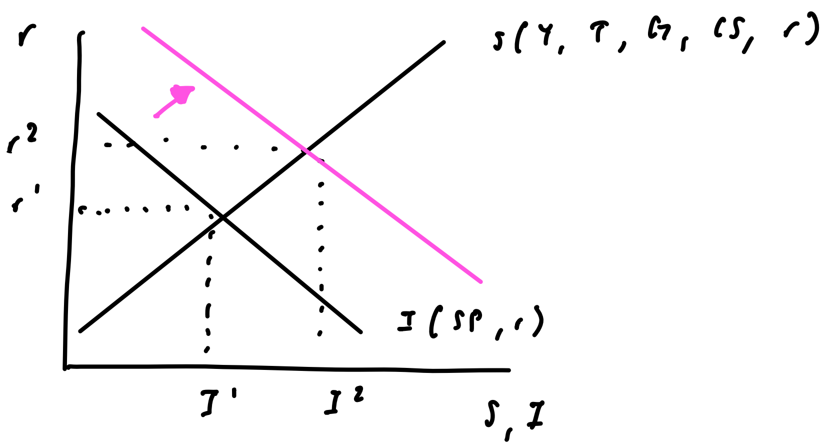
Remember that $S = Y - C - G$

Focusing on a closed economy, where $NX = 0$, we have $\boxed{S = I}$

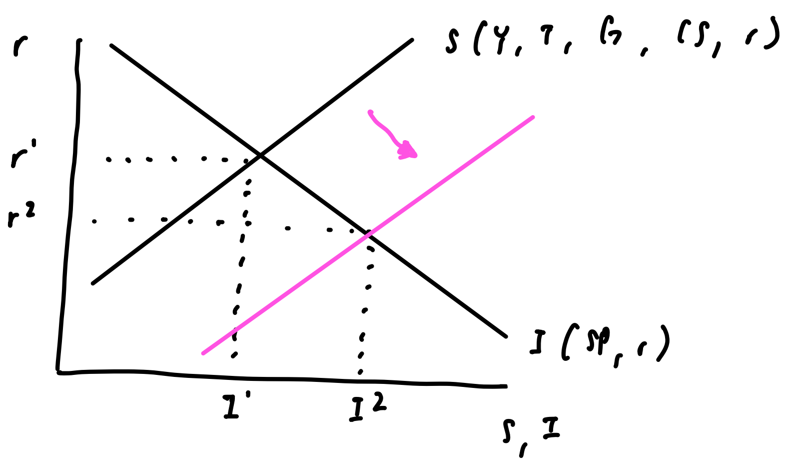
An equilibrium in a savings market is an interest rate that ensures $S = I$, conditional on Y, T, G, CS, and SP.



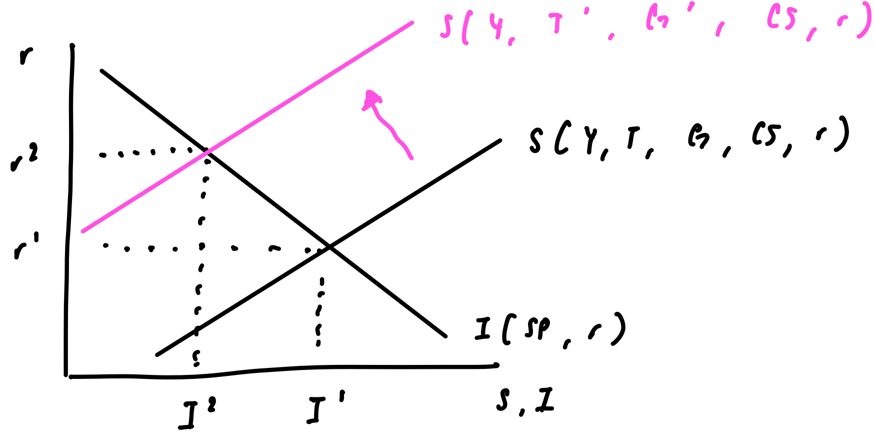
An increase in "Animal Spirits" increases savings, investment, and the interest rate. Graphically,



A decrease in consumer sentiment raises savings, investment, but lowers interest rate. Graphically,



An equal increase in taxes and government spending decreases saving and investment, but raises the interest rate.



The Dual Role of r

r adjusts to equilibrate the goods market <u>and</u> the loanable funds market simultaneously.

How? ⇒ If loanable funds market is in equilibrium, then

$Y - C - G = I$ (savings = investment)

If the goods market is in equilibrium, then

$Y = C + I + G$ (goods supply = demand)

Thus, these two are the same sides of the same coin.

4.2 The Classical Model

It shouldn't be surprising that these markets are linked:

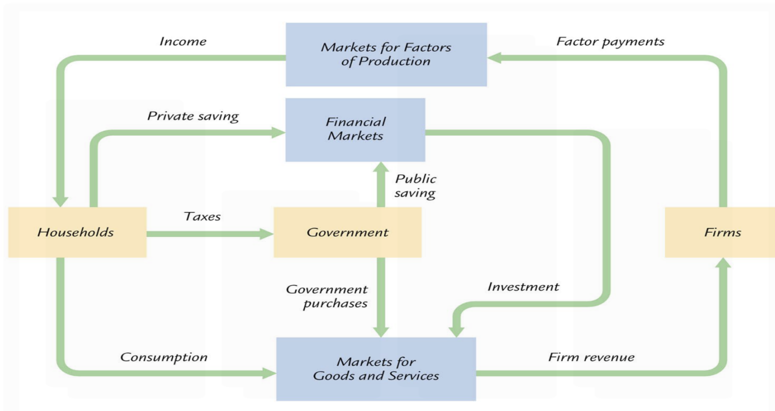


Figure 4.1: In equilibrium, total infows = total outflows for every box.

4.3 The Money Market

Definition 4.3.1: Money

Money is the stock of cash and checkable deposits.

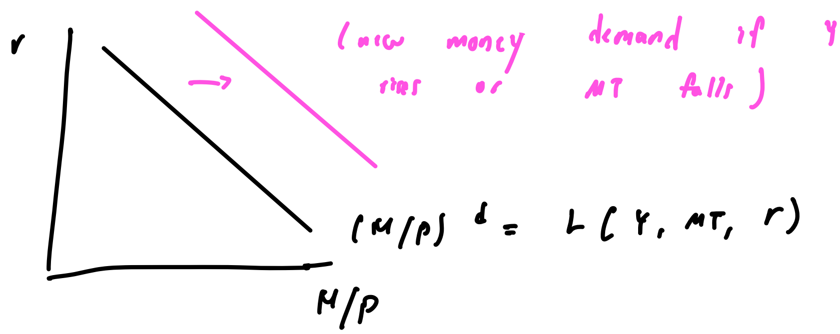
4.3.1 Demand for Real Money Balances

- Demand for real money balances is the amount of wealth that agents want to hold in cash or checking accounts.
- Key factors that affect money demand:
  1. Income: more income, more consumption, hence more cash
  2. Interest rate: opportunity cost to holding money
  3. Technology: some technologies change people's need to hold cash

$$(\frac{M}{P})^d = L(Y, MT, r)$$

Demand for Real Money Balances

$$\left(\frac{M}{P}\right)^d = L(\overset{+}{Y}, \overset{-}{MT}, \overset{-}{r})$$



Supply of Real Money Balances

- The central bank is the agency that controls money supply.
- Money supply is typically adjusted via OPEN-MARKET OPERATIONS: the purchase / sale of bonds in bond markets.
- Bond is a financial instrument that guarantees a certain monetary value in the future.

Suppose the central bank buys a \$100 bond in the market.

Money supply goes ↑.

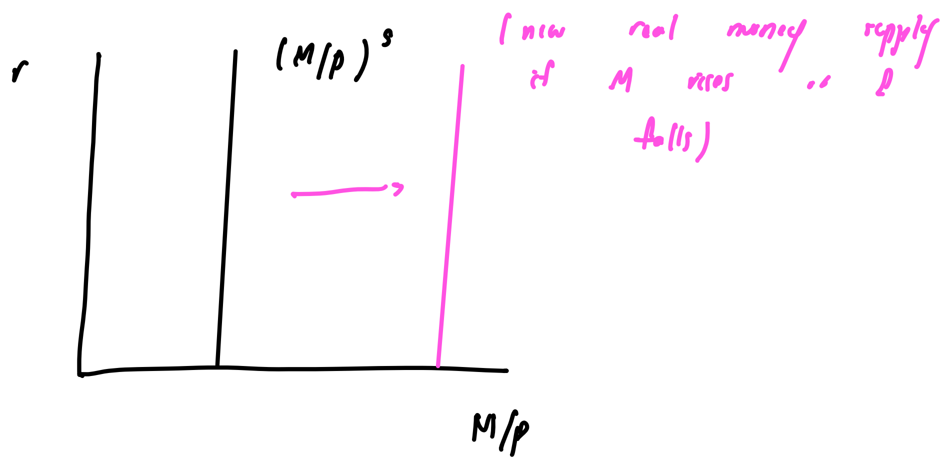
Suppose the central bank sells a \$100 bond in the market.

Money supply goes ↓.

The Central Bank's Tools

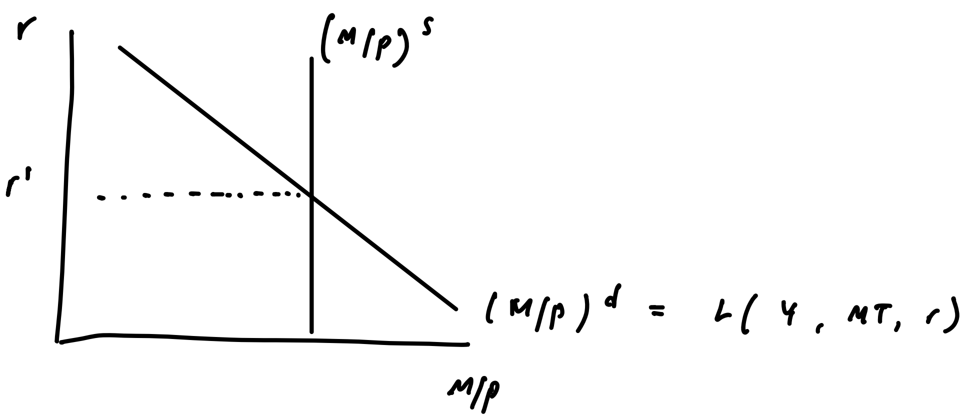
- There are three standard methods of affecting money supply:
  1) Open-market operations: buy / sell bonds
  2) Reserve Ratio: fraction of liabilities banks hold as reserves
  3) Discount Rates: Interest rates charged by central bank to banks for overnight loans.

Real Money Supply

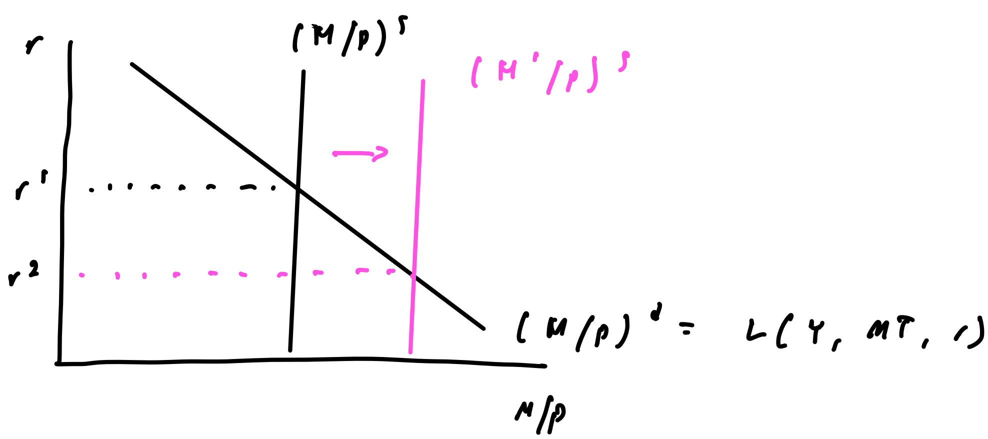


Equilibrium in Money Market

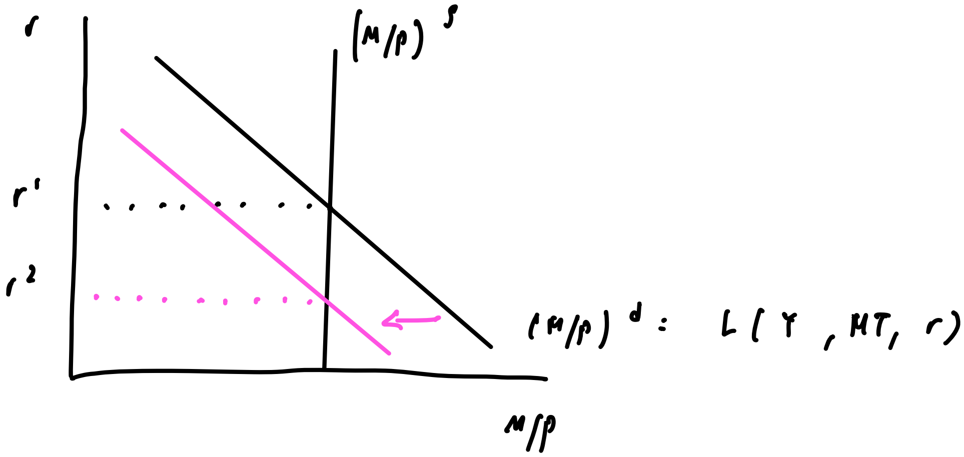
An equilibrium in the money market is an interest rate that ensures $(M/p)^s = (M/p)^d$, on conditional Y, M, MT, and P.



An increase in the money supply pushes the interest rate down:



An increase in the money technology (MT) pushes the interest rate down.


r
$(M/P)^s$
r^1
r^2
$(M/P)^d : L(Y, MT, r)$
M/P

4.3.2 Summary

We have two markets:

1. *Loanable funds market*: equilibrium interest rate such that $S = I$ given $Y, CS, T, G,$ and SP.
2. *Money market*: equilibrium interest rate such that real money supply is equal to real money demand given $Y, P, M,$ and MT.

Each market yields equilibrium interest rate *conditional* on Y. But output is an *endogenous variable*. ***Both the interest rate and output will adjust to ensure equilibrium in both markets***.

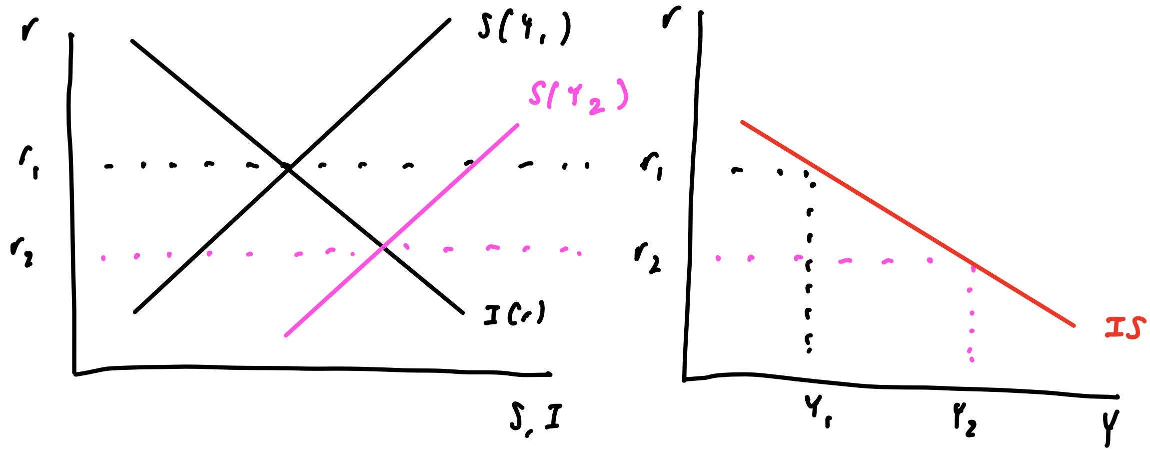
4.4 Graphs & Aggregate Supply & Aggregate Demand

Remark.

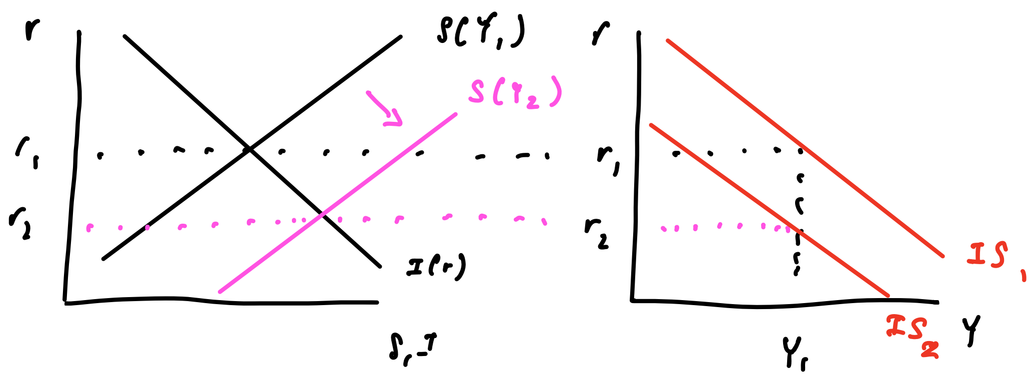
Continued on next page.

IS Curve

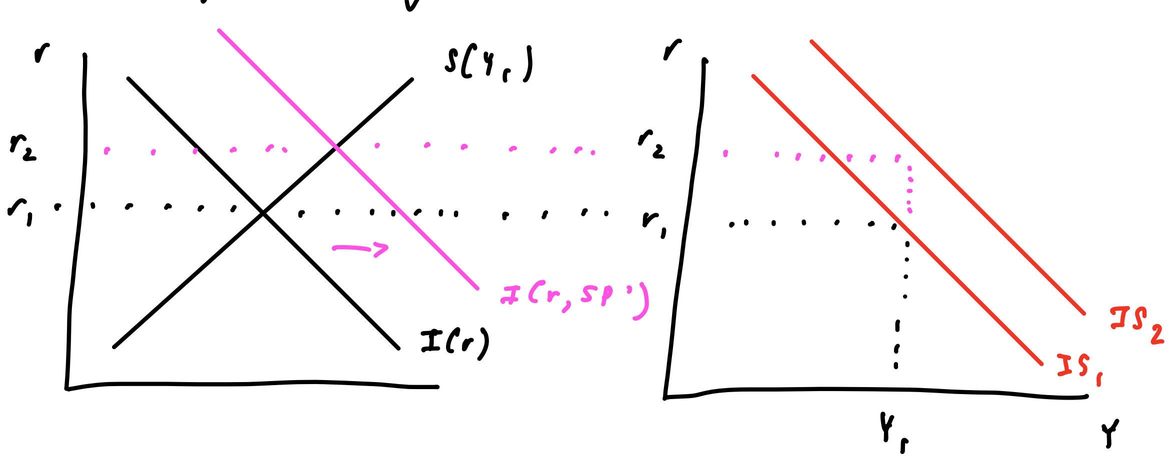
The IS curve summarizes the equilibrium interest rate that clears the savings market for different levels of output.



If T goes up, or if G or cs goes down, the savings curve shifts right, causing the IS curve to shift down (left).

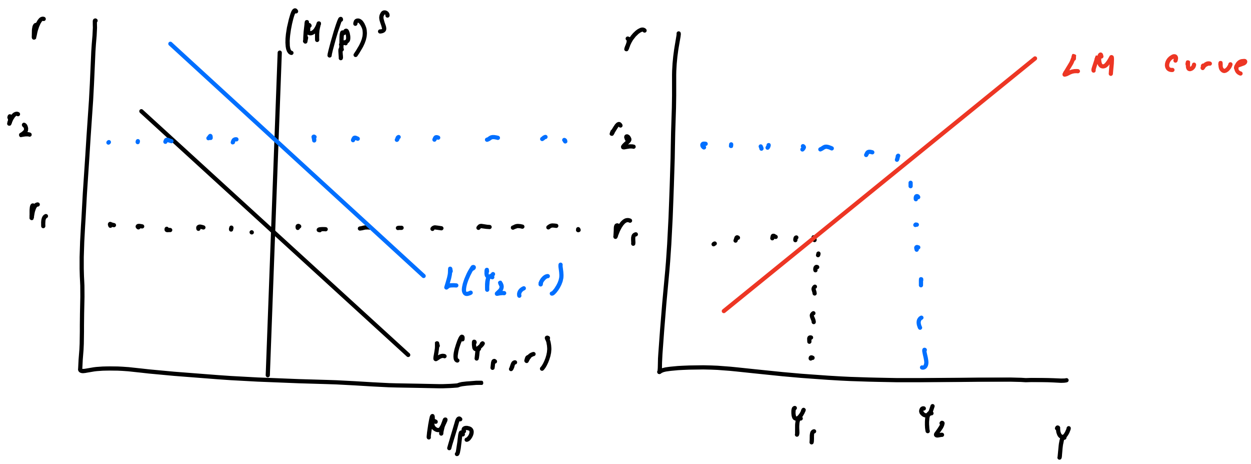


If "Animal Spirits" (SP) goes up, the investment curve shifts right, causing the IS curve to shift up (right).

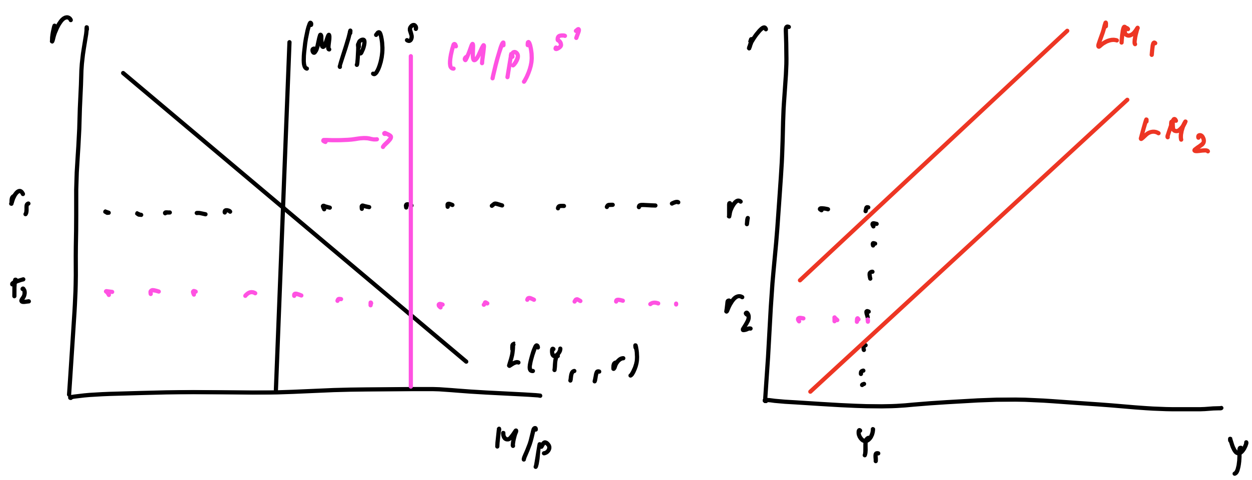


LM Curve

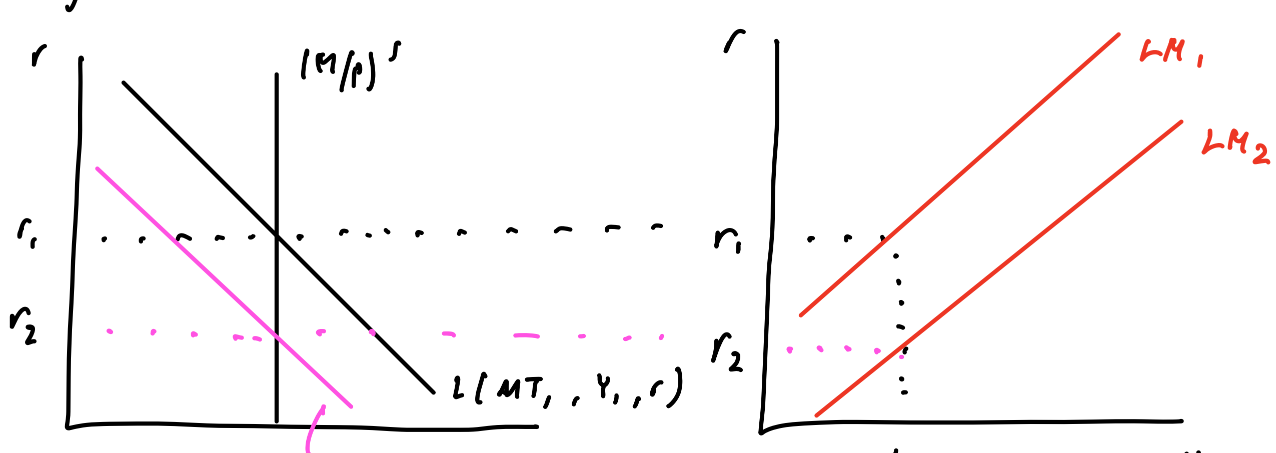
The LM curve summarizes the equilibrium interest rate that clears the money market for different levels of output.



If nominal money supply (M) rises or if prices (P) fall, real money supply expands, pushing interest rates and the LM curve down.



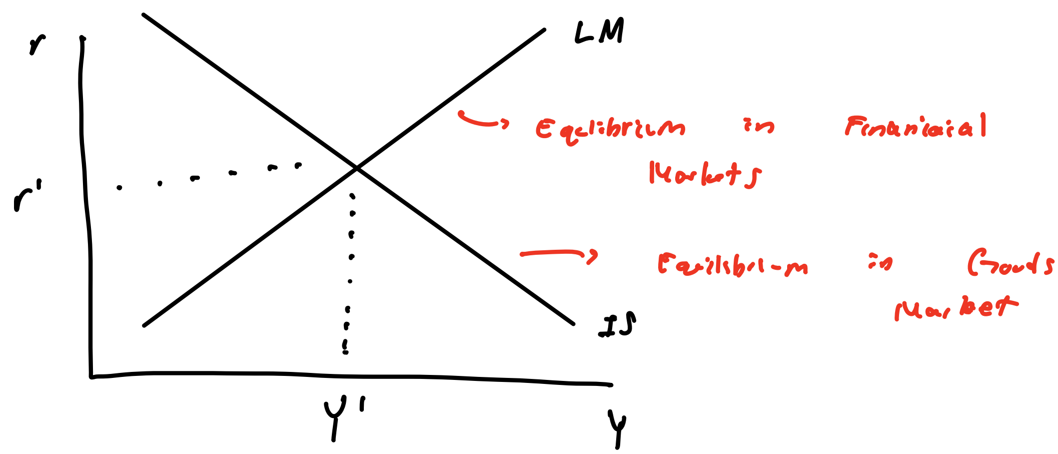
If money technology (MT) rises, then money demand falls, pushing the interest rate down and shifting the LM curve down.



$L(MT_2, Y_1, r)$ M/P Y_1 Y

Equilibrium of the IS-LM Model

An IS-LM equilibrium is a (r^*, Y^*) such that both loanable funds market and the money market clear, given SP, CS_r, T_r, G, M, P, and MT.

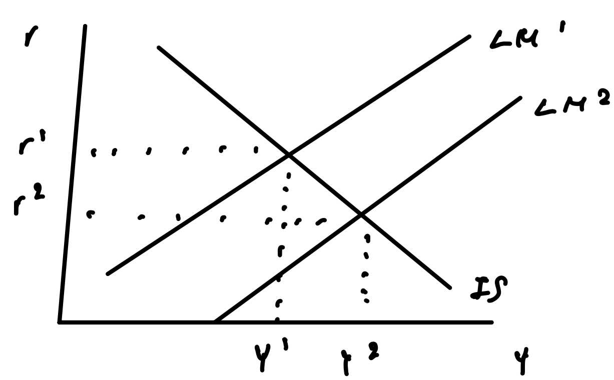


Comparative Statics in the IS-LM Model

Suppose the money supply (M) rises: Expansionary

Note that r goes down and Y goes up.

What about C and I?



1) Investment (I)

$$I = I(\overset{+}{SP}, \overset{-}{r})$$

If r goes down and SP is unchanged, investment must rise.

2) Consumption (C)

$$C = C(\overset{+}{Y - T}, \overset{+}{CS}, \overset{-}{r})$$

If Y goes up and r goes down, the change in consumption must be positive.

M going up pushes interest rates down, which increases investment and consumption, thereby raising output.

Remark.

> There is more material, but posted on the other files, due to size and other study materials.