EC313: Intermediate Macroeconomics

Chapter 4

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Chapter 3: Financial Markets I

1. The Demand for Money

2. Determining the Interest Rate

Why study financial markets?

- to understand how the interest rate is determined in the short run

- The goods market in Chapter 3 did not include an interests rate, which is mentioned in the news almost every day in the real world

- In short; we study financial markets to understand a realistic element of our economic activity!

- but, for simplicity, ignore all financial assets except for **bonds** and **money** (meaning we ignore houses, stock investments, etc)

- bonds: A financial asset that represents a debt contract between the issuer (borrower) and the buyer (lender)

- When you buy a bond with a face value (principal) F = $1000 issued by the US government, you lend 1000 dollars to the US government

- As a borrower, the US government will pay you interest. If the annual **interest rate** is 10%, each year you would receive $100 = 10% * 1000

- bid to buy U.S. federal government bonds (https://www.treasurydirect.gov/indiv/research/indepth/tbonds/res_tbond_buy.ht

- *Example*: Suppose the bonds in our economy are one-year bonds — bonds that promise a payment of a given number of dollars, say 100 dollars, a year from now. Let the price of a bond today be P_B.

- If you buy the bond today and hold it for a year, the rate of return on holding the bond for a year is $\dfrac{100 - P_B}{P_B}$.

- $P_B \uparrow \;\Rightarrow\;$ smaller numerator and larger denominator $\;\Rightarrow\; i \downarrow$

- **The higher the price of the bond, the lower the interest rate**

- what is **interest rate**?

- interest rate is the price for money (why?)

- The interest rate will be determined by equilibrium in the money market: **Money Supply = Money Demand**

The Demand for Money

The Demand for Money

- In order to describe money market equilibrium, we first must understand the demand for money.

- **Money** is the sum of currency and checkable deposits

  - Currency: paper money, coins, etc
  - Checkable Deposits: deposits you have stored with a bank

- Money is used to make transactions, but it does not earn interest

- **Bonds** pay interest rates but cannot be used for transactions

- We assume there is only one type of bond, which pays positive interest rate i

The Demand for Money

- Why hold a mixture of bonds and money?

- First, I need to make transactions! Ex: I buy coffee almost every day. I cannot use bonds to buy coffee, so I make sure that I have some money

- Second, thankfully, I do not spend ALL of my money on coffee. If I'm not using all of my money, I should buy bonds so that I can earn interest

The Demand for Money

- What determines my proportion of bond holdings to money holdings?

- First, *level of transactions*

  - the more purchases I make, the more money and fewer bonds I will hold (for a fixed interest rate)

- Second, *interest rate on bonds*

  - the **higher** the interest rate on bonds, the more bonds and **less** money I will hold (for a fixed level of transactions)
  - Back to the US government bond example: If interest rate increases to 20% per year, you would receive $200 a year. You might want to consider holding more bonds instead of money

Deriving Demand for Money

- Money Demand is denoted by M^d:

$$M^d = \$Y \times L(i)$$

- nominal income: $\$Y$

- interest rate: i

- why does nominal income affect M^d?

- nominal income is proportional to the level of transactions, and hence determines money holdings

Deriving Demand for Money

- why does i affect M^d?

- i determines holdings of bond, and hence affect money holdings

- Do you think $L(i)$ is increasing or decreasing in i?

- An increase in the interest rate decreases the demand for money, as people put more of their wealth into bonds

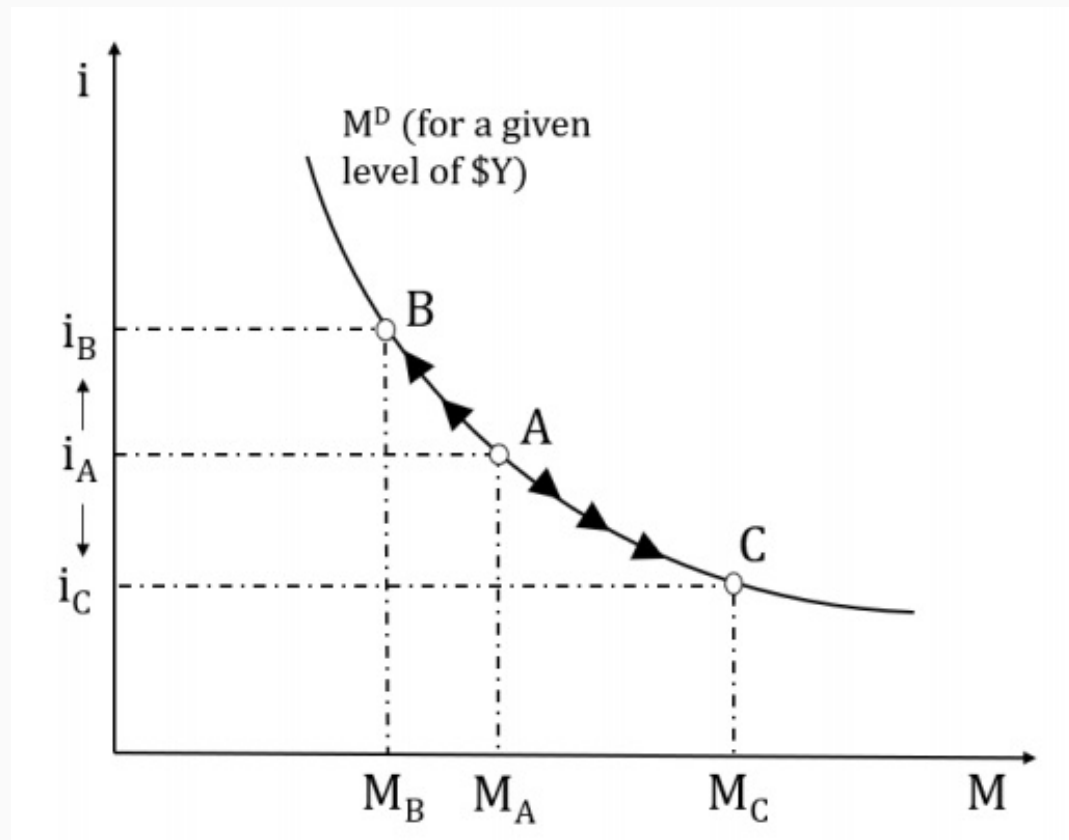# Deriving Demand for Money

$$M^d = \$Y \times L(i)$$

In summary:

- First, the demand for money M^d increases in proportion to nominal income

- Second, the demand for money M^d depends **negatively** on the interest rate i

- How to graphically express the relationship between M^d and i, given a level of nominal income?
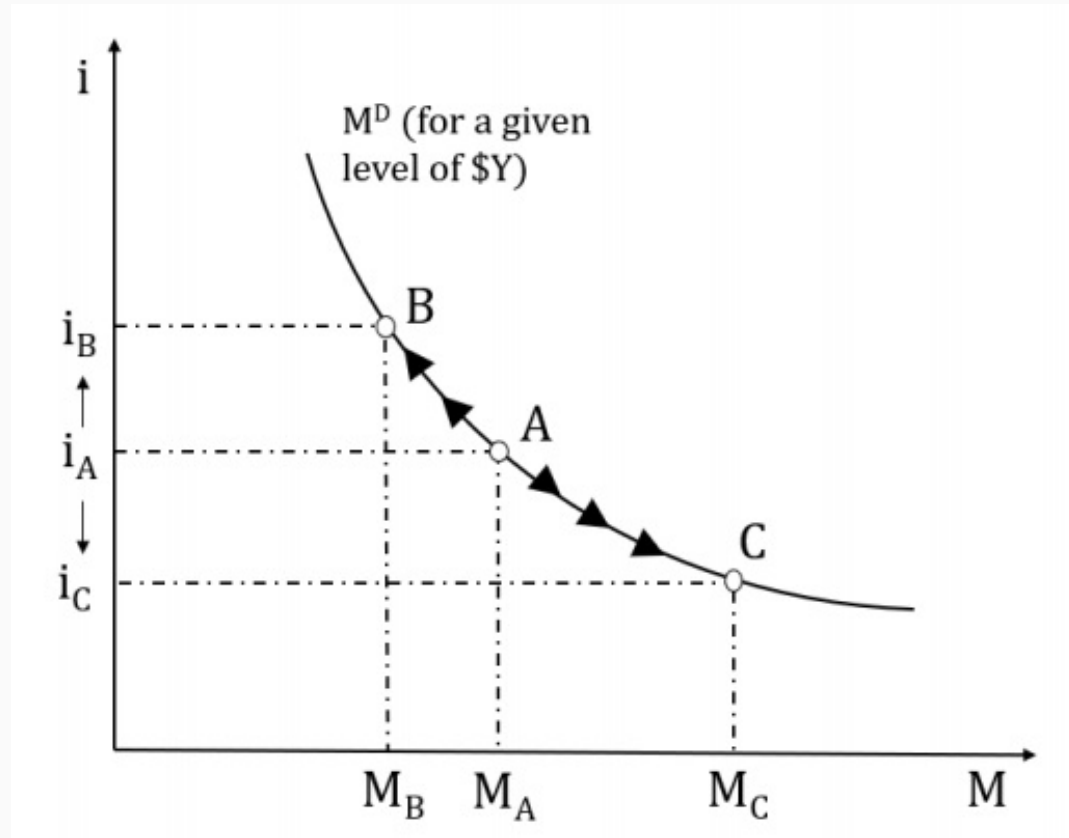
Deriving Demand for Money

$$M^d = \$Y \times L(i)$$

- interest rate i is measured on the vertical axis
- demand for money is measured on the horizontal axis
- The relation between the demand for money M^d and the interest rate i **for a given level of nominal income** is represented by the M^d curve
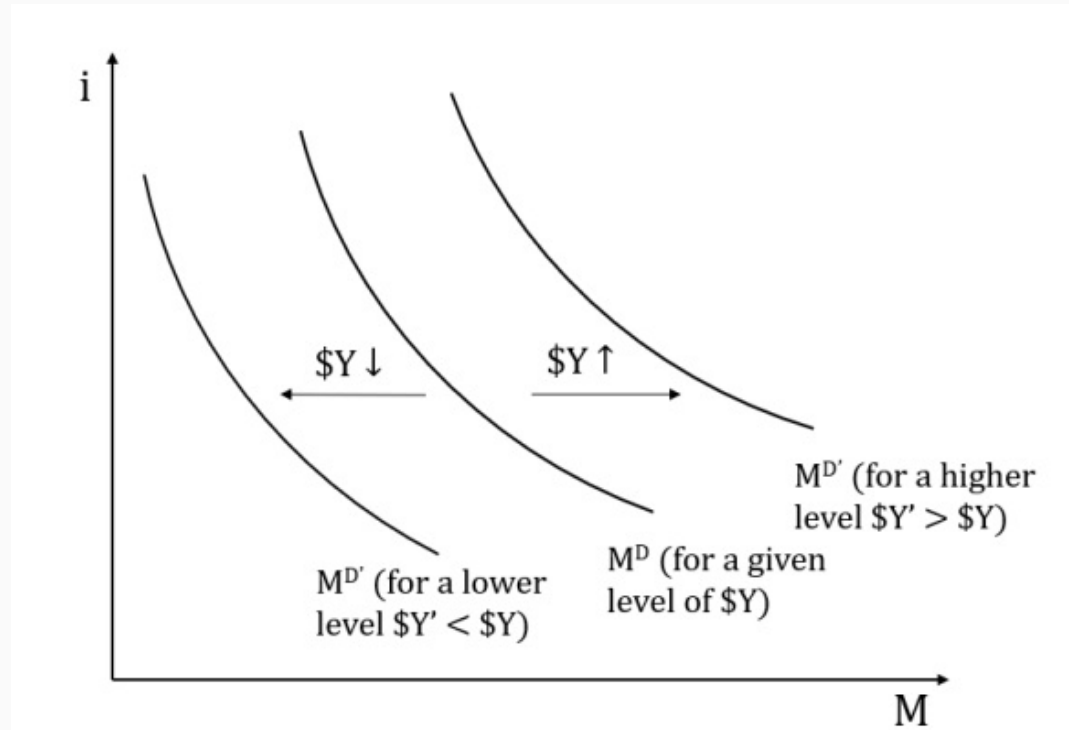
Deriving Demand for Money

- What happens when the **interest rate** increases or decreases in our graph?

- We **move along** the curve M^d

Deriving Demand for Money

i

$Y ↓ $Y ↑

M^{D'} (for a higher
level $Y' > $Y)

M^{D} (for a given
level of $Y)

M^{D'} (for a lower
level $Y' < $Y)

M

- What happens when **nominal income** increases(decreases) in our graph?

- We **shift** the M^d curve to the right(left)

Determining the Interest Rate

Supply of Money

In the real world, there are two types of money: currency and checkable deposits.

- for simplicity, we assume that the only money in the economy is currency

- **Currency**: Money supplied by central banks. This is the paper (or coin) money that we use on a daily basis

- Currency is supplied by the Federal Reserve in the U.S.

Supply of Money

- We have outlined the money demand equation M^d, we must now characterize money supply M^s

- The money supply is entirely determined by the Central Bank: M^s is exogenous!

- the central bank decides to supply an amount of money equal to M (or $\bar{M}$)

- The Money Supply is characterized by:

$$M^s = M$$

Supply of Money

- Since M doesn't depend on i, M^s is a **vertical** line at M
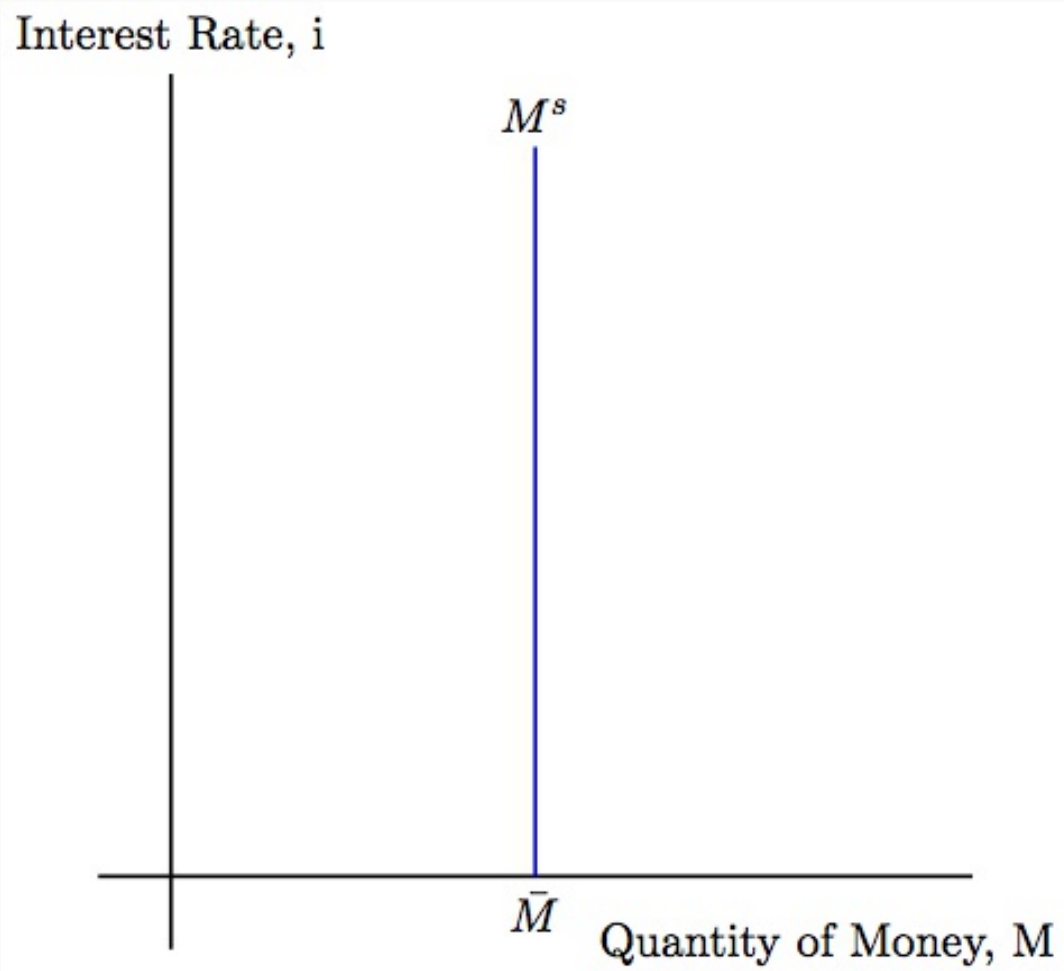
Financial Market Equilibrium

- Equilibrium in financial markets requires that money supply be equal to money demand: $M^s = M^d$

- plug in M^s and M^d, we can get equilibrium condition:

$$M = \$Y \times L(i)$$

- by algebra, at financial market equilibirum, the interest rate must be such that, given their nominal income, people are willing to hold an amount of money equal to the existing money supply M

- how to represent the financial market equilibirum graphically?

Financial Market Equilibrium

- step 1: label axis

  - money (demand and supply) is measured on the horizontal axis
  - interest rate is measured on the vertical axis

- step 2: plot demand for money curve M^d

  - drawn for a given level of nominal income, demand for money M^d is downward sloping (A higher interest rate implies a lower demand for money)

- step 3: plot supply of money curve M^s

  - a vertical line

Financial Market Equilibrium

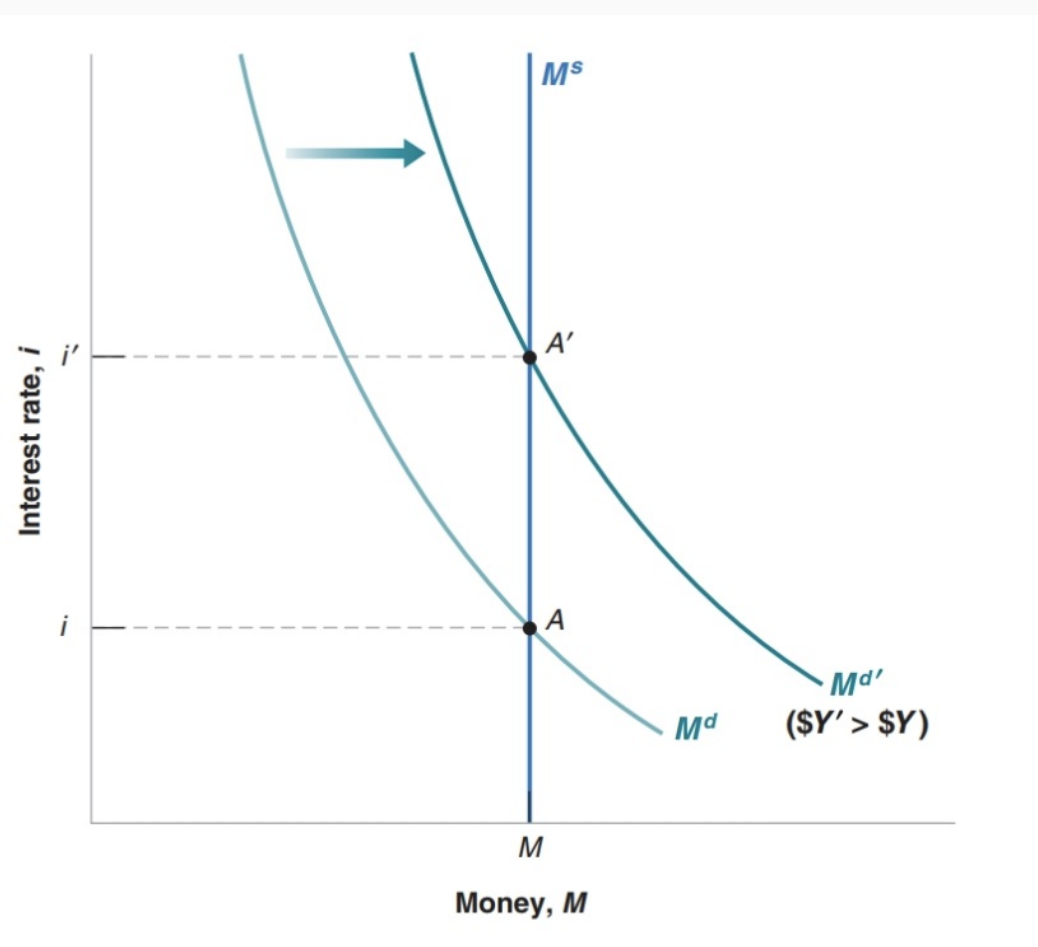- Equilibrium occurs at point A, and the equilibrium interest rate is given by i
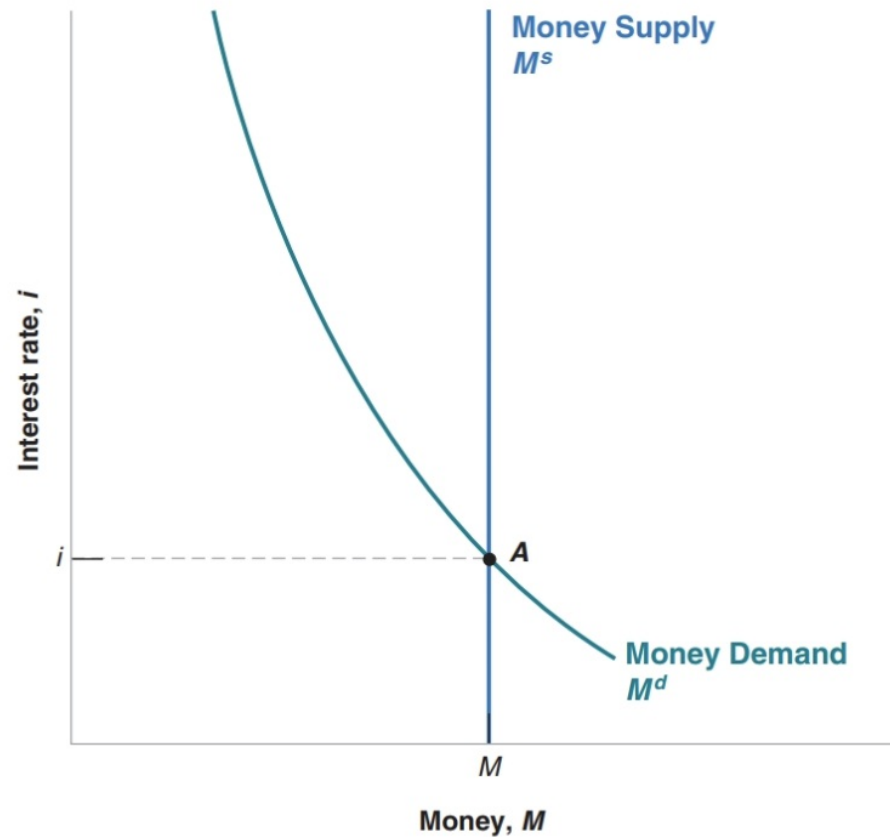
Financial Market Equilibrium

- What happens to the interest rate when **nominal income** ($Y) increases?

- An increases in nominal income increases the level of transaction, which increases the demand for money at any interest rate

- M^d shifts to the right

Financial Market Equilibrium

- The equilibrium moves from A up to A', and the equilibrium interest rate increases from i to i'

- For a given money supply (i.e. fixing the vertical line), an increase in nominal income leads to an increase in the interest rate
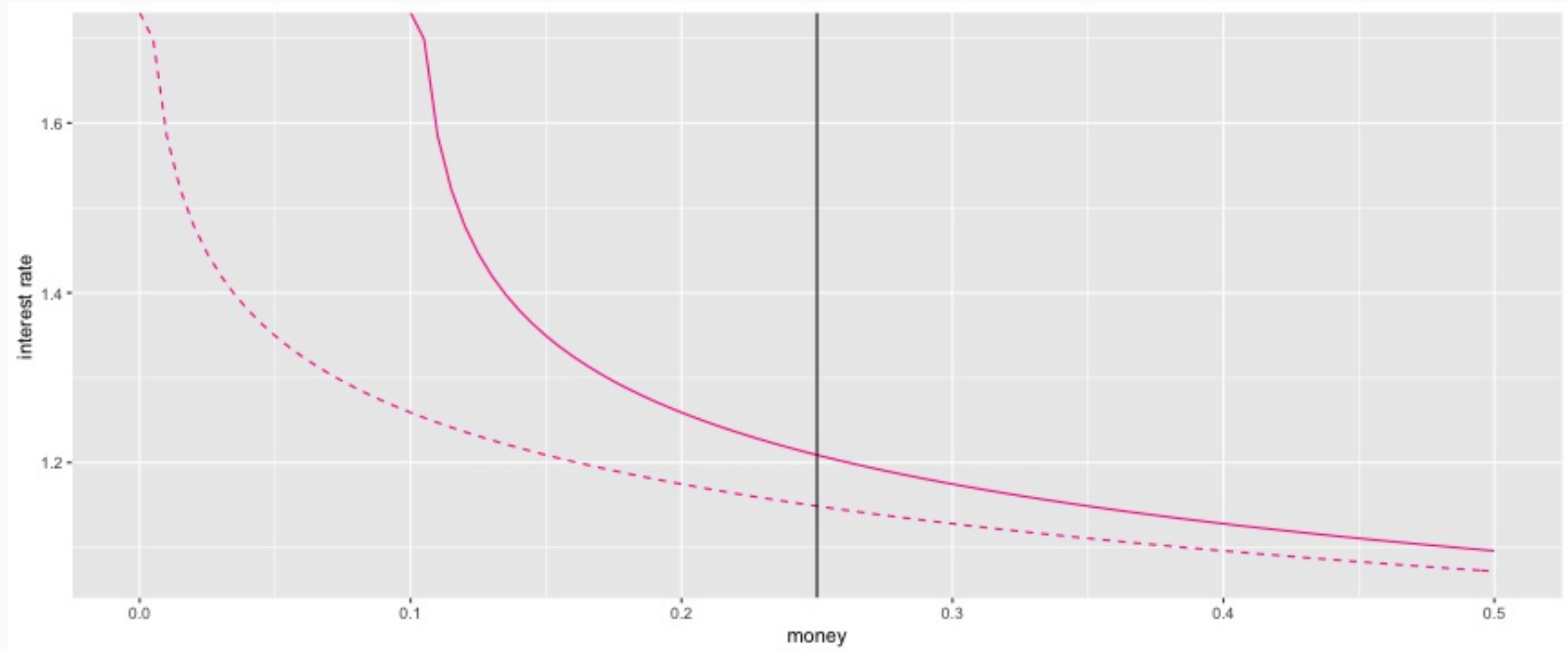
Group Work III

Q1: graphically show what happens to the interest rate when nominal income decreases

HINT:

- step 1: label variables on x-axis and y-axis
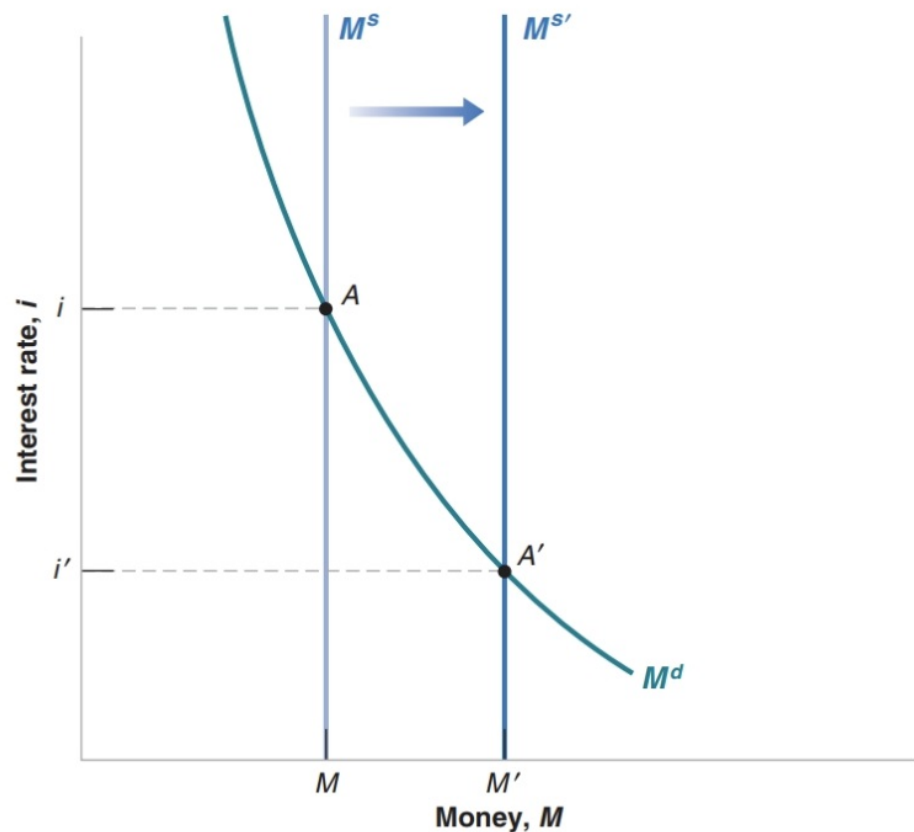- step 2: which curve should be shifted? And to which direction?

Group Work III

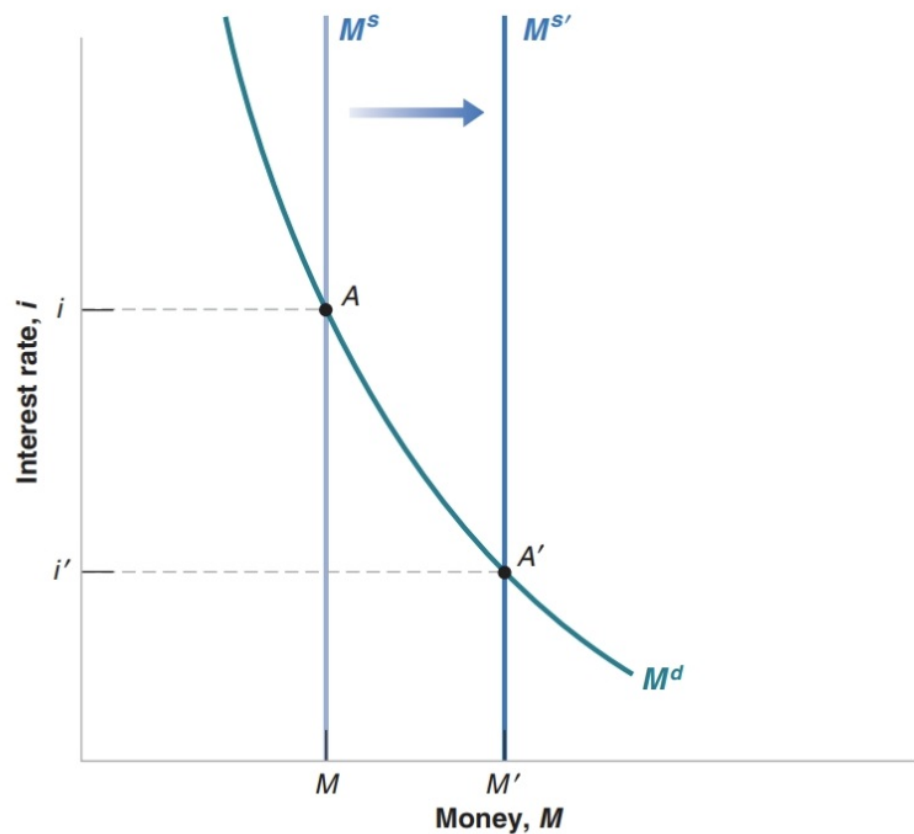demand curve shifts to the left: the equilibrium interest rate decreases

Financial Market Equilibrium

- what happens to the interest rate when there is an increase in the **money supply**(M)?

- money supply curve shifts to the right

Financial Market Equilibrium

- $i' < i$
- an increase in the supply of money by the central bank leads to a decrease in the interest rate
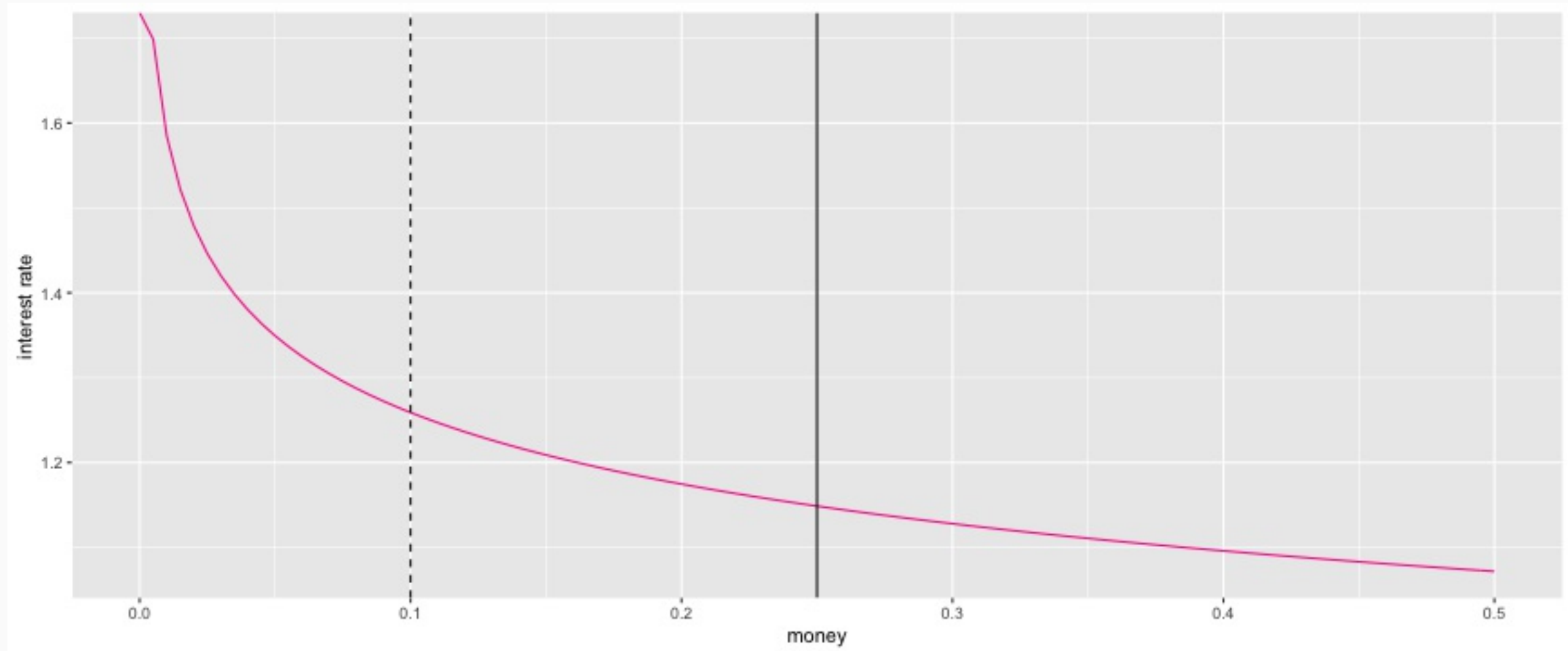
Group Work III

Q2: graphically show what happens to the interest rate when there is a decrease in the money supply

HINT:

- step 1: label variables on x-axis and y-axis
- step 2: which curve should be shifted? And to which direction?

Group Work III

supply curve shifts to the left: increase in the interest rate

Monetary Policy

- Thus far, we have assumed the Central Bank simply changes M^s by choosing a new M. Choosing a new M will shift M^s curve to the left or right, and therefore change the interest rate.

- In reality, it's not this simple.

- In modern economy, central banks typically change the supply of money is by **buying or selling bonds in the bond market**

Monetary Policy

- buying(selling) bonds will change demand(supply) for bonds, and therefore change bonds price

- change in bonds price will then change interest rates, because prices of bonds and interest rates on bonds are **negatively** related (recall today's group work)

- buying or selling bonds is the most important monetary policy for central banks, and are also called **open market operation**

Monetary Policy

Contractionary Monetary Policy: The Central Bank sells bonds, thus removing money from the economy and decreasing (or contracting) the money supply

- Selling bonds leads to a decrease in the money supply (the Central Bank removes money from circulation)

  - M^s shifts to the left
  - interest rate ↑

- meanwhile, selling bonds also leads to an increases supply of bonds

  - bonds supple > bonds demand
  - bonds price ↓
  - interest rate ↑

Monetary Policy

Expansionary Monetary Policy: The Central Bank buys bonds from consumers, pays for them with cash, and therefore increases (or expands) the money supply

- Buying bonds leads to an increase in the money supply

  - M^s shifts to the right
  - interest rate ↓

- meanwhile, buying bonds also leads to an increased demand for bonds

  - bonds supple < bonds demand
  - bonds price ↑
  - interest rate ↓