

## Chapter 7 Addendum

**Demand for Money:** the quantity of monetary assets people choose to hold.

In our treatment of money as an asset we need to briefly discuss three aspects of any asset

1. **Expected Return:** Wealth holders best guess about return to assets. Holders of assets prefer high returns since it means more consumption in future for any given amount of saving done today. But expected return may differ from the actual return.
2. **Risk:** Uncertainty about the return to an asset. Risk refers to the degree to which the actual return received will be very different from the expected return.
3. **Liquidity:** Ease and quickness with which an asset can be exchanged for goods and services. Examples in book: money is most liquid and car is very illiquid.

We shall express the demand for money function and then explain.

$$M^d = PL(Y,i)$$

P = price level

Y = real income or output

i = nominal interest rate earned by  
alternative nonmonetary assets

L = money demand function  
relating money demand  
to real income and  
nominal interest rate

Why this equation?

1. We have included  $P$  because as the price level rises that means that prices are rising. If prices are rising then people need more money to engage in their transactions
2. Higher real incomes,  $Y$ , increase the number of transactions agents make. More transactions mean that people will demand more money.
3. An increase in the nominal interest rate on nonmonetary assets means that these alternative assets become more attractive. People will reduce their demand for money. Note that the nominal return to money is zero and with a positive inflation rate the real return to money is negative.

Note that we don't include  $\dot{i}^m$ , the nominal interest rate on money, in our money demand equation. Of course we could do this. An increase in  $\dot{i}^m$  makes people more willing to hold money and therefore increases money demand. But, this rate does not vary much and the rate on nonmonetary assets does. As your book notes currency and a portion of checking accounts pay a zero nominal interest rate. So, we leave it out.

We can write the nominal rate of interest as the following:

$$\dot{i} = r + e$$

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$r$  = expected real rate of interest

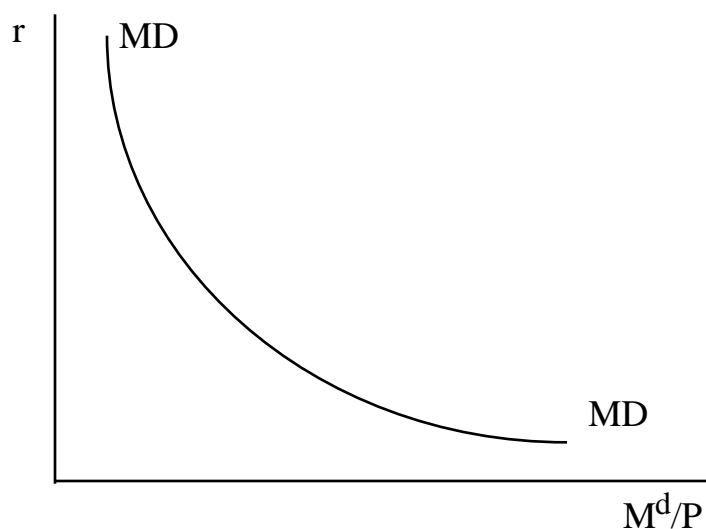
$e$  = expected inflation rate

Now, rewriting our money demand equation

$$M^d = PL(Y, r + e)$$

## Factors that Affect Money Demand

Let's graph the real money demand schedule. We shall graph it in the real expected interest rate, real money demand plane.



Consider all of the factors that affect money demand.

1. An increase in the price level:

$$P M^d = PL Y, r + e$$

nominal money demand  
rises dollar for dollar

$$\frac{M^d}{P} = \overline{L Y, r + e}$$

real money demand  
does not change

2. Real income rises: This is an important one. Why? Recall that we drew the IS curve in the  $r, Y$  plane. This change in income will mean an upward shift in money demand along a stable money supply schedule. This will mean a movement along what is called the LM: all of the combinations of  $r$  and  $Y$  in which the money market is in equilibrium.

$$Y \quad M^d = P L(Y, r + e)$$

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

real money demand shifts upward

3. Real interest rate rises: Nonmonetary assets become more attractive since now they give a higher return. People choose to hold less money in their portfolio.

$$r \quad M^d = P L(Y, r + e)$$

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

real money demand shifts down

4. Expected inflation rises: Higher return on nonmonetary assets relative to money. People choose to hold fewer dollars than they did before.

$$e \quad M^d = P L(Y, r + e)$$

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

real money demand shifts down

5. Nominal interest rate on money rises: A higher return to holding money will mean, ceteris, paribus, people will choose to hold more money in their portfolios.

$$i^m \quad M^d = P L(Y, r + e, i^m)$$

$$\frac{M^d}{P} = L(Y, r + e, i^m)$$

real money demand shifts upward

6. Wealth rises: An increase in wealth means that part of this increase will be held in the form of money

$$\text{wealth} \quad M^d = P L(Y, r + e, \text{wealth})$$

$$\frac{M^d}{P} = L(Y, r + e, \text{wealth})$$

real money demand shifts upward

7. Risk of nonmonetary assets increases: People will choose to hold more money than they did before in their portfolios.

$$\text{risk} \quad M^d = P L(Y, r + e, \text{risk of alternative assets})$$

$$\frac{M^d}{P} = L(Y, r + e, \text{risk of alternative assets})$$

real money demand shifts upward

8. Risk of money increases: People will choose to hold fewer dollars in their portfolios than they did before.

$$\text{risk} \quad M^d = P L(Y, r + e, \text{risk of money})$$

$$\frac{M^d}{P} = L(Y, r + e, \text{risk of money})$$

real money demand shifts down

9. Payments technology increases: People need not hold as much money as they did before. Money demand will fall.

efficiency of payments technologies

$$M^d = P L(Y, r + e, \text{efficiency of payments technologies})$$

real money demand shifts down

10. Nonmonetary asset liquidity rises: The degree to which one can exchange nonmonetary assets for goods, services and other assets, has risen therefore, people will choose to hold less currency and more nonmonetary assets.

liquidity of alternative assets

$$M^d = P L(Y, r + e, \text{liquidity of alternative assets})$$

real money demand shifts down

Normally we suppress a number of items that we have written explicitly above. The way the money demand function is written captures the main macroeconomics determinants. So we will usually write it as

$$M^d = PL(Y, r + e)$$

Let's consider a nonmonetary asset like a government bond. The price of the bond is what the buyer has to pay for the bond. Why is the price of a nonmonetary asset and its nominal interest rate negatively related to one another?

Recall the example used in the book: Consider a discount bond, a bond that doesn't pay any interest before it matures. Assume that a holder will redeem the bond at maturity and receive \$10,000. Suppose that the bond can be purchased today for \$9615. The bond will increase in value by \$385 over the next year.

$$\$10,000 - \$9615 = \$385$$

$$\frac{\$385}{\$9615} \quad .04 \text{ or } \%4$$

nominal rate (or yield) on the bond is %4

What happens if the price of the bond drops to \$9524? The value of the bond will rise. The increase in the value of the bond over the next year will be \$476.

$$\$10,000 - \$9524 = \$476$$

$$\frac{\$476}{\$9524} \quad .05 \text{ or } \%5$$

nominal rate (or yield) on the bond is %5

Recall our formula for the discounted net present value for one year

$$\text{present value} (1+r) = \text{future value}$$

In the last case above

\$10,000 = future value

\$9524 = present value

Plugging in and solving

$$pv(1+r) = fv$$

$$pv = \$9524 \text{ \& } fv = \$10,000$$

$$\$10,000 = \$9524 (1 + r)$$

$$\frac{\$10,000 - \$9524}{\$9524} = r$$

$$\frac{\$476}{\$9524} = r$$

$$5\% = r$$

Conclusion:

**Higher the price of the asset  
the lower the nominal interest rate**

As they note in the book, when we hear that the bond market strengthened, i.e., that bond prices rose, it means that nominal interest rates fell.

Our last step before we can graph this, is that we need to demonstrate a relationship between the price of nonmonetary assets and the real interest rate. For a given expected rate of inflation, the real interest rate and nominal interest rate move together, so real rates and the prices of nonmonetary assets are inversely related.

For  $r^e$ , real rate and price of a nonmonetary asset are inversely related

Summing up what we have done thus far in Chapter 7:

1. We have grouped all assets in the economy into either money or nonmonetary assets.
2. By money we mean all assets that can be used for payment: cash (currency) and demand deposits (checking accounts).
3. All money is assumed to have the same risk and liquidity.
4. All money pays the same nominal interest rate,  $i^m$ . Recall that the nominal interest rate is equal to the sum of the real expected interest rate and the expected rate of inflation:

$$i = r + r^e$$

We can specify this for the nominal interest rate on money

$$i^m = r + r^e$$

For most of the assets called money,

$$i^m = 0 \quad r = -r^e$$

For most of the assets that make up money, the real expected return is negative the rate of expected inflation. This accords with our intuition. Walking around with cash in your pocket does not earn nominal interest, but the value of the currency surely is falling if there is a positive rate of expected inflation. At the end of the year each dollar will exchange for fewer goods and services than it did at the beginning of the year.

5. By nonmonetary assets we mean all assets other than money: stocks, bonds, land, etc. They are all assumed to have the same risk and liquidity. They all pay a nominal interest rate of

$$i = r + r^e$$

We shall denote our two assets as follows

**M** fixed nominal supply of money

**NM** fixed nominal supply of nonmonetary assets

We make this assumption of two types of assets not because we wish to simplify away the world, but because it enables us to highlight and isolate the determinants of money demand. We do not wish to explain the differences between all assets. We do wish to explain why agents choose to hold part of their portfolio in money and part in nonmonetary assets. We will often refer to the fact that agents choose to hold their wealth in that asset which best suits their needs according to the following: expected return, risk, and liquidity. As the interest rate on nonmonetary assets rises, people will choose to hold more of their portfolio in nonmonetary assets than in money.

### **Asset Market Equilibrium**

**quantity of money supplied = quantity of money demanded**

### **Book's Example: Ed's Money**

**M** fixed nominal supply of money

Ed's total nominal wealth =  $m^d + nm^d$

Aggregating across all agents

aggregate nominal wealth =  $M^d + NM^d$

Since there are only two assets,

aggregate nominal wealth =  $M + NM$

Subtracting equations gives us the equilibrium condition for the asset and money markets

$$(M^d - M) + (NM^d - NM) = 0$$

where

$$(M^d - M) \quad \text{excess demand for money}$$

and

$$(NM^d - NM) \quad \text{excess demand for nonmonetary assets}$$

With the assumption of two assets, money and nonmonetary assets, asset market equilibrium occurs only when money supplied equals money demanded. So when we look at the demand and supply for money, we need not consider the asset market. **Equilibrium in one implies equilibrium in the other.**

#### Asset Market Equilibrium Condition:

Recall our money demand function

$$M^d = PL(Y, i)$$

In equilibrium

$$M^s = M^d$$

$$M^s = PL(Y, i)$$

$$\frac{M^s}{P} = L(Y, i)$$

Now we can graph this relationship

