University of Illinois
Macroeconomic Principles - Econ 103 - Spring 2013
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Additional Reading 8–on Money Market short run vs long run

Chapter 11 is a classical demand-and-supply analysis on Money Market where nominal interest rate is the "price" and money is our "product". The rationale of the analysis on the money market is exactly the same as on a good or service market.If you have forgotten about classical theory on price and quantity, please read Review on Microeconomics. As you can see later, we put the "price" of holding money–nominal interest rate on vertical axis and the quantity of money as measured by M_1, M_2 and M_3 on horizontal axis.
And also I want to point out that we do not have to differentiate between nominal and real interest rates if our horizon is in the short run where expected inflation is fixed due to fact that prices are fixed according to Keynesian Theory.If you look at $r = i - \pi^e$, you'll be convinced that this is reasonable because r and i always co-move with each other in the short run when π^e is fixed.So we can also put real interest rate r on the vertical axis.

1. **Money Demand**
   The portfolio choice of individuals is to decide how much to invest in various financial assets. Suppose, for simplicity, that an investor has to decide how much to invest of her assets into money (cash or deposit balances that have a zero interest rate return) and how much to invest into interest-bearing assets (short term Treasury bills). So We can represent people's wealth as

   $$W = M_D + B_D$$

   Money balances do not offer any nominal return (zero interest rate) but they are more liquid in that you can use them to do transactions (buy/sell goods) whereas short term T-bonds have the advantage that they earn interest; however, they have the disadvantage that they cannot be used to make transactions (you need money to buy goods and services). So, an investor will have to decide on how to allocate its wealth between money and bonds considering the benefits and costs of both instruments. (This can be further explained by transaction or speculative motive)
   So the demand for money will depend positively on the amount of transactions made (which is in turn determined by the aggregate income or output abbreviated as Y) and negatively on the opportunity cost ("price") of holding money which is the difference between the rates of return on money and short term T-bonds:

Table 1: The real and nominal returns on two assets: Money and Bonds

Asset	Real Return	Nominal Return
Money	$-\pi^e$	0
Short-term T-bonds	r	$i = r + \pi^e$
Difference	$i = r + \pi^e$	$i = r + \pi^e$

   where π^e is the expected inflation rate,i is the nominal interest rate and r is the real interest rate.
   So the equation for **the nominal demand of money**(also called liquidity preference equation) is:

   $$M_D = \overset{+}{P}L(\overset{-}{i}, \overset{+}{Y})$$

   Where M_D is the number of dollars demanded
   P is the price of goods.
   L is the function relating how money are demanded to Y and i.
   This equation suggests that there are three main determinants of the nominal demand for money:

- **Nominal Interest rates.** An increase in the interest rate will lead to a reduction in the demand for money because higher interest rates will lead investors to put less of their portfolio in money (that has a zero interest rate return) and more of their portfolio in interest-rate bearing assets (Treasury bonds).So T-bonds and money are **substitutes**.
- **Real aggregate income.** An increase in the income of the investor will lead to an increase in the demand for money. In fact, if income is higher consumer will need to hold more cash balances to make transactions (buy goods and services).
- **The price level.** An increase in the price level P will lead to a proportional increase in the nominal demand for money: in fact, if prices of all goods double, we need twice as much money to make the same amount of real transactions.

We can represent the relation between the demand for money and the interest rate on a graph where the interest rate is on the vertical axis and the demand for money is on the horizontal axis. The relation will be downward-sloping because a higher (lower) interest rate will cause a reduction (increase) in the demand for money.
Note that either P or Y would shift the position of money demand curve. For example, an increase in the level of income Y(or Price Level P) will lead to an increase in the demand for money, at any level of the interest rate. So, an increase in Y(or Price Level P) leads to an outward shift of the money demand curve. Therefore, in Figure 1 changes in the interest rate are represented by a movement along the same money demand curve while changes in the income(price) are represented by shifts of the entire curve.

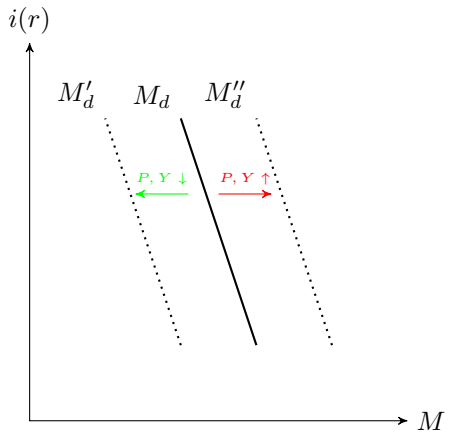


Figure 1: Money Demand Curve

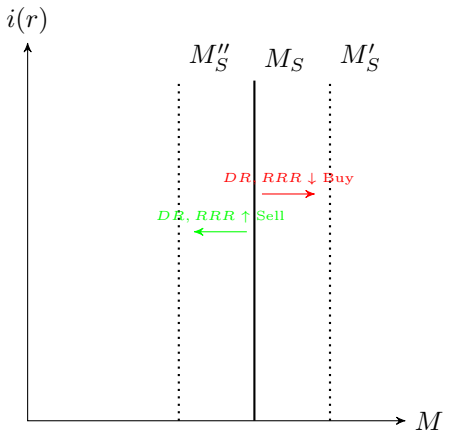


Figure 2: Money Supply Curve

2. **Money Supply**
   The nominal supply of money is determined by the Fed. As we learned in Chapter 10, the Fed can use three conventional tools to manipulate money supply:Required Reserve Ratio;Discount Rate;Open Market Operation. So we assume M_S is invariant to nominal interest rate and on the diagram for money market, it is perfectly inelastic or vertical. An increase in money supply translates into a rightward shift of supply curve and vice versa.As you can see in Figure 2, Money supply curve is vertical and shows that money supply is fixed unless the Fed wants to adjust it through monetary tools such as OMO, RRR and Discount Rate etc.

3. **Liquidity Preference Framework**
   The equilibrium in the financial market can be described by the following three equilibrium conditions:

   - The wealth can be broken down into two forms of assets:

     $$W = B_S + M_S = B_D + M_D$$

     where the bonds and money supply can be adjusted by the OMO of the Federal Reserve and the demand side depends on the households.

- The equilibrium in the bond market will be achieved when

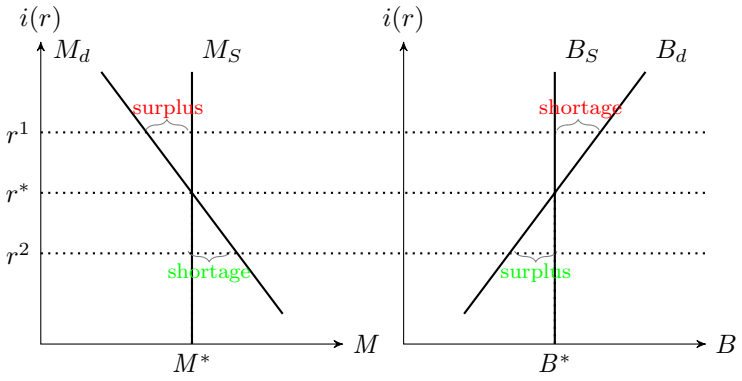
$$B_S = B_D$$

- The equilibrium in the money market will be reached if

$$M_S = M_D$$

One thing to notice is that when the bond market is in equilibrium, the money market also has to be in the equilibrium.Why? Rearranging the identity above: $B_S - B_D = M_D - M_S$.So when bond market is at equilibrium, $B_S - B_D = 0$, of course, we have $M_D - M_S = 0$ or money market is also in equilibrium. Therefore, we only need to analyze one of these two markets.In this chapter, we focus on money market while we also keep an eye on bonds market to get more insights into how everything pieces together. This equilibrium in the money market is represented in Figure 3.Note that the supply of money M_S is exogenously given. Given the demand for money curve, there is only one interest rate (r^*) at which the money demand is equal to the money supply.

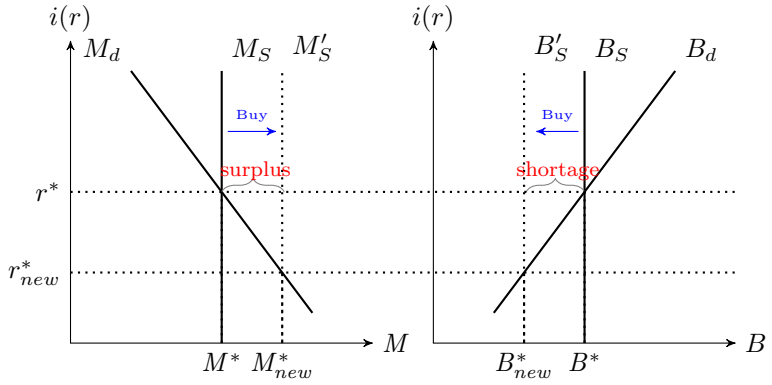
Figure 3: The Equilibrium in Money and Bonds Markets



Note that, if the interest rate is above (below) the equilibrium one, the demand for money will be lower (higher) than the money supply and this will tend to decrease (increase) the interest rate until the equilibrium interest rate is restored.
To understand the economic mechanism that leads to this adjustment, note that the investor must decide how much to invest in money and how much to invest in bonds. Since the demand for money move negatively with interest rate, the demand for bonds is positively related with the interest rate, i.e. as interest rates become higher, the investor would like to put more of her wealth in bonds and less of her wealth in money. This positive relation between the interest rate and the demand for bonds (B_D) is represented in Figure 3.
In Figure 3, we also show the supply of bonds: the total supply of bonds is equal to the total amount of bonds issued by the government that are now held by households.The total supply of bonds is determined by the bond issues of the government and the OMO of the Federal Reserve.Note that the equilibrium interest rate that ensures that the demand for money is equal to the supply of money is the same as the interest rate at which the demand for bonds is equal to the supply of bonds.
Therefore, as we can see in Figure 3, when $r^1 > r^*$, there is a surplus in money and shortage in bonds ($M_d < M_s$while it has to be true that $B_d > B_s$).Conversely,if $r^2 < r^*$,there is a shortage in money and surplus in bonds ($M_s < M_d$ and $B_s > M_d$).Intuitively, when interest rate is r^1 at which there is an excess supply of money(surplus) meaning that more people want to increase their holdings of bonds and decrease their holdings of money, this will drive down the interest rate to restore the equilibrium.At r^2, a lower-than-equilibrium interest rate, more people want to increase their holdings of money and decrease their holdings of bonds, thus putting more upward pressure on the interest rate to restore the equilibrium.
In your homework, questions 13,14 and 18 address this question of how the money and bonds markets adjust back to the equilibrium point from states of disequilibria.

Given money and bonds markets in equilibrium($M_s = M_d$ and $B_s = B_d$), we ask what moves would create a surplus in money supply? The answer is easy, i.e. M_s curve moves to the right or M_d shifts to left. Now take an increase in Money supply for example, suppose the Fed has expanded its monetary base by buying some short-term T-bonds. This would shift the money supply curve to the right and bonds supply curve to the left thus leading to a surplus in money supply and a shortage in bonds supply.In the bonds market,a more intense competition among bonds buyers would cause bonds price to go up thus driving down the interest rate while in the money market the people are going to hold more money once the interest rtes on bonds are lower. In a word,money surplus put downward pressure on the interest rate so that the equilibrium can be restored. This move is shown in Figure 4.
Let's consider money demand now, either price level fall or aggregate income decrease would cause lower demand for more money thus creating an excessive liquid market with too much money. Therefore, the interest rate has to go down so that people are willing to hold more money as a way to restore the equilibrium.
Obviously, if M_s moves to the left or M_d shifts to the right or both,this will cause interest rate to rise in order to restore the equilibrium.

Figure 4: An increase(decrease) in Money(Bonds) Supply in Money(Bonds) Market



4. **The Elasticity of Money Demand and Effectiveness of Monetary Policy**
We know that M_S curve is perfectly inelastic but M_D curve is not. Therefore, the effectiveness of monetary policy to a large degree depends on the slope of M_D curve.Now look at the graph on page 174 in your course packet, given a fixed amount of increase in the supply of money from MS to MS, if the interest rate changes by a **greater amount**,we say this monetary policy is relatively **more effective**. It can be clearly seen that interest rate falls by a greater amount for MD_1 which is the steeper one compared to MD_2. In other words, monetary policy will have a more pronounced effect along MD_1 than along MD_2. In conclusion, monetary policy tends to be more effective when individuals demand for money is less sensitive to the interest rate.The intuition behind this is that in the universe of MD_1, people have greater preference over liquidity than those in the universe of MD_2, so they care more about the change in the quantity of money in circulation than their counterparts in universe MD_2 thus leading to a greater change in equilibrium interest rate.

5. **Long run money market**
In the long run, when prices are flexible, we have to differentiate between nominal and real interest rates because an increase in the rate of growth of money leads to an immediate proportional increase in the inflation rate, in the nominal interest rate with no effects on the real interest rate.In other words, the proportional increase in the price that demands more money might fully offset the increase in the money supply which left real interest rate unchanged but led to nominal interest rate going up. This is called **Fisher Effect** which means once money supply is increased, the nominal interest rate will eventually go up in the long run. Because real interest rate stays the same(and investment, consumption and real output), we say money is **NEUTRAL** in the long run because money as a nominal variable has no effect on real variables(This is also called **Classcial Dichotomy**). Later, we are going

to see monetarist view(a variant of classical view) that prices are flexible even in the short run and therefore money is also neutral is in the long run.
However, empirical evidence shows that higher money growth reduces the nominal and real interest rate in the short run and leads to an increase in the rate of inflation only slowly over time. The reduction in the real interest rate, in turn, leads to a short-run increase in investment, consumption and the level of output.In other words, the data tell us that in the short run Keynesian "liquidity" effect dominates the economy with money being non-neutral and over time, Classical Fisher effect takes over and eventually money will become neutral with the growth of money supply being digested by the inflation.
The Figure 5 shows you the **Fisher Effect** where the money supply is followed by an increase in the price level(an inflation), the nominal interest rate may increase instead of decrease as predicted by Keynesians who assume prices are STICKY.Notice in this case we put nominal interest rate on the vertical axis.
In your homework, Question 9 asks you to do a similar thing.In that question,the growth rates of output and prices are high enough to fully offset the Keynesian Effect expanding money supply has on the interest rate thus leading to a higher interest rate.

Figure 5: The Equilibrium in Money and Bonds Markets