FINANCIAL MARKETS

In an aggregate economy, we often find that the expenditure needs of one sector (households) is often less than income or revenue resulting is a surplus of funds. These funds are often known as savings and more specifically, private savings. The opposite is often true for the business sector and government sector of the economy. For these sectors expenditure often exceeds revenue such that there is a need to borrow funds from the household sector. The transfer of funds from one sector to another via lending and borrowing is facilitated by financial markets and the use of different financial instruments.

There are two methods by which these funds may be transferred. One method is through **financial intermediation** that involves the use of a commercial banking system to attract deposits from individuals and institutions and make loans to other individuals or institutions. The key assets for these banks are money (cash balances) and **deposits**. These banks act as **intermediaries** between lender and borrower hopefully minimizing the transactions costs (risk-assessment of borrower and liquidity needs of the depositor) related to this type of financial activity. A second method is known as **direct finance** when borrower and lender directly interact through activity in equity or debt markets. In this case the lender will buy financial instruments (shares of stock or bonds) being sold by borrowers.

Households with surplus funds (income in excess of spending needs) will seek to choose the best way in which to use these funds. This best way depends on the liquidity needs of the household, attitudes towards financial risk, and desired return when these funds are made available to financial markets. These households may deposit these funds in a commercial bank or savings institution, maintain a high level of liquidity (easy and quick access to these funds), be exposed to small risk of capital loss, and earn a small return in the form of simple interest. An alternative would be to buy a share of stock or a bond where the returns may be higher in the form of dividends, interest, and capital gains. However, this activity exposes the individual to more risk (default in the case of bonds and capital losses) and less liquidity (having to convert these types of financial instruments into cash). Other possibilities would be to buy commodity assets or properties that often pay no interest or dividends but may appreciate over time. The returns may be greater combined with more risk and less liquidity. A final option available to the household would be to remain perfectly liquid, that is, avoid financial risk and hold these surplus funds as **cash** (*money*) even though this type of asset pays no return (interest, rents, dividends, or capital gains).

The information made available by financial markets (*as well as commodity and property markets*) to the owners of these surplus funds helps in making decisions about the best use of these funds. However, because perfect liquidity is an option, money plays a special role in financial market activity.

Financial Instruments

Two common capital market financial instruments are **Stocks** (*or Equities*) and **Bonds**. A share of stock conveys certain ownership rights to the holder such that person may share in the profits or earnings of a publicly-held corporation and, in some cases, have a voice in how that company is managed. A bond is a debt contract explicitly stating the amount borrowed and to be repaid, date of repayment, and interest to be paid by the borrower to the lender. Bonds may be issued (sold) by large corporations, municipal governments, or the federal government to meet budgetary needs.

Bonds and the Inverse Relationship between Asset Prices and Asset Yields

A **Bond** represents a long-term debt contract between a borrower and lender. The terms of this contract include the face value (the amount borrowed per bond issued) **F**, a rate of (annual or semi-annual) interest **r**, and the maturity (the date when the face amount must be repaid) **N**. The coupon of the bond **R** represents the periodic dollar amount of interest paid to the lender/owner of the bond over the life of that bond. This coupon amount is calculated simply by taking the product of the face value and rate of interest:

$$\mathbf{R} = (\mathbf{F})(\mathbf{r})$$

The price (or *present value*) of a 30 year bond that pays an annual coupon of '**R**' and has a face value of '**F**' to be repaid at the end of 30 years is defined by the following formula:

$$\mathbf{P}_{bond} = \mathbf{PV}_{bond} = \Sigma_{[t=1,30]}\, \mathbf{R}_t(1+r)^{-t} + \mathbf{F}(1+r)^{-30}$$

or using the formula for a sum of a geometric series:

$$= (\mathbf{R}/r)[1 - (1+r)^{-30}] + \mathbf{F}(1+r)^{-30}$$

If the current rate of discount 'r' is the same as the printed interest rate on the bond (so that R/r = F) then:

$$\mathbf{P}_{bond} = \mathbf{F}$$

As 'N' approaches infinity, (the Bond never matures) for any rate of discount, this expression reduces to:

$$\mathbf{P}_{bond} = (\mathbf{R}/r)$$

which is known as the **present value of a perpetuity** and provides a simple formula for understanding the relationship between asset prices 'P' and asset yields 'Ψ' (or interest rates).

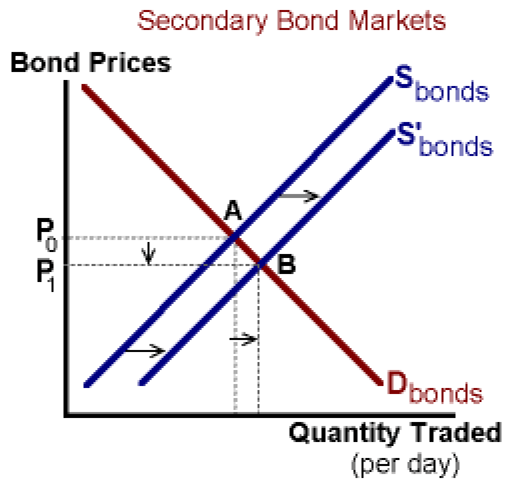
$$\Psi = \mathbf{R} / \mathbf{P}_{bonds}$$

Bonds are first issued in **primary bond markets** where the seller represents the borrower and the buyer represents the lender. Activity in primary markets is modeled by the flow of funds model. The coupon payment and face value are fixed by contract over the life of the bond. If market interest rates are the same as the printed rate of interest on the bond, then the price (present value) of that bond is the same as its face value-- the bond sells at **par-value**. If market interest rates have risen, prior to the sale of the bond, such that investors can receive higher yields on competing investments; then, the market price of the bond will be less than its face value. The bond will sell at a **discount**. If the opposite is true such that market rates have fallen, then the bond will sell at a **premium** -- the market price will exceed its face value. Bond prices move in the opposite direction of market interest rates.

In order to maintain liquidity with respect to bond (and stock) ownership, a **secondary bond market** also exists for the buying and selling of these bonds at current interest rates. This buying and selling does not represent any new debt activity but rather the exchange of bonds (and other securities) among investors.

Activity in secondary markets often reflects changes in the economic environment where buying and selling activity is driven by changes in inflationary expectations, changing attitudes towards (credit and interest rate) risk, and changes in perceived uncertainty about the future.

Figure 1, An Increase in Inflationary Expectations



For example, suppose that information becomes available such that investors revise their inflationary expectations upward. Given that inflation lowers the real rate of return received by lenders (*or those holding bonds and other securities*), these individuals will begin to sell existing bonds in the secondary market. This selling creates a surplus of bonds being offered such that bond prices must fall to induce potential buyers to accept these securities in an accelerating inflationary environment. With this decline in bond prices, secondary bond yields increase:

$$(\mathbf{R} / \mathbf{P}_{\text{bonds}} \downarrow) = \Psi \uparrow$$

When yields do rise, investors have the option of buying existing bonds in the secondary bond market or new bonds in the primary market. In order for these new bonds to be competitive with existing bonds, a higher rate of interest must be offered. This higher rate of (nominal) interest will reflect the upward revision of expected inflation.

Table 1: A Bond Market Example:

Secondary Market	**Primary Market**
(*Existing Bonds*)	(*New Debt Issues*)
F = \$1,000	**F** = \$1000
i = 5%, **R** = \$50	i = 8%, **R** = \$80
$\Psi' = 8\%$	
P_{mkt} = \$625.00 = (\$50/Ψ')	P_{mkt} = \$1,000 = \$80/i
Yield = \$50/\$625.00 = 8%	Yield = \$80/\$1,000 = 8%

Secondary markets also facilitate portfolio adjustments in reaction to a changing economic environment. For example given two different assets one being higher risk (a BBB rated 5 year corporate bond) and the other no risk (i.e., a Treasury Note), we would expect that:

$$\Psi_{\text{BBB-Corporate}} > \Psi_{\text{T-Note}} \text{ such that: } \quad \rho = (\Psi_{\text{BBB-Corporate}} - \Psi_{\text{T-Note}})$$

If for some reason the perceived risk of holding debt instruments were to increase, we would expect to observe a flight to quality – a selling the corporate bonds and buying of Treasury instruments.

Secondary Market Activity – "A Flight to Quality"

Figure 2a, Risky Debt Instruments

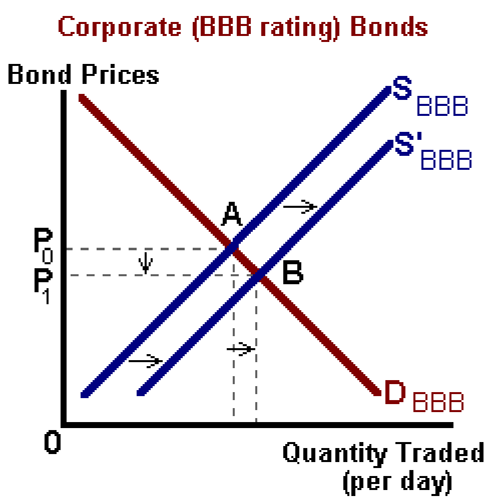
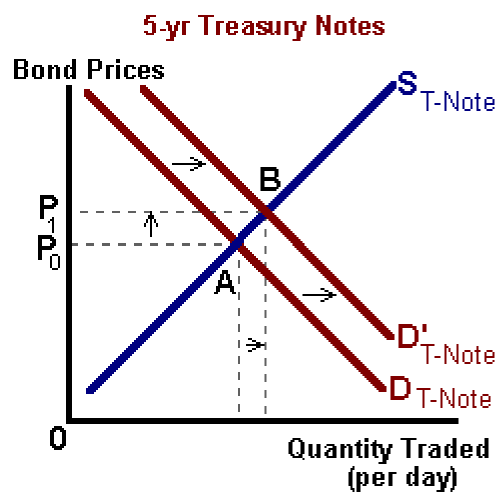


Figure 2b, Risk-free Debt Instruments



Increased selling will drive the price of Corporate bonds down and buying activity will drive the price of Treasury Notes up or:

$$P_{\text{BBB-Corporate}} \downarrow \Psi_{\text{BBB-Corporate}} \uparrow \qquad \text{and} \qquad P_{\text{T-Note}} \uparrow \; \Psi_{\text{T-Note}} \downarrow$$

Such that:

$$(\Psi_{\text{BBB-Corporate}} \uparrow - \Psi_{\text{T-Note}} \downarrow) \quad \Rightarrow \quad \rho \Uparrow$$

This increase in perceived risk will translate into higher risk premiums in secondary markets and thus require that riskier borrowers pay a higher premium (*higher nominal interest rates*) in primary markets.

Common Stock

Common stock represent ownership (equity) shares in publicly-held corporations. These rights of ownership often include a share in the profits (earnings) of that corporation. However, these earnings may be used either as a source of internal financing, known as retained earnings, or paid out as a periodic payment to the owners as dividends. The value of the corporation is thus based on the present value of this stream of earnings '**E**' whether they are paid out or not.

$$\mathbf{P}_{share} = \sum \mathbf{E}_t(1+r)^{-t}$$

Much is made of the **price/earnings (PE) ratio** of different common stocks with a low PE being often preferred to a high PE for a given stock. This ratio is often used as a benchmark to determine if that corporation is over-valued (too high) or under-valued (too low) by the stock market based on its current trading price. This ratio is nothing more than the reciprocal of a simple yield calculation based on the present-value of a perpetuity formula:

$$P_{asset} = (\mathbf{R}/r)$$

or

$$\Psi_{asset} = \mathbf{R}/P_{asset}$$

or

$$\Psi_{stock} = \mathbf{E}/P_{share}$$

The earnings-over-price ratio is often in percentage form and by taking the reciprocal we define an integer expression that is often easier for use in making comparisons among different stocks. However, for purposes of evaluation, we can use the reciprocal of the PE and compare with investments of equivalent risk and maturity or against the yields on perhaps safer marketable assets.

What is unique about equity instruments is that their value often is based not just on the periodic return (earnings in this case) but also the expected rate of growth for the corresponding corporation. The rate of return on common stock is often (usually for well-established mature corporations) calculated by the following formula:

$$\Psi = \mathbf{E}/P_{share} + E[g]$$

where 'Ψ' is the rate of return, '**E**' represents annual earnings (or dividend), 'P' is the purchase price of a share of the stock, and E[g] is the expected growth rate in future earnings.

Given annual earnings of $1.00/share, a purchase price of $30.00 per share, and an expected growth rate of 5%; the rate of return would be:

Ψ = (\$1.00/\$30.00) + .05 = .0333 + .05 = 8.33%

This formula can also be used to determine the appropriate price to be paid per share of stock given expected growth rates in the annual dividend and some measure of the rate of return 'r*' based on similar investments. Solving for 'P', we have:

$P_{share} = \mathbf{E}/(r^* - g)$

or given annual earnings per share of \$2.00, an expected (or required) rate of return of 8%, and an expected growth rate in future earnings for that company of 3% per year; we calculate the purchase price to be:

P = \$2.00 / (0.08 - 0.03) = \$40.00

Quite often the explanation for the existence of both buyers and sellers of the same shares of stock is that buyers expect higher growth rates in future dividends relative to the expectations of sellers.

Treasury Bills, Money Market and other Short-term Debt instruments.
Most Treasury bills and/or commercial paper (due to their short maturity -- 1 year or less) are discounted at the time of sale rather than pay some coupon payment over the holding period. This **discount** is calculated as follows:

$$\text{Discount} = \frac{(\mathbf{F})(r)(d)}{365}$$

where **F** is the face value (the amount borrowed or principal), 'd' is the days to maturity, and r is the market interest rate.

For example, if a business needs to borrow roughly \$1,000,000 for six months (182 days) to finance seasonal inventory needs, and current market rates are 10% then the amount of the discount would be:

$$\frac{(\$1{,}000{,}000)(0.10)(182)}{365} = \$49{,}683$$

thus the actual amount borrowed by that business firm is:

\$1,000,000 - \$49,683 = \$950,137

However the full \$1,000,000 is repaid at the maturity date.

The rate of return (the yield) on this short-term debt instrument is equal to the amount of the discount divided by the amount borrowed or:

$$\frac{\$49,683}{\$950,137} = \Psi = 5.23\% \text{ semi-annually}$$

or an **effective rate** of:

$$(1.0523)^2 - 1 = 10.7\% \text{ annually}$$

Note: the **effective yield** ‘$\Psi_{effective}$’, for ‘k’ compounding periods and *annual* interest rate ‘r’, is calculated as follows:

Given: $FV^k = P(1 + r/k)^k$

$$\Psi_{effective} = [P(1 + r/k)^k - P]/P$$

$$= (1 + r/k)^k - 1$$

Trading of money market instruments of particular face value ‘**F**’ is based on prices offered for these instruments in secondary markets or via auction in primary markets. The yield is then computed as follows:

$$\Psi = \frac{\mathbf{F} - P_{offered}}{P_{offered}} = \frac{\mathbf{F}}{P_{offered}} - 1$$

such that as $P_{offered} \uparrow$, $\Psi \downarrow$.

The Expected Total Rate of Return (ETRR)

Since stocks, bonds and money market instruments are marketable securities, the potential exists for changes in market price which may translate into **capital gains** or perhaps **capital losses**. A capital gain occurs when the selling price of a security 'P_s' exceeds the purchase price 'P_p'. If the selling price is less than the purchase price then the owner will incur a capital loss.

Capital gains and losses can either enhance or reduce the normal rate of return on a given security. For this reason, acquisition of these securities are often based on expectations of future capital gains in addition to the normal rate of return. This overall yield or **Expected Total Rate of Return** 'ETRR' defined as follows:

$$\mathbf{ETRR} = [R + E[P_s] - P_p]/P_p$$
$$= r_n + (E[P_s] - P_p)/P_p$$

where 'r_n' represents the normal rate of return (current yield -- R/P_p) on the security and '$E[P_s]$' represents the expected selling price of the security at some point in the future.

Expectations about the selling price ($E[P_s]$) depend on expected changes in market interest rates (such that these prices and interest rates will move in opposite directions), and/or expected rates of growth in earnings (in the case of equities). Lower market interest rates or higher rates of growth can lead to capital gains on the sale of these assets such that the ETRR is *greater* than the current yield. If market interest rates are expected to increase or growth rates in earnings are revised downwards, then these assets may sell a price *below* the price paid and thus a capital loss results. In this case the ETRR may be less than the current yield and, in the case of an extreme increase in interest rates, be negative with a significant decline in the selling price (the capital loss more than offsets the normal yield). *In situations where investors expect the total rate of return to be negative on a financial asset,* ***cash*** *will present a suitable alternative given that:*

$$TRR_{cash} = 0.$$

Thus solid reasons may exist for holding cash in a portfolio of financial assets even though cash does not pay any type of periodic return. In the expectation of capital losses on marketable securities, principal may be preserved by holding cash.

Cash as a Financial Asset

In any economy, money plays several roles:

- To act as a **medium of exchange** to facilitate the payment of income and purchase of goods and services.
- To act as a **unit of account**--a measure by which all prices are established, and
- To act as a **store of value** -- that is to alter the timing of spending decisions relative to earning income.

Because of the dual role of money as a **medium of exchange** and **store of value**, several economic variables affect the desire to hold this type of financial asset.

Money can be narrowly defined as anything that may be used for purchasing goods and services or more broadly to include anything of value that may be used for trade. Two common definitions as established by monetary authorities are M_1 and M_2:

- M_1 = Currency + Demand Deposits (checking accounts or current accounts)
- $M_2 = M_1$ + Time Deposits (simple interest-bearing savings accounts)

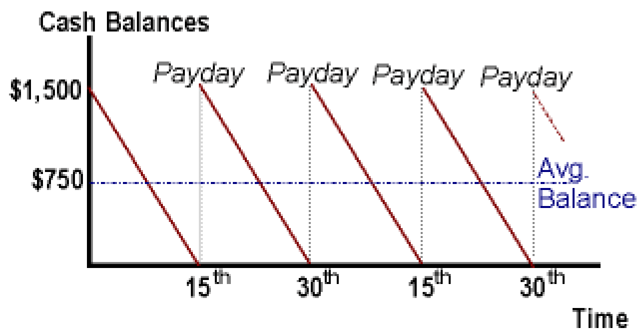
The first measure is known as the narrow definition of money that represents components that are readily accepted as payments for goods or to satisfy debts. The second measure is known as a broader definition that includes savings accounts that can easily be converted into currency or demand deposits.

Individuals typically hold cash balances (money) to allow for making transactions (that is buying goods and services) and the paying of bills and other obligations. The volume of these transactions tends to be proportional to that individual's level of income such that the demand for these cash balances in support of transactions needs will also be proportional to income '**Y**'.

$$M_d = \mathbf{k}_{[+]}(\mathbf{Y})$$

This is best understood by looking at the cash balances held by an individual over time. Assume that a person is paid a monthly salary of $3000 and paid twice a month. On the 1st and 15th of each month, this person is paid $1500 which is held as cash or as a deposit in a checking (current) account. Over the days that follow these cash balances are run-down as this person buys goods and services or pays his monthly bills such that towards the end of a pay period, his cash balances are close to $0. However, at the beginning of the next pay period $1500 is received and his cash balances are restored. Thus at the beginning of a pay period this person is holding (demanding) $1500 and towards the end of the pay period he is holding some amount close to $0. On average this person has cash balances of about $750 [($1500-0)/2] or 25% of his/her monthly income.

Figure 3, A time profile of Cash Balances



This represents part of his individual demand for cash balances or money. By aggregating over all individuals and institutions in the economy we can derive the aggregate demand for money as the sum of individual demands. With an increase in income (either for an individual or in the aggregate) we would expect that more is held such that the average amount held over time increases.

$$M_d^T = f_{[+]}(\mathbf{Y}) \qquad \textit{note}: \mathbf{Y} = \text{NGDP } \textit{in the aggregate.}$$

One might question the notion that at the end of a pay period, cash balances are equal to $0. Cash balances not used for transactions represent a source for savings (a surplus of funds). The individual might choose to keep these "savings" in the form of currency of on deposit in a checking account. But by making this choice, the individual is giving up the opportunity to earn some form of return (or yield) on these funds in the form of interest, profits, or rents. As yields rise, the opportunity cost of holding cash balances also increases inducing the individual to minimize his cash holdings. The individual can do this by buying an alternative financial asset in the form of a time deposit (or certificate of deposit), share of stock, or a bond. When one of these assets is purchased (or demand deposit balances are converted to time deposit balances) the individual's cash balances are reduced.

The expression for money demand can be amended as follows:

$$\mathbf{M_d} = f\,(\mathbf{Y}_{[+]}, \mathrm{i}_{[-]}).$$

We can therefore state that money demand is *directly* proportional to Nominal GDP and *inversely* related to market interest rates and yields on different financial assets. In summary, economic performance in the real sector (*changes in income*) or activity in financial markets (*buying and selling of stocks, bonds, and related financial instruments affecting these asset yields*) can influence the demand for money/cash balances.

The Inventory-Theoretic Model of Money Demand

One approach to derive the functional form of money demand is that based on inventory control theory common in many models of management. In this approach, optimal cash balances are based on minimizing the total cost of holding these cash balances. This total cost is based on the sum of making transactions into or out of cash and the increasing opportunity cost of holding larger balances.

This cost relationship can be expressed as follows:

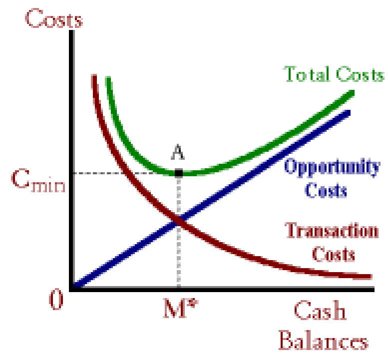
$$\mathit{min}\ \text{Costs} = b(\mathbf{Y}/\mathbf{M}) + \mathbf{M}(\mathrm{i})$$

where:

- b = the cost of making a single cash transaction
  (i.e., withdrawals from a checking or savings account or conversion into stocks and bonds)
- **Y** = Income.
- **i** = a market-determined interest rate or yield.
- **M** = the size of Cash Balances.

The ratio Y/M represents the number of transactions made per time period. For example is an individual's income is $2000 per month and he/she holds on average $400 at any point in time, that individual will make 5 transactions per month. A smaller amount held as cash balances results in a greater number of transactions being made per time period and thus an increase in the cost of holding these cash balances. Given this second component, larger cash balances result in greater opportunity costs measured in foregone interest income. Thus a tradeoff exists where an individual may want to hold larger cash balances to *minimize* the **transactions costs** but may want to hold smaller balances to reduce the **opportunity cost** of holding these balances. These cost relationships may be seen in the following diagram:

Figure 4, Cost of holding Cash Balances



Minimizing the sum of these costs implies finding the lowest point on the total cost curve in the above diagram. This point occurs at point '**A**' corresponding with optimal balances of **'M*'** This optimal value may also be found by using calculus and taking the derivative of the cost function with respect to M and setting the result equal to zero:

$$dC/dM = -b\mathbf{Y}/\mathbf{M}^2 + i = 0$$

or

$$b\mathbf{Y}/\mathbf{M}^2 = i$$

or

$$\mathbf{M^*} = (b\mathbf{Y}/i)^{1/2} = (b\mathbf{Y})^{1/2}(i)^{-1/2}$$

also known as the "square-root" rule. This result can be generalized as:

$$\mathbf{M^*} = (bY)^{\alpha}(i)^{-\beta}$$

The exponent 'α' represent the *income elasticity of money demand* and 'β' represents the *interest elasticity* of money demand. These elasticities measure the sensitivity of cash balance holdings to changes in the corresponding variable (income or the interest rate).

The above result states that optimal cash balances **M*** are directly related to income 'Y' and inversely related to interest rates 'i'. Lower interest rates lead to greater demand for cash balances as shown in the diagram below (left). An increase in Income (**NGDP**) will have the same effect by shifting the Money Demand function outward (below right):

Money Demand

Figure 5a, Change in the Interest Rate

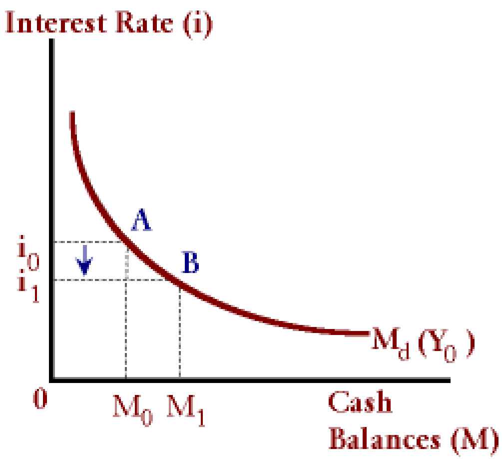
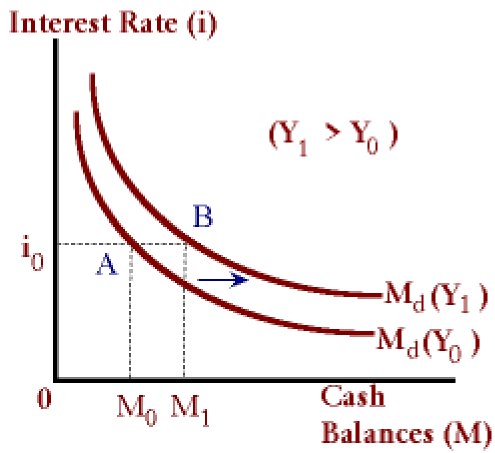


Figure 5b, A Change in Income



The Money Supply Process

Given the unique characteristics of money as a financial asset, manipulation of the **Money Supply** presents an opportunity for policy makers (Central Bankers) to affect the structure of interest rates and influence real economic activity. The use of monetary policy can target one particular short-term rate – the **Federal Funds Rate** that serves as a barometer of liquidity within the banking system. Typically as the Federal Funds rate increases or decreases, other short-term rates tend to follow. Thus monetary policy may be used to control the flow of funds through financial intermediaries – commercial banks.

Changes to the money supply can occur due to:

- changes in behavior (i.e., a desire to hold more cash 'C' relative to demand deposits 'DD' or time deposits 'TD'),
- changes in expectations (optimism or pessimism on behalf of the non-bank public or perhaps among bank managers), *or*
- changes in monetary policy (reserve requirements and open market operations).

To best understand how these changes occur, it is useful to look at the basic components and sample values of the balance sheets of the non-bank public, the commercial banks (that also includes balances for their treasury bond-trader customers), and the central bank (i.e., the Federal Reserve):

Non-Bank Public		Commercial Banking System		The Federal Reserve	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
C = \$2000		rR = \$500	DD = \$5000		C = \$2000
DD = \$5000		xR = \$500	TD=\$0		R = \$1000
TD = \$0					
	L = \$3000	L = \$3000			
		S_C = \$1000		S_F = \$2000	

In the above example, **C** represents currency in circulation -- an asset of the non-bank public and a liability of the central bank. **DD** refers to demand deposits, **TD** refers to time deposits – deposits being assets of the non-bank public and an liabilities of commercial banks. **rR (required reserves)**, **xR (excess reserves)** , and their sum **R** represent **total reserves** and are *non-income producing assets* of the commercial banks and a liability of the central bank respectively. **L** refers to loans outstanding -- a liability of the non-bank public and an *income-producing asset* for the commercial banks. Finally **S** (= $S_C + S_F$ held by commercial banks and the Fed respectively) is a reference to securities, specifically government securities (treasuries), that are liabilities of the Federal Government.

The M_1 Money Multiplier

If we focus on M_1 = C + DD, we find that this measure represents the main liquid financial assets of the non-bank public. In a similar manner we can define the **monetary base B** (also known as high-powered money), as the sum of the main liabilities of central bank. If we relate these two measures to one-another, we can define a link between the two, known as the **Money Multiplier**. This is accomplished as follows:

$$\mathbf{M_1} = [1 + (C/DD)](\mathbf{DD})$$

$$\mathbf{B} = r_d DD + xR + C$$
$$= [r_d + (xR/DD) + (C/DD)](\mathbf{DD})$$

where r_d represents the reserve requirements on demand deposits. Rearranging, we can write:

$$\mathbf{DD} = \mathbf{B} / [r_d + (xR/DD) + (C/DD)]$$

thus

$$\mathbf{M_1} = \{[1 + (C/DD)] / [r_d + (xR/DD) + (C/DD)]\}\mathbf{B}$$

or

$$\mathbf{M_1} = \mathbf{mm}\ (\mathbf{B})$$

where

$$\mathbf{mm} = \{[1 + (C/DD)] / [rd + (xR/DD) + (C/DD)]\}$$

and

$$\mathbf{mm} > 1.0 \text{ if } (r_d + xR/DD) < 1.0$$

This money multiplier represents the ability of a fractional-reserve banking system to create money within the economy, that is, for each dollar of reserves the money supply is some multiple of that value.

See: The Digital Economist: http://www.digitaleconomist.com/m_mult.html *to experiment with changes the in relevant parameters of the money multiplier.*

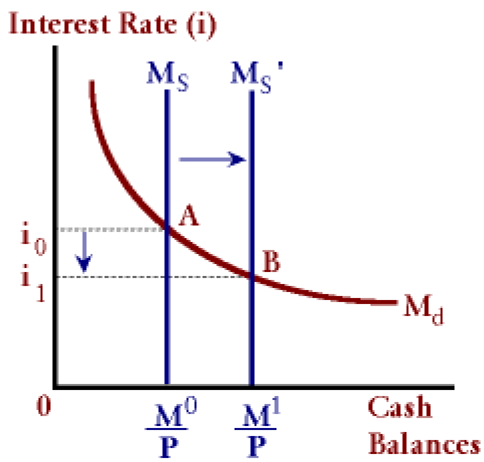
Increasing the reserve requirement, an infrequent tool of monetary policy, 'r_d' will reduce the value of the money multiplier and thus when holding the monetary base constant, reduce the money supply. Increases to the excess reserve-demand deposit ratio 'xR/DD' (*pessimism among bank management*) will have a similar affect on the money supply. Finally, changes in the currency-demand deposit ratio 'C/DD' will directly affect the money multiplier -- holding more cash in relative terms will reduce the money supply.

Open market operations, one policy tool of the Federal Reserve, will affect the monetary base. If the central bank chooses to pursue an **expansionary monetary policy**, they would begin to buy government securities from the commercial banks. Payment for these securities would be in the form of reserves credited to the commercial bank's account with the central bank. Thus there is a change in the composition of assets within the commercial bank's balance sheet -- a change that lead to fewer income producing assets (securities) and more non-income producing assets (excess Reserves). Banks will attempt to convert some or all of these excess reserves to new loans by lowering the interest rate that they charge on these loans.

Non-Bank Public		**Commercial Banking System**		**The Federal Reserve**	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
C		rR	DD		C
DD		xR $\uparrow^{(1)} \downarrow^{(2)}$	TD		R $\uparrow^{(1)}$
TD					
	L $\uparrow^{(2)}$	L $\uparrow^{(2)}$			
		S $\downarrow^{(1)}$		S $\uparrow^{(1)}$	

As the non-bank public takes out these new loans, they convert these funds into new deposits at the same or other banks in the commercial banking system. Demand deposits expand as does the money supply. Thus this particular type of open market operations (*buying securities*) leads to more reserves, expansion in the money supply and lower interest rates (note in the diagram below, $\mathbf{i_0} \rightarrow \mathbf{i_1}$ represents changes to the Federal Funds rate). This is shown in the diagram below:

Figure 6, Money Supply and Money Demand



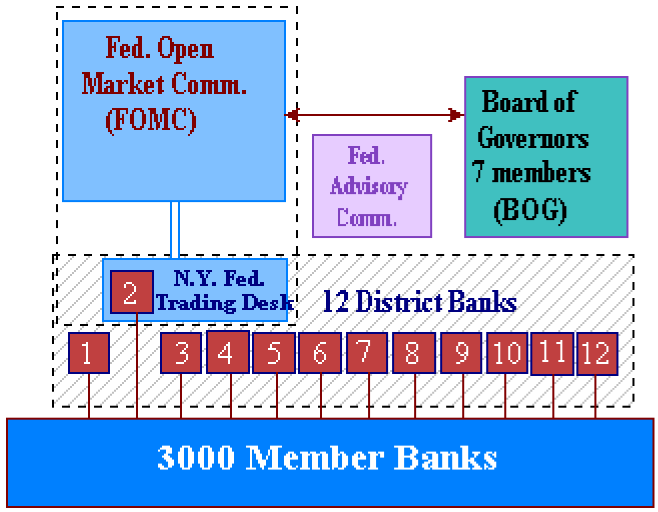
Contractionary monetary policy would do just the opposite. The central bank would sell government securities to the commercial banks, removing reserves from the system, causing these banks to curtail their loan activity and raising the interest rates charged on loans.

The Federal Reserve System and Central Banking

The Federal Reserve System, the Central Bank of the United States, was created by an act of Congress in 1913. Originally, the 'Fed' was designed as a *decentralized* Central Bank with 12 District banks located throughout the U.S. and the Board of Governors 'BOG' located in Washington D.C. However, over time the development and direction of monetary policy has migrated from these District banks to the BOG. Also by design, the Fed is both a quasi-public / quasi-private institution. Public in that the 7 members of the BOG are appointed by the President to staggered single 14 year terms and confirmed by Congress. Private in that the assets of the Fed are privately owned through stock owned by commercial banks as ownership shared in their local District bank.

The Fed is a *system* composed of roughly **3000 member commercial banks** (nationally chartered banks must be a member of the Federal Reserve System – State chartered banks have the option of joining), **12 District Banks** and **25 Branch District Banks**. In addition the system includes the seven-member Board of Governors and a twelve member **Federal Open Market Committee** – the FOMC. It is the FOMC; composed of the 7 Governors, 4 District Bank presidents serving on a rotating basis, and the President of the N.Y. District Bank that is responsible for providing directives guiding Open Market Operations.

Figure 7, The Federal Reserve System



The Fed has four main areas of responsibility:

- To act as *lender of last resort* or the *banker's bank*. In this role, the Fed is responsible for maintaining liquidity and solvency of the private commercial banking system.
- To maintain the purchasing power of the currency; that is, to promote price stability
- To promote stable economic growth by providing for an elastic currency to meet the needs of a dynamic market economy.
- To manage the international value of the Dollar on foreign exchange markets.

Sometimes these responsibilities are complementary but more often one goal is in conflict with another. Inflation fighting can sometimes come at the expense of economic growth. Injecting liquidity into the banking system in times of crisis can also lead to future inflationary pressure in the economy.

The above responsibilities can often be thought of as primary goals. The Fed will work to achieve certain goals by influencing different intermediate targets. These targets include: interest rates (specifically the **Federal Funds** rate), Money supply targets ($\mathbf{M_1}$ or $\mathbf{M_2}$), or a particular exchange rate. These targets are affected through three tools of monetary policy.

- **Open Market Operations** -- the buying and selling of Government Securities in the open market thus injecting or removing liquidity from the banking system. These operations will have direct effect on the Monetary Base,
- Changes to **Reserve Requirements** (thus changing the value of the Money Multiplier), *or*
- Changes to the **Discount Rate**.

Open market operations as described above, is the most common tool used in the implementation of monetary policy. For example, if the goal is to fight inflation, the Fed will set a target of a higher Federal Funds rate (*the directive will be to buy and, more likely, sell securities on the open market to achieve this target rate*). A higher Federal Funds rate will be an indication of less liquidity in the banking system and thus higher interest rates charged by these banks to their customers. With higher borrowing rates, certain investment projects will become less profitable and thus investment spending will decline. With the reduction in this investment spending, aggregate expenditure (Nominal GDP) should also decline. Less spending in the demand-side of the economy should eliminate any upward pressure on prices that may exist.

> *See: The Federal Reserve Website for more:* http://www.federalreserve.gov/general.htm
> *also*: Monetary Policy: http://www.newyorkfed.org/pihome/addpub/monpol

Interest rates thus act as a barometer of changing expectations, reaction to new information about economic events and of changes in monetary policy In addition interest rates provide the linkage between financial markets and the real economy. Changes in the money supply, the buying and selling of financial assets in secondary markets, or the issue and acquisition of financial assets in primary markets all affect returns to lenders and more importantly the cost of borrowing. It is these borrowing costs that affect investment spending decisions and thus real economic activity.

Be sure that you understand the following concepts and terms:

- Financial Markets
- Direct Finance
- Indirect Finance
- Financial Intermediary
- Primary (Financial) Market
- Secondary (Financial) Market
- Stocks
- Bonds
- Money Market Instrument
- Yield
- Present Value
- Present Value of a Perpetuity
- Discount
- Earnings
- Dividends
- Price-Earnings Ratio
- Expected Total Rate of Return
- Medium of Exchange
- M_1 & M_2
- Demand Deposits
- Time Deposits
- Required Reserves
- Excess Reserves
- Reserve Requirements
- Open Market Operations
- Central Bank
- The Quantity Equation
- Money Velocity

Suggested Readings:

- Blustein, Paul, *The Chastening, Inside the Crisis That Rocked the Global Financial System and Humbled the IMF*, 2001, Perseus Book Group.
- Friedman, Milton and Anna Schwartz, *Monetary History of the United States (1867-1960)*, 1963, Princeton University Press.
- Galbraith, John Kenneth, *MONEY Whence it Came, Where it Went*, 1975, Houghton Mifflin.
- Greider, William, *Secrets of the Temple, How the Federal Reserve Runs the Country*, 1987, Touchstone Books.
- Kindleberger, Charles P., *Manias, Panics, and Crashes: A History of Financial Crises*, 2000, John Wiley & Sons.
- Shiller, Robert J., *Irrational Exuberance*, 2000, Broadway Books.
- Woodward, Bob, *Maestro, Greenspan's Fed and the American Boom*, 2000, Simon and Schuster.

Problem Set #5: Present Value Calculations

1. Given the following:

$$PV_{bond} = \sum_{t=1}^{n} R_t(1+r)^{-t} + \mathbf{F}(1+r)^{-n} = \frac{R_t[1-(1+r)^{-n}]}{r} + \frac{\mathbf{F}}{(1+r)^n}$$

Calculate the following for a $1000 -- 30 year bond issued at 6% interest.

a. The Present Value of the first five interest payments ($r_{mkt} = 6\%$) :

b. The Present Value of this bond two years after it was originally sold ($r_{mkt} = 6\%$):

c. The Present Value of this bond two years after it was originally sold ($r_{mkt} = 8\%$):

2. Calculate the Total Rate of Return on this bond (from question #1) assuming that you paid full face value when it was issued and held it for exactly one year. However, in selling the bond, market interest rates had risen to 7%:

$$TRR = \frac{R_t + P_{sold} - P_{paid}}{P_{paid}}$$

Repeat these calculations for a market interest rate of 5% and 5.5%.

Problem Set #5, page 2

3. You have choice between two assets:

i. **Asset 1** which pays a single payment '**R**' of $5000 at the end of 24 months.
ii. **Asset 2** which pays $2,400 ($\mathbf{R_1}$) at the end of 12 months and $2500 ($\mathbf{R_2}$)at the end of 24 months.

The current price of each asset is $3500.

a. Calculate the rate of interest 'r' by which you would be indifferent between these two assets.

b. If the market rate of interest is 10% (r = 0.10) and **Asset 2** is priced at $3500, how much would you be willing to pay for **Asset 1** such that the present value of these two assets were equal?

4. Calculate the present value of an asset that pays a net return '**R**' of $450 annually over a 20 year period with the first payment received at the end of year five. (20 payments total). The annual rate of interest to be used is 5%. Show your work.

5. Which asset would be preferred: the asset described in problem #2 or an asset that pays $400 over a 20 year period with the first payment received at the end of year 1. (20 payments total). Use the same rate of interest (5%) and explain your answer. How is a drop in the market rate of interest likely to affect your answer

6. How much would you bid on a $10,000 twelve-month T-bill if your desired annual yield is 8%? How much would you bid on a 6-month T-bills?

7. Calculate the *effective rate of interest* 'r_e' given an annual rate of interest 'r' of 8% compounded quarterly. Perform the same calculate for monthly compounding.

Problem Set #6: The Money Supply

1. Given the following (all values in billions):

   C = Currency in circulation
   DD = Demand Deposits = $1,200
   XR = Excess Reserves
   r_d = reserve requirement on Demand Deposits = 0.10

   (C/DD) = 0.25, (XR/D) = 0.05

- Calculate the value of the monetary base.
- What does the monetary base represent?
- Calculate the value of the M_1 money supply.
- What is the value of the money multiplier?

If the central bank desires to target M_1 at $1,600, by how much should it change the monetary base?

How will this change affect: Currency in Circulation (ΔC)?, Demand Deposits (ΔDD)?

Explain exactly how *Open Market Operations* will be used to achieve this goal.

Problem Set #6: page 2

2. Using the data from question #1 combined with the following information about money demand equation and Nominal GDP (note: in equilibrium, $M_1 = M_s = M_d$):

NGDP (**Y**) = $10,000 {income held constant}

$M_d = 0.20Y - 100(i)$

Calculate the value of the nominal interest rate before and after the change in the money supply calculated on the previous page.

3. Suppose that we have the following additional information:

$Y_e = \alpha[A_o - h(r)]$ Equilibrium in the Real Economy where:
α = the Spending Multiplier,
A_o = Autonomous Expenditure, and '
h' = the Interest Sensitivity of Investment

$= 2.50[5000 - 200(r)]$ {note: r = i. such that $\pi = 0$}

Using the Money Demand equation of question #2, calculate the equilibrium level of income (Y_e) and market interest rate (r), before and after the changes in the money supply on the previous page.