Lecture 6: The Behavior of Interest Rates
Determinants of Asset Demand

- **Wealth**: the total resources owned by the individual, including all assets
- **Expected Return**: the return expected over the next period on one asset relative to alternative assets
- **Risk**: the degree of uncertainty associated with the return on one asset relative to alternative assets
- **Liquidity**: the ease and speed with which an asset can be turned into cash relative to alternative assets
Holding all other factors constant:

1. The quantity demanded of an asset is positively related to wealth
2. The quantity demanded of an asset is positively related to its expected return relative to alternative assets
3. The quantity demanded of an asset is negatively related to the risk of its returns relative to alternative assets
4. The quantity demanded of an asset is positively related to its liquidity relative to alternative assets
### Summary Table 1: Response of the Quantity of an Asset Demanded to Changes in Wealth, Expected Returns, Risk, and Liquidity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Variable</th>
<th>Change in Quantity Demanded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wealth</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Expected return relative to other assets</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Risk relative to other assets</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Liquidity relative to other assets</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

*Note: Only increases in the variables are shown. The effect of decreases in the variables on the change in quantity demanded would be the opposite of those indicated in the rightmost column.*
Supply and Demand in the Bond Market

• At lower prices (higher interest rates), ceteris paribus, the quantity demanded of bonds is higher: an inverse relationship

• At lower prices (higher interest rates), ceteris paribus, the quantity supplied of bonds is lower: a positive relationship
Derivation of Bond Demand Curve

One-year, discount bond, \( F = $1000 \)

\[
i = RET^e = \frac{(F - P)}{P} \quad (= \text{yield to maturity})
\]

**Point A:**

\( P = $950 \)

\[
i = \frac{($1000 - $950)}{$950} = 0.053 = 5.3\%
\]

\( B^d = $100 \text{ billion} \)
Derivation of Bond Demand Curve

Point B:  
\( P = $900 \)

\[ i = \frac{($1000 - $900)}{$900} = 0.111 = 11.1\% \]

\( B^d = $200 \) billion

Point C:  \( P = $850, i = 17.6\% \) \( B^d = $300 \) billion

Point D:  \( P = $800, i = 25.0\% \) \( B^d = $400 \) billion

Point E:  \( P = $750, i = 33.0\% \) \( B^d = $500 \) billion

Demand Curve is line \( B^d \) which connects points A, B, C, D, E.  
Has usual downward slope.
Derivation of Bond Supply Curve

Underlying premise: At higher bond prices (lower cost of borrowing) firms are willing to supply more bonds.

Point F: \( P = 750, i = 33.0\%, B^s = 100 \text{ billion} \)

Point G: \( P = 800, i = 25.0\%, B^s = 200 \text{ billion} \)

Point C: \( P = 850, i = 17.6\%, B^s = 300 \text{ billion} \)

Point H: \( P = 900, i = 11.1\%, B^s = 400 \text{ billion} \)

Point I: \( P = 950, i = 5.3\%, B^s = 500 \text{ billion} \)

Supply Curve is line \( B^s \) that connects points F, G, C, H, I.

Has the usual upward slope.
Figure 1 Supply and Demand for Bonds

With excess supply, the bond price falls to $P^*$.

With excess demand, the bond price rises to $P^*$.
Market Equilibrium

• Occurs when the amount that people are willing to buy (demand) equals the amount that people are willing to sell (supply) at a given price

• $B_d = B_s$ defines the equilibrium (or market clearing) price and interest rate.

• When $B_d > B_s$, there is excess demand, price will rise and interest rate will fall

• When $B_d < B_s$, there is excess supply, price will fall and interest rate will rise
Changes in Equilibrium Interest Rates

• Shifts in the demand for bonds:

• Wealth: in an expansion with growing wealth, the demand curve for bonds shifts to the right

• Expected Returns: higher expected interest rates in the future lower the expected return for long-term bonds, shifting the demand curve to the left

• Expected Inflation: an increase in the expected rate of inflations lowers the expected return for bonds, causing the demand curve to shift to the left

• Risk: an increase in the riskiness of bonds causes the demand curve to shift to the left

• Liquidity: increased liquidity of bonds results in the demand curve shifting right
Figure 2  Shift in the Demand Curve for Bonds

An increase in the demand for bonds shifts the bond demand curve rightward.
Summary Table 2  Factors That Shift the Demand Curve for Bonds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Variable</th>
<th>Change in Quantity Demanded at Each Bond Price</th>
<th>Shift in Demand Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wealth</td>
<td>↑</td>
<td>↑</td>
<td>$P$</td>
</tr>
<tr>
<td>Expected interest rate</td>
<td>↑</td>
<td>↓</td>
<td>$P$</td>
</tr>
<tr>
<td>Expected inflation</td>
<td>↑</td>
<td>↓</td>
<td>$P$</td>
</tr>
<tr>
<td>Riskiness of bonds relative to other assets</td>
<td>↑</td>
<td>↓</td>
<td>$P$</td>
</tr>
<tr>
<td>Liquidity of bonds relative to other assets</td>
<td>↑</td>
<td>↑</td>
<td>$P$</td>
</tr>
</tbody>
</table>

Note: Only increases in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the remaining columns.
Shifts in the Supply of Bonds

- Expected profitability of investment opportunities: in an expansion, the supply curve shifts to the right
- Expected inflation: an increase in expected inflation shifts the supply curve for bonds to the right
- Government budget: increased budget deficits shift the supply curve to the right
### Summary Table 3  Factors That Shift the Supply of Bonds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Variable</th>
<th>Change in Quantity Supplied at Each Bond Price</th>
<th>Shift in Supply Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profitability of investments</td>
<td>↑</td>
<td>↑</td>
<td><img src="image1" alt="Graph" /></td>
</tr>
<tr>
<td>Expected inflation</td>
<td>↑</td>
<td>↑</td>
<td><img src="image2" alt="Graph" /></td>
</tr>
<tr>
<td>Government deficit</td>
<td>↑</td>
<td>↑</td>
<td><img src="image3" alt="Graph" /></td>
</tr>
</tbody>
</table>

*Note: Only increases in the variables are shown. The effect of decreases in the variables on the change in supply would be the opposite of those indicated in the remaining columns.*
Figure 3  Shift in the Supply Curve for Bonds

An increase in the supply of bonds shifts the bond supply curve rightward.
Figure 4  Response to a Change in Expected Inflation

Step 1. A rise in expected inflation shifts the bond demand curve leftward . . .

Step 2. and shifts the bond supply curve rightward . . .

Step 3. causing the price of bonds to fall and the equilibrium interest rate to rise.
Figure 5  Expected Inflation and Interest Rates (Three-Month Treasury Bills), 1953–2011

Figure 6  Response to a Business Cycle Expansion

Step 1. A business cycle expansion shifts the bond supply curve rightward...

Step 2. and shifts the bond demand curve rightward, but by a lesser amount...

Step 3. so the price of bonds falls and the equilibrium interest rate rises.
Figure 7 Business Cycle and Interest Rates (Three-Month Treasury Bills), 1951–2011

Supply and Demand in the Market for Money: The Liquidity Preference Framework

Keynesian model that determines the equilibrium interest rate in terms of the supply of and demand for money.

There are two main categories of assets that people use to store their wealth: money and bonds.

Total wealth in the economy = $B^s + M^s = B^d + M^d$

Rearranging: $B^s - B^d = M^s - M^d$

If the market for money is in equilibrium ($M^s = M^d$), then the bond market is also in equilibrium ($B^s = B^d$).
Figure 8  Equilibrium in the Market for Money

![Graph showing the equilibrium in the market for money with interest rate and quantity of money axes.]

- With excess supply, the interest rate falls to $i^*$. (Point C)
- With excess demand, the interest rate rises to $i^*$. (Point E)
Demand for Money in the Liquidity Preference Framework

• As the interest rate increases:
  – The opportunity cost of holding money increases…
  – The relative expected return of money decreases…

• …and therefore the quantity demanded of money decreases.
Changes in Equilibrium Interest Rates in the Liquidity Preference Framework

• Shifts in the demand for money:

• **Income Effect**: a higher level of income causes the demand for money at each interest rate to increase and the demand curve to shift to the right

• **Price-Level Effect**: a rise in the price level causes the demand for money at each interest rate to increase and the demand curve to shift to the right
Shifts in the Supply of Money

• Assume that the supply of money is controlled by the central bank

• An increase in the money supply engineered by the Federal Reserve will shift the supply curve for money to the right
Summary Table 4  Factors That Shift the Demand for and Supply of Money

**Factors That Shift the Demand for and Supply of Money**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Variable</th>
<th>Change in Money Demand ($M^d$) or Supply ($M^s$) at Each Interest Rate</th>
<th>Change in Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>↑</td>
<td>$M^d$↑</td>
<td>↑</td>
</tr>
<tr>
<td>Price level</td>
<td>↑</td>
<td>$M^d$↑</td>
<td>↑</td>
</tr>
<tr>
<td>Money supply</td>
<td>↑</td>
<td>$M^s$↑</td>
<td>↓</td>
</tr>
</tbody>
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Figure 9  Response to a Change in Income or the Price Level

Step 1. A rise in income or the price level shifts the money demand curve rightward . . .

Step 2. and the equilibrium interest rate rises.
Figure 10  Response to a Change in the Money Supply

**Step 1.** An increase in the money supply shifts the money supply curve rightward...

**Step 2.** and the equilibrium interest rate falls.
Price-Level Effect and Expected-Inflation Effect

• A one time increase in the money supply will cause prices to rise to a permanently higher level by the end of the year. The interest rate will rise via the increased prices.

• Price-level effect remains even after prices have stopped rising.

• A rising price level will raise interest rates because people will expect inflation to be higher over the course of the year. When the price level stops rising, expectations of inflation will return to zero.

• Expected-inflation effect persists only as long as the price level continues to rise.
Does a Higher Rate of Growth of the Money Supply Lower Interest Rates?

• Liquidity preference framework leads to the conclusion that an increase in the money supply will lower interest rates: the liquidity effect.

• Income effect finds interest rates rising because increasing the money supply is an expansionary influence on the economy (the demand curve shifts to the right).
Does a Higher Rate of Growth of the Money Supply Lower Interest Rates? (cont’d)

• Price-Level effect predicts an increase in the money supply leads to a rise in interest rates in response to the rise in the price level (the demand curve shifts to the right).

• Expected-Inflation effect shows an increase in interest rates because an increase in the money supply may lead people to expect a higher price level in the future (the demand curve shifts to the right).
Figure 11  Response over Time to an Increase in Money Supply Growth

(a) Liquidity effect larger than other effects

(b) Liquidity effect smaller than other effects and slow adjustment of expected inflation

(c) Liquidity effect smaller than expected-inflation effect and fast adjustment of expected inflation
Figure 12  Money Growth (M2, Annual Rate) and Interest Rates (Three-Month Treasury Bills), 1950–2011