The Behavior of Interest Rates

Lectures 9 and 10 will use the following transparencies. All figures / tables are from chapter 5 of the textbook.
### Determinants of Asset Demand

#### Table 1: Response of the Quantity of an Asset Demanded to Changes in Income or 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>Income or 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 demand would be the opposite of those indicated in the rightmost column.*
Derivation of Bond Demand Curve

\[ i = RET^c = \frac{(F - P)}{P} \]

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:

\[ P = $900 \]

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

\[ B^d = $200 \text{ billion} \]

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

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

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

Demand Curve is  \( B^d \) in Figure 1 which connects points A, B, C, D, E.

Has usual downward slope
Derivation of Bond Supply Curve

Point F: \[ P = \$750 \quad i = 33.0\% \quad B^s = \$100 \text{ billion} \]

Point G: \[ P = \$800 \quad i = 25.0\% \quad B^s = \$200 \text{ billion} \]

Point C: \[ P = \$850 \quad i = 17.6\% \quad B^s = \$300 \text{ billion} \]

Point H: \[ P = \$900 \quad i = 11.1\% \quad B^s = \$400 \text{ billion} \]

Point I: \[ P = \$950 \quad i = 5.3\% \quad B^s = \$500 \text{ billion} \]

Supply Curve is \( B^s \) that connects points F, G, C, H, I, and has upward slope.
Market Equilibrium

1. Occurs when \( B^d = B^s \), at \( P^* = $850 \), \( i^* = 17.6\% \)

2. When \( P = $950 \), \( i = 5.3\% \), \( B^s > B^d \) (excess supply): \( P \downarrow \) to \( P^* \), \( i \uparrow \) to \( i^* \)

3. When \( P = $750 \), \( i = 33.0 \), \( B^d > B^s \) (excess demand): \( P \uparrow \) to \( P^* \), \( i \downarrow \) to \( i^* \)
Loanable Funds Terminology

1. Demand for bonds = supply of loanable funds

2. Supply of bonds = demand for loanable funds
Shifts in the Bond Demand Curve
Factors that Shift the Bond Demand Curve:

1. Wealth
   A. Economy ↑, wealth ↑, \( B^d \) ↑, \( B^d \) shifts out to right

2. Expected Return
   A. \( i \) ↓ in future, \( RET^e \) for long-term bonds ↑, \( B^d \) shifts out to right
   B. \( \pi_e \) ↓, Relative \( RET^e \) ↑, \( B^d \) shifts out to right

3. Risk
   A. Risk of bonds ↓, \( B^d \) ↑, \( B^d \) shifts out to right
   B. Risk of other assets ↑, \( B^d \) ↑, \( B^d \) shifts out to right

4. Liquidity
   A. Liquidity of Bonds ↑, \( B^d \) ↑, \( B^d \) shifts out to right
   B. Liquidity of other assets ↓, \( B^d \) ↑, \( B^d \) shifts out to right
### Factors that Shift Demand Curve for Bonds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Variable</th>
<th>Change in Quantity Demanded</th>
<th>Shift in Demand Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wealth</td>
<td>↑</td>
<td>↑</td>
<td>(increases ↑)</td>
</tr>
<tr>
<td>Expected interest rate</td>
<td>↑</td>
<td>↓</td>
<td>(increases ↑)</td>
</tr>
<tr>
<td>Expected inflation</td>
<td>↑</td>
<td>↓</td>
<td>(increases ↑)</td>
</tr>
<tr>
<td>Riskiness of bonds relative to other assets</td>
<td>↑</td>
<td>↓</td>
<td>(increases ↑)</td>
</tr>
<tr>
<td>Liquidity of bonds relative to other assets</td>
<td>↑</td>
<td>↑</td>
<td>(increases ↑)</td>
</tr>
</tbody>
</table>

*Note: *$P$ and $i$ increase in opposite directions: $P$ on the left vertical axis increases as we go up the axis, while $i$ on the right vertical axis increases as we go down the axis. 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 Bond Supply Curve

1. Profitability of Investment Opportunities
   Business cycle expansion, investment opportunities ↑, \( B^s \uparrow \), \( B^s \) shifts out to right

2. Expected Inflation
   \( \pi^e \uparrow \), \( B^s \uparrow \), \( B^s \) shifts out to right

3. Government Activities
   Deficits ↑, \( B^s \uparrow \), \( B^s \) shifts out to right
### 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</th>
<th>Shift in Supply Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profitability of investments</td>
<td>↑</td>
<td>↑</td>
<td>$P$ (increases ↑)</td>
</tr>
<tr>
<td>Expected inflation</td>
<td>↑</td>
<td>↑</td>
<td>$P$ (increases ↑)</td>
</tr>
<tr>
<td>Government deficit</td>
<td>↑</td>
<td>↑</td>
<td>$P$ (increases ↑)</td>
</tr>
</tbody>
</table>

**Note:** $P$ and $i$ increase in opposite directions: $P$ on the left vertical axis increases as we go up the axis, while $i$ on the right vertical axis increases as we go down the axis. 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.
Changes in $\pi^e$: the Fisher Effect

If $\pi^e \uparrow$

1. Relative $RET^e \downarrow$, $B^d$ shifts in to left
2. $B^s \uparrow$, $B^s$ shifts out to right
3. $P \downarrow$, $i \uparrow$
Evidence on the Fisher Effect in the United States
Business Cycle Expansion

1. Wealth ↑, $B^d \uparrow$, $B^d$ shifts out to right
2. Investment ↑, $B^s \uparrow$, $B^s$ shifts right
3. If $B^s$ shifts more than $B^d$ then $P \downarrow$, $i \uparrow
Evidence on Business Cycles and Interest Rates
Response to a Low Savings Rate

Price of Bonds, $P$
($P$ increases $\uparrow$)

Interest Rate, $i$
($i$ increases $\downarrow$)

Quantity of Bonds, $B$

$B^s$

$B^d$

$P_1$

$P_2$

$i_1$

$i_2$
Relation of Liquidity Preference Framework to Loanable Funds

Keynes’s Major Assumption

Two Categories of Assets in Wealth

Money
Bonds

1. Thus: \( M^s + B^s = \text{Wealth} \)
2. Budget Constraint: \( B^d + M^d = \text{Wealth} \)
3. Therefore: \( M^s + B^s = B^d + M^d \)
4. Subtracting \( M^d \) and \( B^s \) from both sides:
   \( M^s - M^d = B^d - B^s \)

Money Market Equilibrium

5. Occurs when \( M^d = M^s \)
6. Then \( M^d - M^s = 0 \) which implies that \( B^d - B^s = 0 \), so that \( B^d = B^s \) and bond market is also in equilibrium
1. Equating supply and demand for bonds as in loanable funds framework is equivalent to equating supply and demand for money as in liquidity preference framework.

2. Two frameworks are closely linked, but differ in practice because liquidity preference assumes only two assets, money and bonds, and ignores effects from changes in expected returns on real assets.
Liquidity Preference Analysis

Derivation of Demand Curve
1. Keynes assumed money has $i = 0$
2. As $i \uparrow$, relative $RET^e$ on money $\downarrow$ (equivalently, opportunity cost of money $\uparrow$) $\Rightarrow M^d \downarrow$
3. Demand curve for money has usual downward slope

Derivation of Supply curve
1. Assume that central bank controls $M^s$ and it is a fixed amount
2. $M^s$ curve is vertical line

Market Equilibrium
1. Occurs when $M^d = M^s$, at $i^* = 15$
2. If $i = 25\%$, $M^s > M^d$ (excess supply): Price of bonds $\uparrow$, $i \downarrow$ to $i^* = 15\%$
3. If $i = 5\%$, $M^d > M^s$ (excess demand): Price of bonds $\downarrow$, $i \uparrow$ to $i^* = 15\%$
Money Market Equilibrium
Rise in Income or the Price Level

1. Income $\uparrow$, $M^d \uparrow$, $M^d$ shifts out to right
2. $M^s$ unchanged
3. $i^*$ rises from $i_1$ to $i_2$
1. \( M^s \uparrow, M^s \) shifts out to right
2. \( M^d \) unchanged
3. \( i^* \) falls from \( i_1 \) to \( i_2 \)
Factors that Shift Money Demand and Supply Curves

**Table 4** 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 (Md) or Supply (Ms)</th>
<th>Change in Interest Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income</td>
<td>↑</td>
<td>Md↑</td>
<td>↑</td>
</tr>
<tr>
<td>Price level</td>
<td>↑</td>
<td>Md↑</td>
<td>↑</td>
</tr>
<tr>
<td>Money supply</td>
<td>↑</td>
<td>Ms↑</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 demand would be the opposite of those indicated in the remaining columns.
Money and Interest Rates

Effects of money on interest rates

1. Liquidity Effect
   \[ M^s \uparrow, \quad M^s \text{ shifts right, } i \downarrow \]

2. Income Effect
   \[ M^s \uparrow, \quad \text{Income} \uparrow, \quad M^d \uparrow, \quad M^d \text{ shifts right, } i \uparrow \]

3. Price Level Effect
   \[ M^s \uparrow, \quad \text{Price level} \uparrow, \quad M^d \uparrow, \quad M^d \text{ shifts right, } i \uparrow \]

4. Expected Inflation Effect
   \[ M^s \uparrow, \quad \pi^e \uparrow, \quad B^d \downarrow, \quad B^s \uparrow, \quad \text{Fisher effect, } i \uparrow \]

Effect of higher rate of money growth on interest rates is ambiguous

1. Because income, price level and expected inflation effects work in opposite direction of liquidity effect
Does Higher Money Growth Lower Interest Rates?

(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
Evidence on Money Growth and Interest Rates