

## Interest Rate

### Definition

Price of debt capital (rent on borrowed money), expressed as an annual percentage of amount borrowed

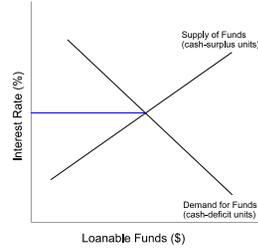
### Importance

Influences other asset prices  
Influences general level of economic activity

### Determination

Interest rates are set in credit markets ("loanable funds")

Demand: Borrowers (deficit units)  
Supply: Lenders (surplus units)



### Issue(s)

What determines the interest rate on a specific instrument at a specific time?

or What determines the *general* level of interest rates?  
What determines the *spread* between rates on different instruments?

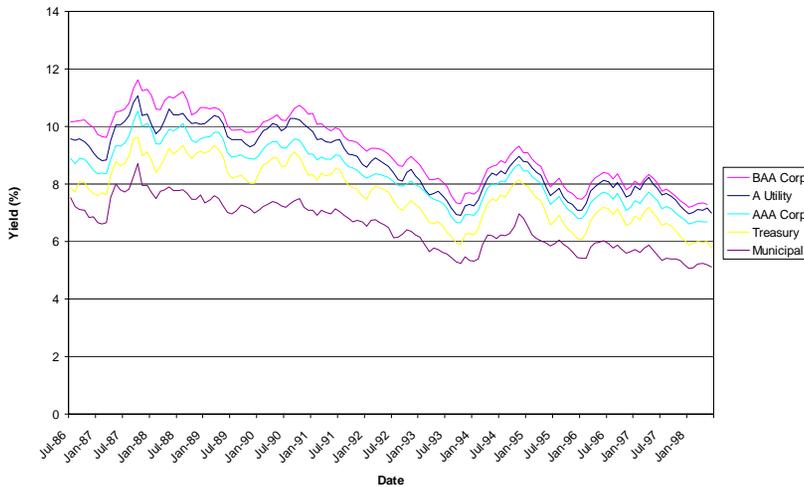
## Issue: General Level of Interest Rates

Annual Inflation Rates and Long-Term Interest Rates



## Issue: Spreads between Interest Rates

Yields on Bonds with Differing Characteristics



## Determinants of Real Interest Rates

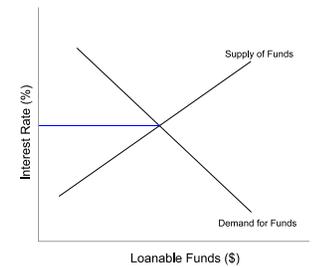
(Assume, for simplicity, that no inflation is expected)

### Primary

Demand: Borrowers with best production opportunities will bid most

Supply: Lenders with the least urgent desire to spend will accept least ("time preference")

Result: Capital flows from those with the least urgent uses to those with the most urgent uses



### Secondary

Federal Reserve monetary policy shifts supply curve  
Federal deficit shifts demand curve  
Balance of payments shifts supply curve  
Taxes shifts either/both curves

## Pricing of Debt

Many types of debt exist, distinguished by the characteristics of their cash flows

Size  
Timing  
Risk

Each type has its own market and interest rate, determined by its own supply and demand  
These rates are interdependent, due to substitution

The rate for any particular loan depends on  
the general level of interest rates (risk-free rate, common to all loans)  
specific characteristics of the contract itself (risk premium, specific to this loan)

Interest rate on instrument  $i$

$$k_i = \underbrace{\text{Risk-free Rate}}_{k_{RF}} + \underbrace{\text{Risk Premium}_i}_{RP_i}$$

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## Risk-free Rate ( $\Rightarrow$ General Level)

### Basis for all rates

What you charge a borrower who is sure to repay

*Real* risk-free rate what you charge, if you expect no inflation during the life of the loan (once called the "corn rate")  
*Nominal* risk-free rate what you charge, if you expect inflation (marked-up); actually observed (e.g., T-Bill rate)

### Effect of Expected Inflation (Fisher Effect)

Loan contracts generally specify *number* of dollars to be repaid (*nominal* terms)  
Inflation will reduce *purchasing power* of dollars repaid (*real* terms)  
To preserve purchasing power, we build our expectation of inflation into the interest rate that we ask/offer

$$\underbrace{k_{RF}}_{\text{nominal risk-free rate}} = \underbrace{k^*}_{\text{real risk-free rate}} + \underbrace{IRP}_{\text{inflation risk premium}}$$

When our *expectations* about inflation change, interest rates change in the same direction, by (approximately) the same amount.

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## Inflation and Interest Rates: Example

Suppose you lend a friend \$1000 for 1 year  $k^* = 0\%$

|                                     | Year 0 | Year 1 | Interest Rate |
|-------------------------------------|--------|--------|---------------|
| Expected inflation rate             | 0%     |        |               |
| Your Cash Flows (nominal)           | (1000) | 1000   | 0%            |
| Actual inflation rate               | 0%     |        |               |
| Price Level (CPI)                   | 100%   | 100%   |               |
| Purchasing Power of your CFs (real) | (1000) | 1000   | 0%            |
| Actual inflation rate               | 100%   |        |               |
| Price Level (CPI)                   | 100%   | 200%   |               |
| Purchasing Power of your CFs (real) | (1000) | 500    | -50%          |
| Expected inflation rate             | 100%   |        |               |
| Your Cash Flows (nominal)           | (1000) | 2000   | 100%          |
| Actual inflation rate               | 100%   |        |               |
| Price Level (CPI)                   | 100%   | 200%   |               |
| Purchasing Power of your CFs (real) | (1000) | 1000   | 0%            |

before the fact:  $k_{RF} = k^* + IRP$

after the fact:  $\text{rate} = \frac{\text{repayment} - \text{loan}}{\text{loan}}$

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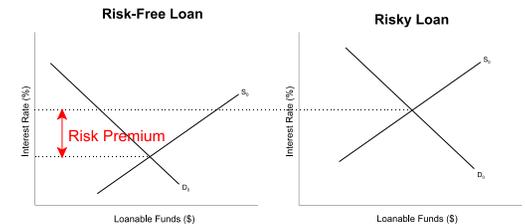
## Risk Premium ( $\Rightarrow$ Spread)

### Unique

Each instrument has its own risks and its own risk premium

### Risk Premiums

Default Risk Premium ( $DRP_i$ )  
for default risk  
Liquidity Premium ( $LP_i$ )  
for illiquidity of market  
Maturity Risk Premium ( $MRP_i$ )  
for interest rate risk



Risk premium on instrument  $i$ :  $RP_i = DRP_i + LP_i + MRP_i$

Interest rate on instrument  $i$ :  $k_i = \underbrace{\text{Risk-free Rate}}_{k_{RF}} + \underbrace{\text{Risk Premium on } i}_{RP_i}$   
 $k^* + IRP$   $DRP_i + LP_i + MRP_i$

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## Interest Rate Risk Premiums: Example

| Component               | 3-Month<br>T-bill | 20-Year<br>T-bond | 30-Year Bonds |              |              |
|-------------------------|-------------------|-------------------|---------------|--------------|--------------|
|                         |                   |                   | T-bond        | Corporate    |              |
|                         |                   |                   |               | AAA          | OTC          |
| Real risk-free rate     | 2.5%              | 2.5%              | 2.5%          | 2.5%         | 2.5%         |
| Expected inflation rate | 6.5%              | 6.5%              | 6.5%          | 6.5%         | 6.5%         |
| Default risk premium    |                   |                   |               | 2.0%         | 3.0%         |
| Liquidity premium       |                   |                   |               |              | 1.0%         |
| Maturity risk premium   |                   | 1.0%              | 2.0%          | 2.0%         | 2.0%         |
| Nominal risk-free rate  | 9.0%              | 9.0%              | 9.0%          | 9.0%         | 9.0%         |
| Risk premium            | 0.0%              | 1.0%              | 2.0%          | 4.0%         | 6.0%         |
| <b>Observed rate</b>    | <b>9.0%</b>       | <b>10.0%</b>      | <b>11.0%</b>  | <b>13.0%</b> | <b>15.0%</b> |

$$k_i = (k^* + IRP) + (DRP_i + LP_i + MRP_i)$$