

be no longer than
ut in no case more than 30
maximum loan term offered.

INTEREST RATE

national supply of long term i
generally, loan terms of

Guidelines

- General Description
- Present Value
- Future Value
- Real Interest Rate
- Nominal Interest Rate
- Coupon Bonds
- Treasury Bonds
- NPV
- IRR
- MIRR
- Behavior of Interest Rates



DEFINITION of 'Interest Rate'

The amount charged, expressed as a percentage of principal, by a lender to a borrower for the use of assets.

Simple Interest = P (principal) x I (annual interest rate) x N (years)

Compound Interest = P (principal) x [(1 + I(interest rate) ^N (months)) - 1]
[P (1 + i)ⁿ] – P

Compound Interest = Total amount of Principal and Interest in future (or Future Value) less Principal amount at present (or Present Value)



DEFINITION of 'Future Value - FV'

The value of an asset or cash at a specified date in the future that is equivalent in value to a specified sum today. There are two ways to calculate FV:

- **Simple annual interest** = Original Investment x $(1 + (\text{interest rate} \times \text{number of years}))$
- **Interest compounded annually**: = Original Investment x $(1 + \text{interest rate})^{\text{number of years}}$



DEFINITION of 'Real Interest Rate'

An interest rate that has been adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower, and the real yield to the lender.

Real Interest Rate = Nominal Interest Rate - Inflation
(Expected or Actual)

For example - if you are earning 4% interest per year on the savings in your bank account, and inflation is currently 3% per year, then the real interest rate you are receiving is 1% (4% - 3% = 1%). The real value of your savings **will only** increase by 1% per year, when purchasing power is taken into consideration.



DEFINITION of 'Nominal Interest Rate'

The interest rate before taking inflation into account. The nominal interest rate is the rate quoted in loan and deposit agreements. The equation that links nominal and real interest rates is:

$(1 + \text{nominal rate}) = (1 + \text{real interest rate}) (1 + \text{inflation rate})$.

It can be approximated as $\text{nominal rate} = \text{real interest rate} + \text{inflation rate}$.



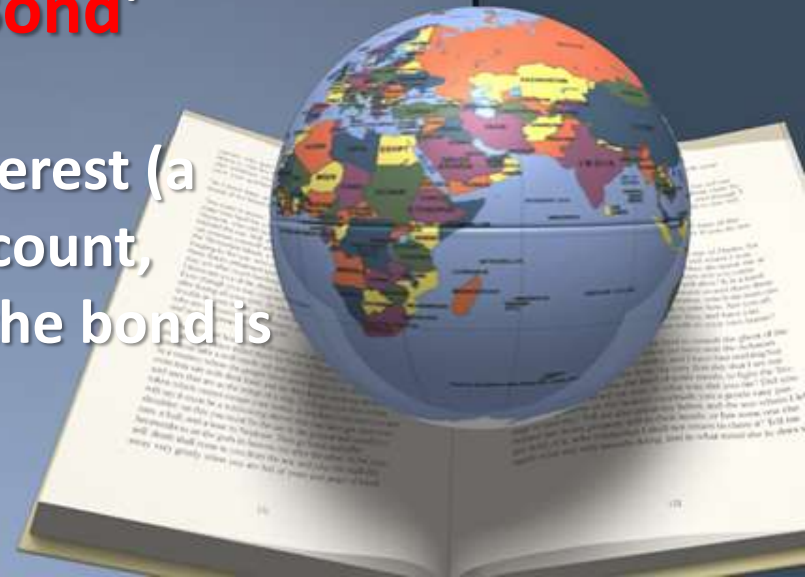
DEFINITION of 'Coupon Bond'

A debt obligation with coupons attached that represent semiannual interest payments.

Fixed interest payment during years and then at the end of the period should be paid principal

DEFINITION of 'Zero-Coupon Bond'

A debt security that doesn't pay interest (a coupon) but is traded at a deep discount, rendering profit at maturity when the bond is redeemed for its full face value.



→ **Consol Bond / Perpetuity**

Lifelong same payments $P=C/I$

→ **Coupon Bond Price**

$$C/(1+i) + C/(1+i)^2 + C/(1+i)^3 + \dots + C/(1+i)^n + F/(1+i)^n$$



Yield to Maturity: Bonds

3. Coupon Bond (Coupon rate = 10% = C/F)

$$P = \frac{\$100}{(1+i)} + \frac{\$100}{(1+i)^2} + \frac{\$100}{(1+i)^3} + \frac{\$100}{(1+i)^{10}} + \frac{\$1000}{(1+i)^{10}}$$

$$P = \frac{C}{(1+i)} + \frac{C}{(1+i)^2} + \frac{C}{(1+i)^3} + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

Consol: Fixed coupon payments of \$C forever

$$P = \frac{C}{i} \quad i = \frac{C}{P}$$

4. Discount Bond ($P = \$900$, $F = \$1000$), one year

$$\$900 = \frac{\$1000}{(1+i)} \quad \Rightarrow$$

$$i = \frac{\$1000 - \$900}{\$900} = 0.111 = 11.1\%$$

$$i = \frac{F - P}{P}$$

DEFINITION of 'Treasury Bond - T-Bond'

A marketable, fixed-interest U.S. government debt security with a maturity of more than 10 years. Treasury bonds make interest payments semi-annually and the income that holders receive is only taxed at the federal level.



Definition of "Net Present Value - NPV"

The difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project.

The following is the formula for calculating NPV:
where:

$$NPV = \sum_{t=1}^T \frac{C_t}{(1+r)^t} - C_0$$

C_t = net cash inflow during the period

C_0 = initial investment

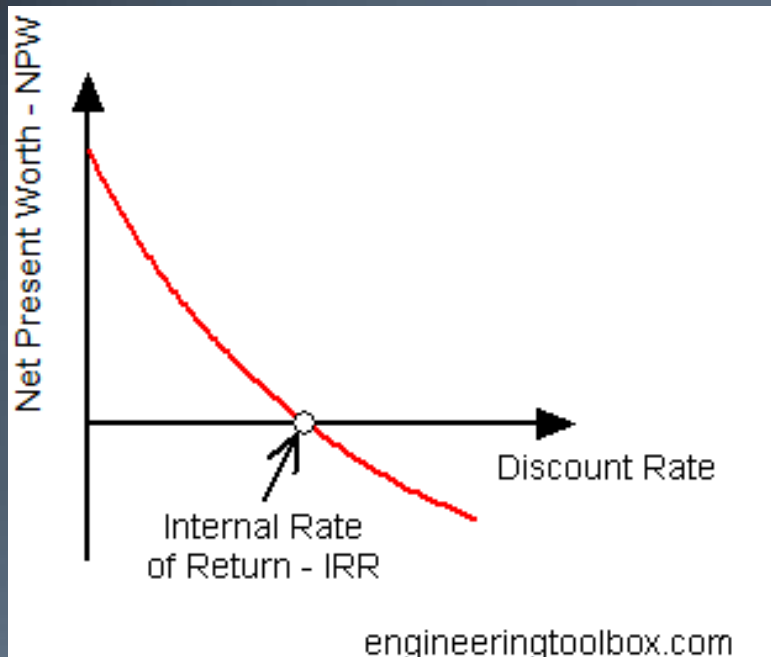
r = discount rate, and

t = number of time periods



Definition of "Internal Rate Of Return - IRR"

The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero.



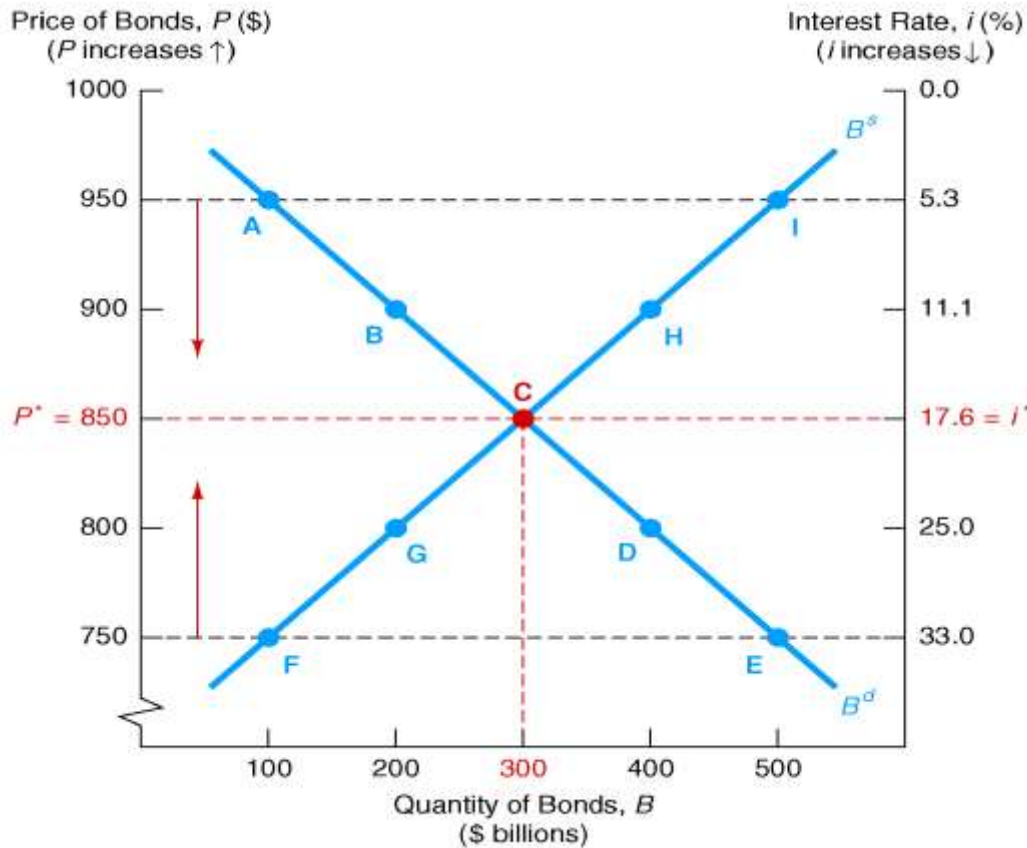
DEFINITION of 'Modified Internal Rate Of Return - MIRR'

While the internal rate of return (IRR) assumes the cash flows from a project are reinvested at the IRR, the modified IRR assumes that positive cash flows are reinvested at the firm's cost of capital, and the initial outlays are financed at the firm's financing cost. Therefore, MIRR more accurately reflects the cost and profitability of a project.

$$MIRR = \sqrt[n]{\frac{FV(\text{Positive Cash Flows, cost of capital})}{PV(\text{Initial Outlays, Financing Cost})}} - 1$$

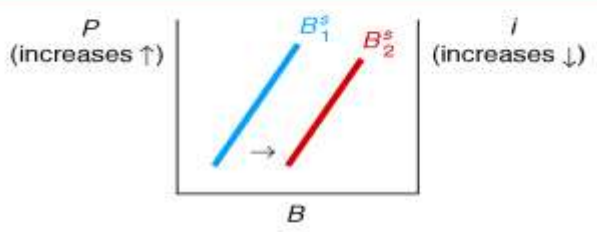
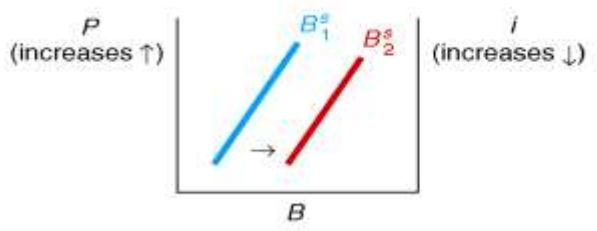
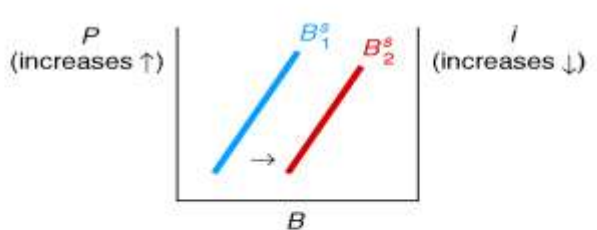


Supply and Demand Analysis of the Bond Market



Factors that Shift Supply Curve

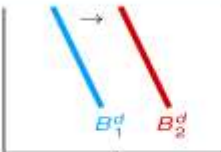
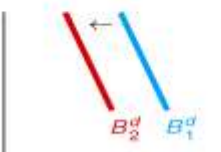
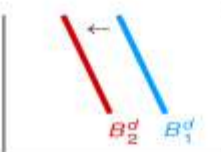
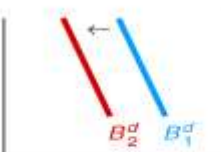
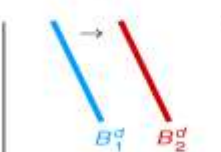
TABLE 2 Factors That Shift the Supply of Bonds

Variable	Change in Variable	Change in Quantity Supplied	Shift in Supply Curve
Profitability of investments	↑	↑	
Expected inflation	↑	↑	
Government deficit	↑	↑	

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.



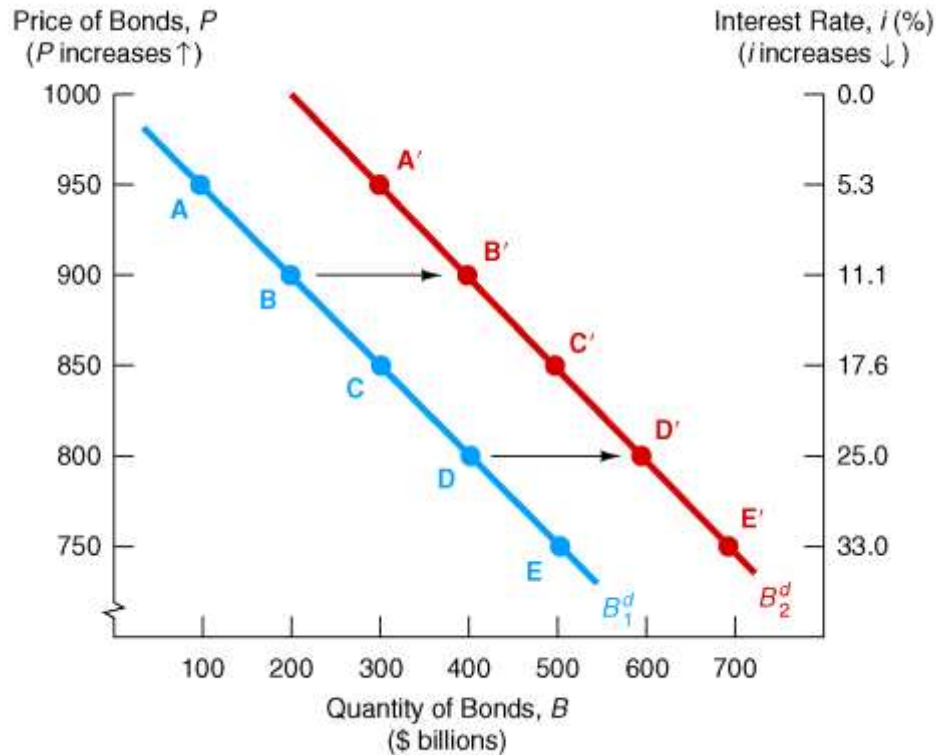
TABLE 1 Factors That Shift the Demand Curve for Bonds

Variable	Change in Variable	Change in Quantity Demanded	Shift in Demand Curve
Wealth	↑	↑	P (increases ↑)  B
Expected interest rate	↑	↓	P (increases ↑)  B
Expected inflation	↑	↓	P (increases ↑)  B
Riskiness of bonds relative to other assets	↑	↓	P (increases ↑)  B
Liquidity of bonds relative to other assets	↑	↑	P (increases ↑)  B

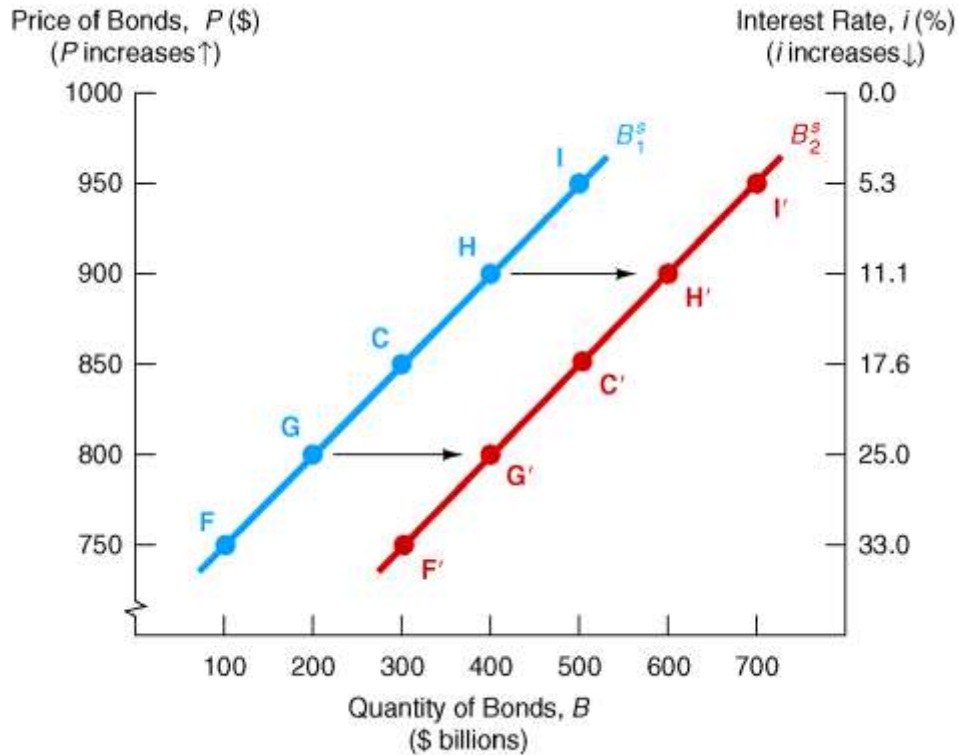
Note: Only increases (↑) in the variables are shown. The effect of decreases in the variables on the change in demand would be the opposite of those indicated in the remaining columns.



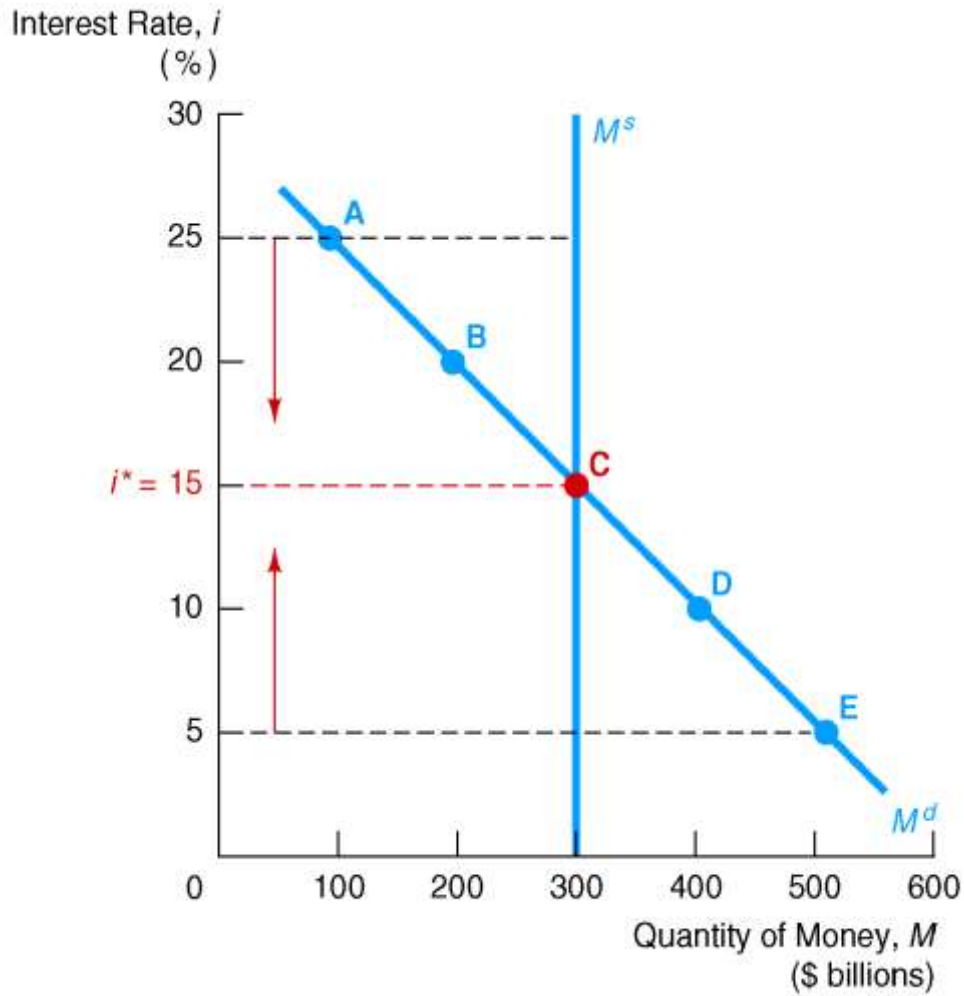
Shifts in the Demand Curve



Shifts in the Supply Curve

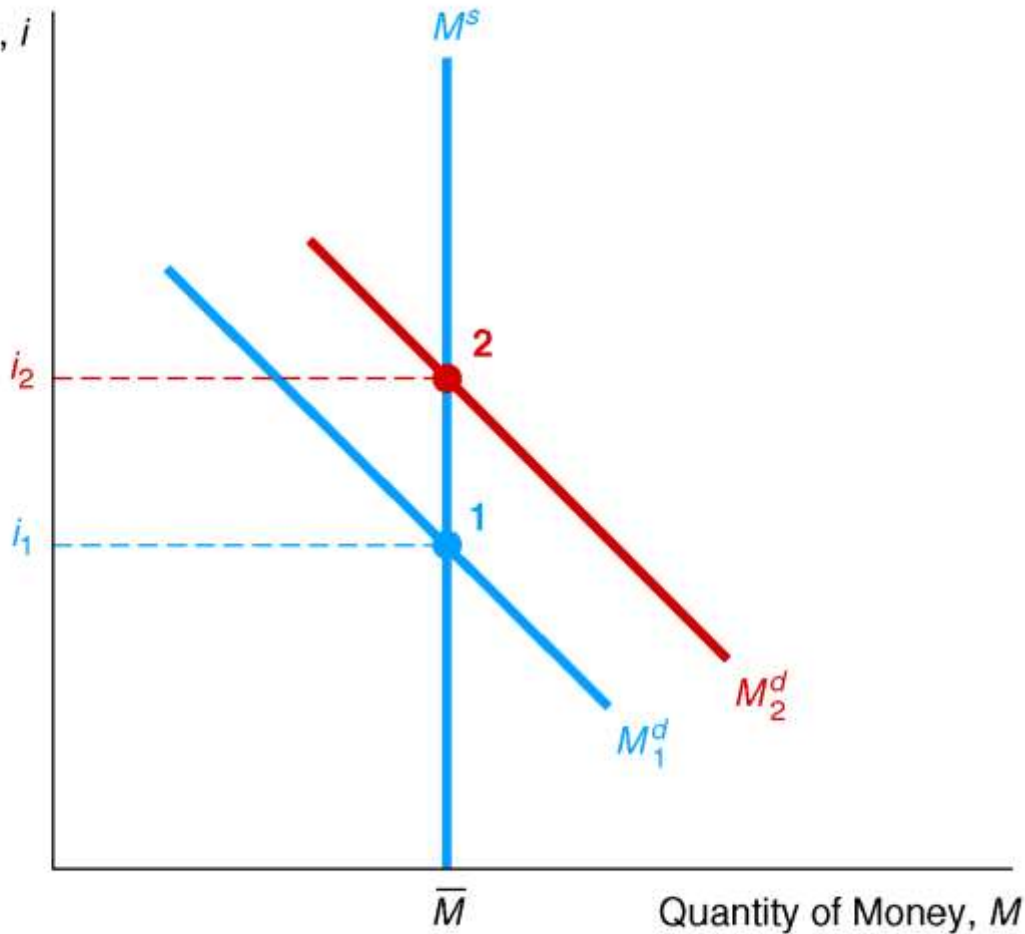


Money Market Equilibrium



Rise in Income

Interest Rate, i



Income \bar{M}^d , \bar{M}^d
shifts out to right
 M^s unchanged
 i^* rises from

Factors that Shift Money Demand and Supply Curves

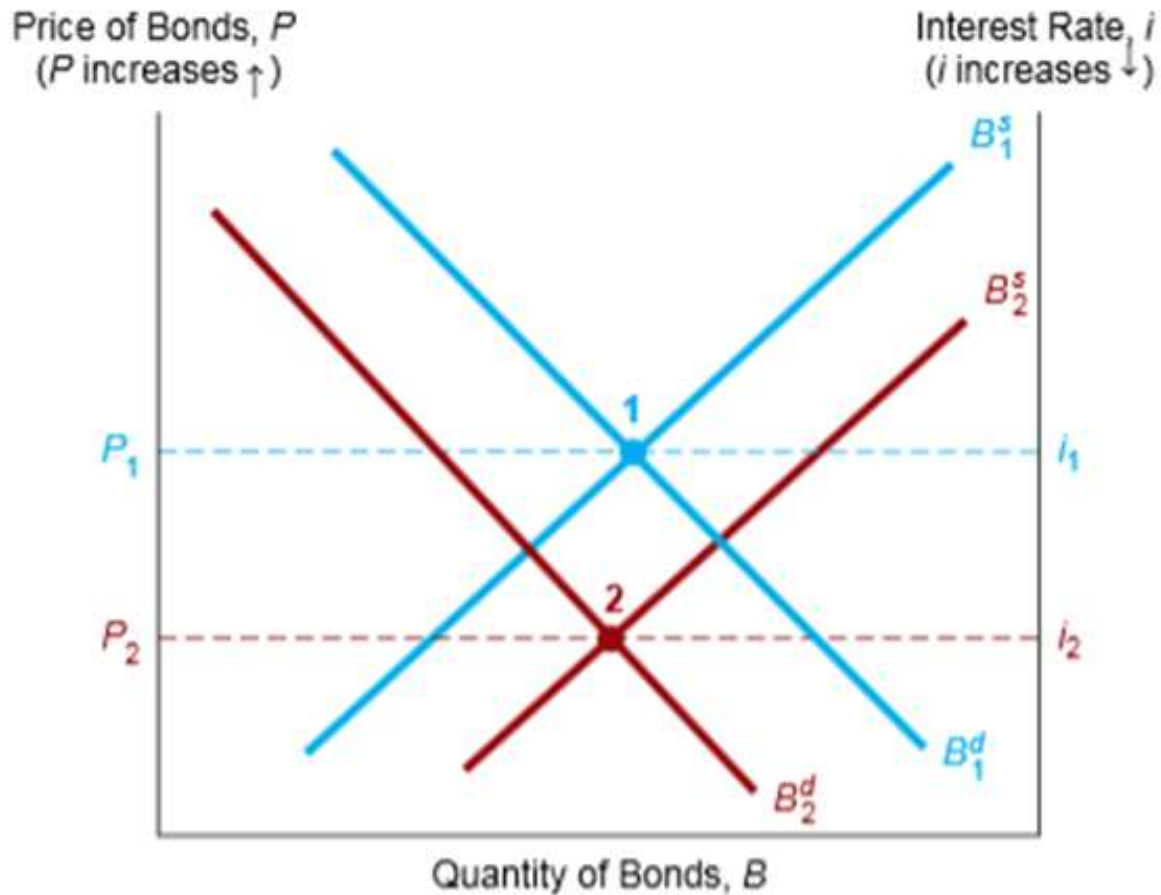
TABLE 3 Factors That Shift the Demand for and Supply of Money

Variable	Change in Variable	Change in Money Demand (Md) or Supply (Ms)	Change in Interest Rate	
Income	↑	$M^d \uparrow$	↑	
Price level	↑	$M^d \uparrow$	↑	
Money supply	↑	$M^s \uparrow$	↓	

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.



Expected inflation rise

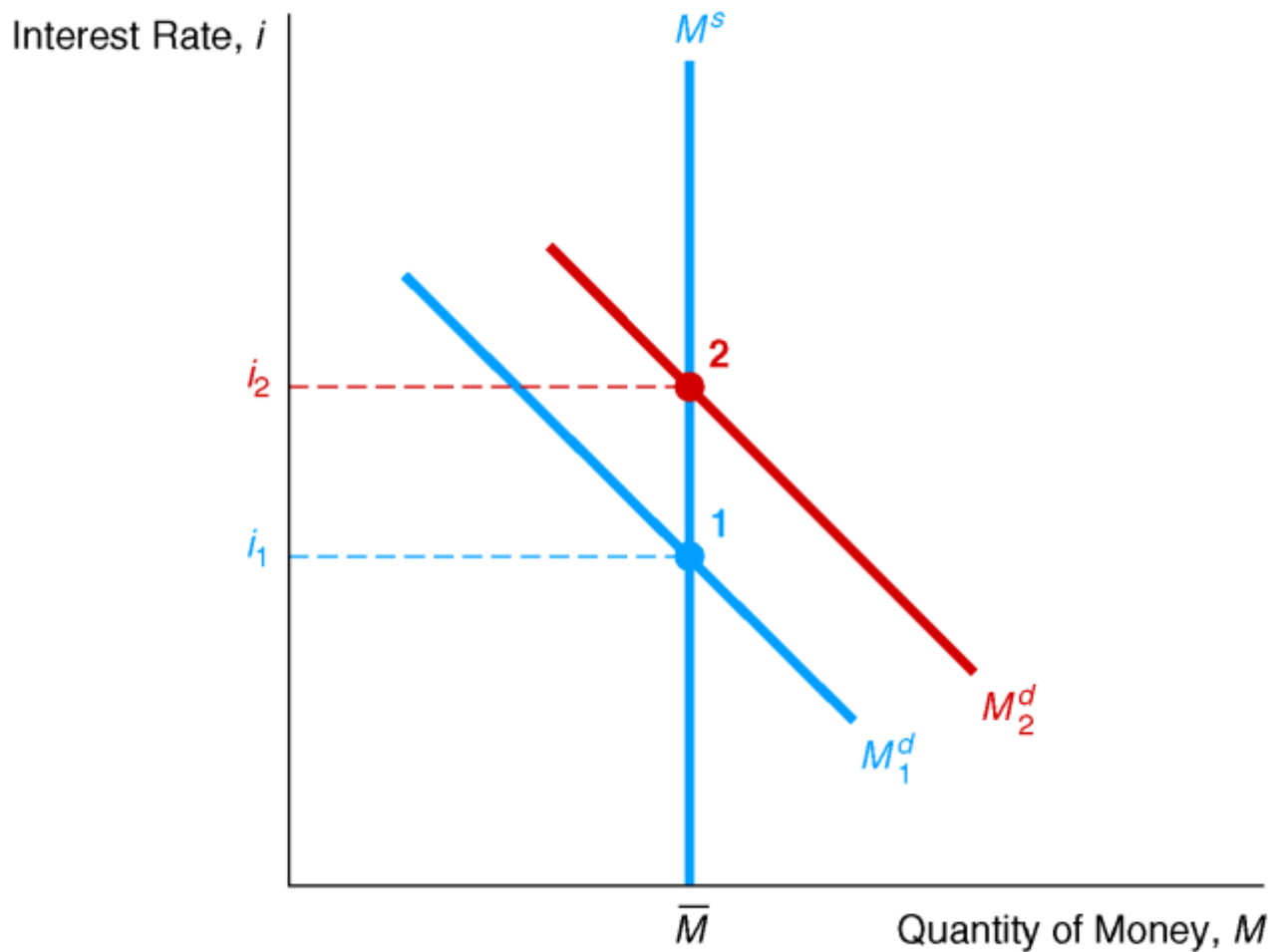


SUMMARY

Table 4 Factors That Shift the Demand for and Supply of Money

Variable	Change in Variable	Change in Money Demand (M^d) or Supply (M^s)	Change in Interest Rate	
Income	↑	$M^d \uparrow$	↑	
Price level	↑	$M^d \uparrow$	↑	
Money supply	↑	$M^s \uparrow$	↓	

Rise in Price Level



Rise in Money Supply

