

Principles of Finance

Prof. Dr. Dennis A. V. Dittrich

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DuckTales: Inflation

Fisher Equation

- ▶ 2 individuals write a loan contract to borrow P_t dollars at a nominal interest rate of i
- ▶ next year the amount to be repaid will be $P_t \times (1 + i)$
- ▶ imagine the individuals decide to write a loan contract to guarantee a constant real return r (payment in goods next year instead of cash)
- ▶ to repay the loan, the lender has to buy $(1+r)$ units of goods next year for each unit of goods that he can buy now
- ▶ the (nominal) prices will change with the inflation π .
- ▶ if the price of one unit of goods is P_t today, its price P_{t+1} next year will be $P_{t+1} = P_t \times (1 + \pi)$
- ▶ the total amount of dollars needed next year to repay the loan is then $P_t \times (1 + \pi) \times (1 + r)$

Fisher Equation

- ▶ if the two loan contracts with repayments
 - ▶ $P_t \times (1 + i)$
 - ▶ $P_t \times (1 + \pi) \times (1 + r)$are equal:

$$\begin{aligned}(1 + i) &= (1 + \pi) \times (1 + r) \\ 1 + i &= 1 + r + \pi + r\pi \\ i &= r + \pi + r\pi \\ i &\approx r + \pi\end{aligned}$$

- ▶ if r and π are small the error by discarding $r\pi$ is very small, e.g. $r = 0.030$ and $\pi = 0.015$ results in $r\pi = 0.00045$, a less than one percent error.

Fisher Equation

$$i = i_r + \pi^e$$

i = nominal interest rate

i_r = real interest rate

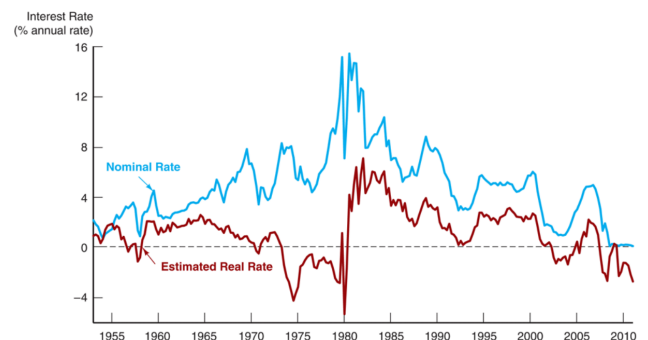
π^e = expected inflation rate

When the real interest rate is low,

there are greater incentives to borrow and fewer incentives to lend.

The real interest rate is a better indicator of the incentives to borrow and lend.

Real & Nominal Interest Rates (3-Month T-Bill)



Estimating the real interest rate involves estimating expected inflation as a function of past interest rates, inflation, and time trends and then subtracting the expected inflation measure from the nominal interest rate.

If you expect the inflation rate to be 15% next year and a one-year bond has a yield to maturity of 7%, then the real interest rate on this bond is...?

Assuming the same coupon rate and maturity length, when the interest rate on a Treasury Inflation Protected Security is 3%, and the yield on a nonindexed Treasury bond is 8%, the expected rate of inflation is...?

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

Theory of Portfolio Choice

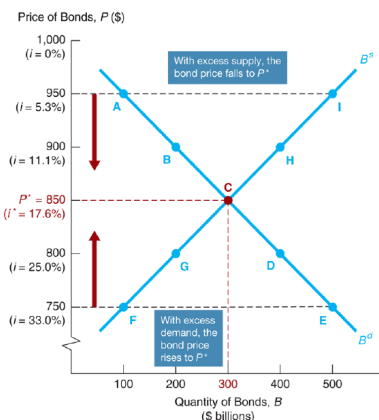
Holding all other factors constant:

- ▶ The quantity demanded of an asset is positively related to wealth
- ▶ The quantity demanded of an asset is positively related to its expected return relative to alternative assets
- ▶ The quantity demanded of an asset is negatively related to the risk of its returns relative to alternative assets
- ▶ The quantity demanded of an asset is positively related to its liquidity relative to alternative assets

Response of the Quantity of an Asset Demanded to Changes in Wealth, Expected Returns, Risk, and Liquidity

Variable	Change in Variable	Change in Quantity Demanded
Wealth	↑	↑
Expected return relative to other assets	↑	↑
Risk relative to other assets	↑	↓
Liquidity relative to other assets	↑	↑

Supply and Demand in the Bond Market



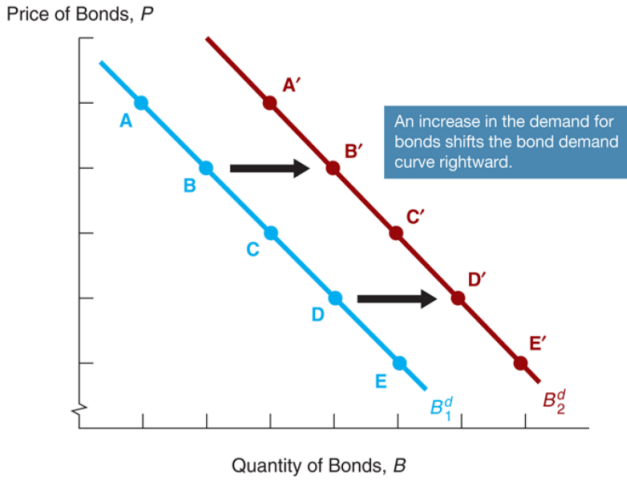
Demand: At lower prices (higher interest rates), ceteris paribus, the quantity demanded of bonds is higher: an inverse relationship

Supply: At lower prices (higher interest rates), ceteris paribus, the quantity supplied of bonds is lower: a positive relationship

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

Shift in the Demand Curve for Bonds



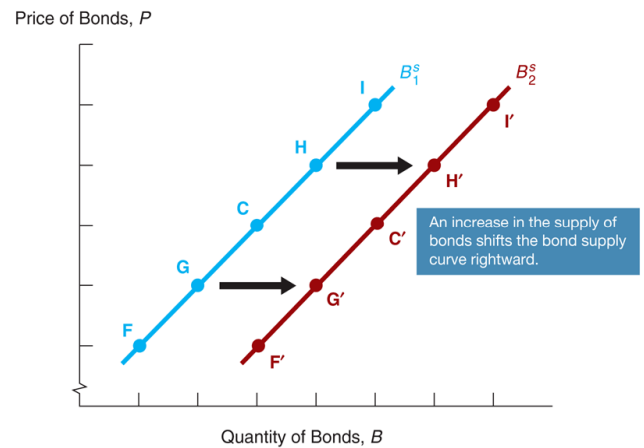
Shifts in the demand for bonds

- 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

Factors That Shift the Demand Curve for Bonds

Variable	Change in Variable	Change in Quantity Demanded at Each Bond Price	Shift in Demand Curve
Wealth	↑	↑	
Expected interest rate	↑	↓	
Expected inflation	↑	↓	
Riskiness of bonds relative to other assets	↑	↓	
Liquidity of bonds relative to other assets	↑	↑	

Shift in the Supply Curve for Bonds



Shifts in the Supply of Bonds

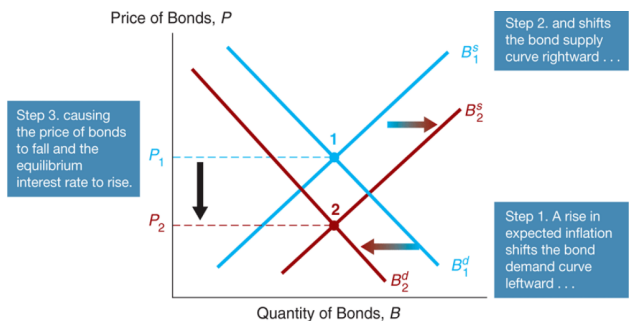
- Expected profitability of investment opportunities** in an expansion, the supply curve shifts to the right
- Expected inflation** an increase in expected inflation shifts the supply curve for bonds to the right
- Government budget** increased budget deficits shift the supply curve to the right

Factors That Shift the Supply of Bonds

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

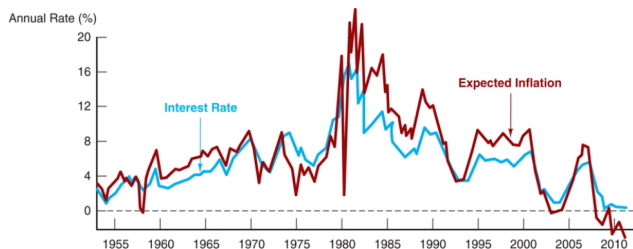
What happens if expected inflation rises?

Response to a Rise in Expected Inflation



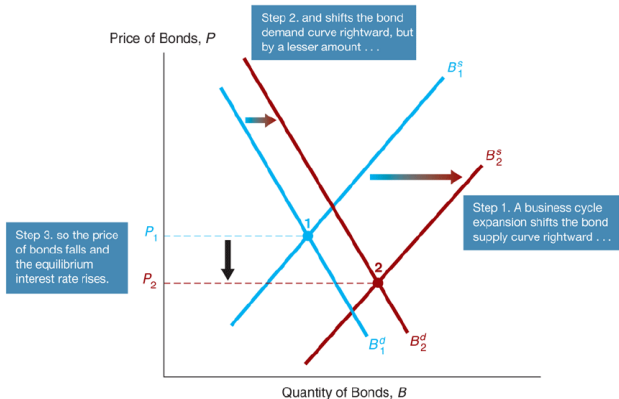
Expected Inflation and Interest Rates (Three-Month Treasury Bills), 1953-2011

What happens if the economy expands?



Response to a Business Cycle Expansion

Business Cycle and Interest Rates (Three-Month Treasury Bills), 1951-2011



How might a sudden increase in people's expectations of future real estate prices affect interest rates?

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

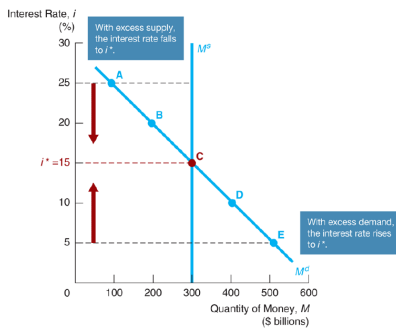
Keynesian model that determines the equilibrium interest rate in terms of the supply of and demand for money.
There are two main categories of assets that people use to store their wealth: money and bonds.

$$\text{Total wealth in the economy} = B^s + M^s = B^d + M^d$$

$$\text{Rearranging: } B^s - B^d = M^s - M^d$$

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

Equilibrium in the Market for Money



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.

Shifts in the demand for money

Changes in Equilibrium Interest Rates in the Liquidity Preference Framework

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

Changes in Equilibrium Interest Rates in the Liquidity Preference Framework

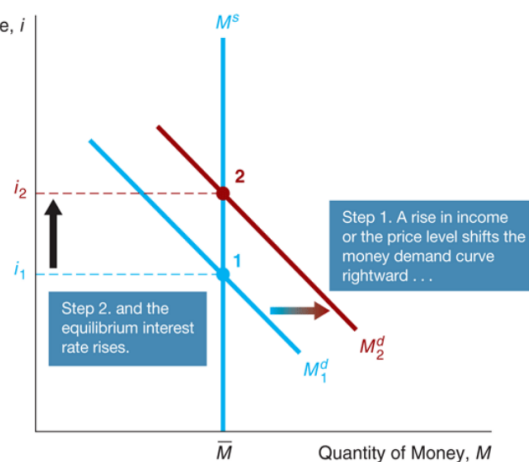
- ▶ Assume that the supply of money is controlled by the central bank
- ▶ An increase in the money supply engineered by the Central Bank will shift the supply curve for money to the right

Factors That Shift the Demand for and Supply of Money

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

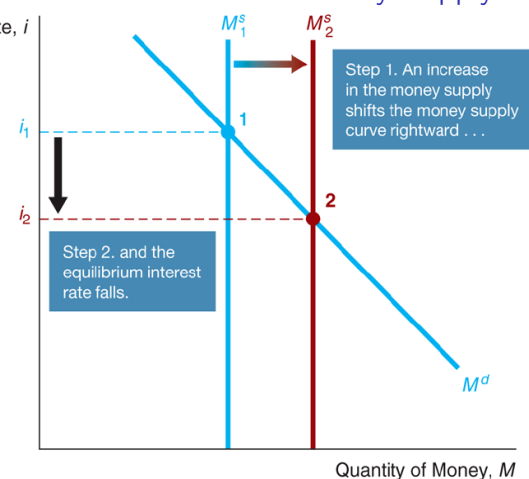
What happens if income rises?

Response to an Increase in Income or the Price Level



What happens if the money supply increases?

Response to an Increase in the Money Supply



Price-Level Effect and Expected-Inflation Effect

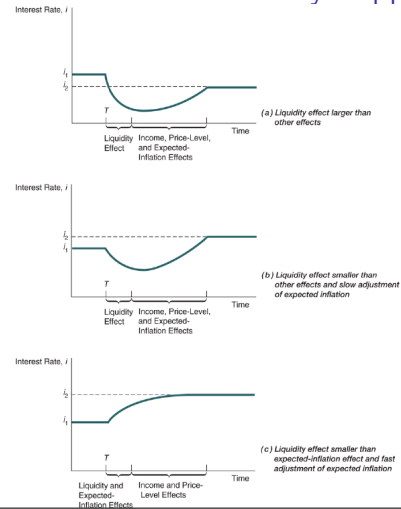
- ▶ A one time increase in the money supply will cause prices to rise to a permanently higher level. The interest rate will rise via the increased prices.
- ▶ Price-level effect remains even after prices have stopped rising.
- ▶ A rising price level will raise interest rates because people will expect inflation to be higher in the (near) future.
- ▶ 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.

Why should a rise in the price level (but not the expected inflation) cause interest rates to rise when the nominal money supply is fixed?

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).
- ▶ **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).

Response to an Increase in Money Supply Growth



Money Growth (M2, Annual Rate) and Interest Rates (Three-Month Treasury Bills), 1950-2011

