Monetary Theory and Policy

Chapter 5: The Behavior of Interest Rates

Interest Rate and Bond Price

- Interest rate moves in the opposite direction with the bond price
- Analyze the behavior of bond price to infer the behavior of interest rate
- Need a theory about the demand for and supply of bonds

Determining the Quantity Demanded of an Asset

- **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 Asset Demand

- Holding all other factors constant (ceteris paribus)
  - 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

Theory of Portfolio Choice

SUMMARY TABLE 1

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

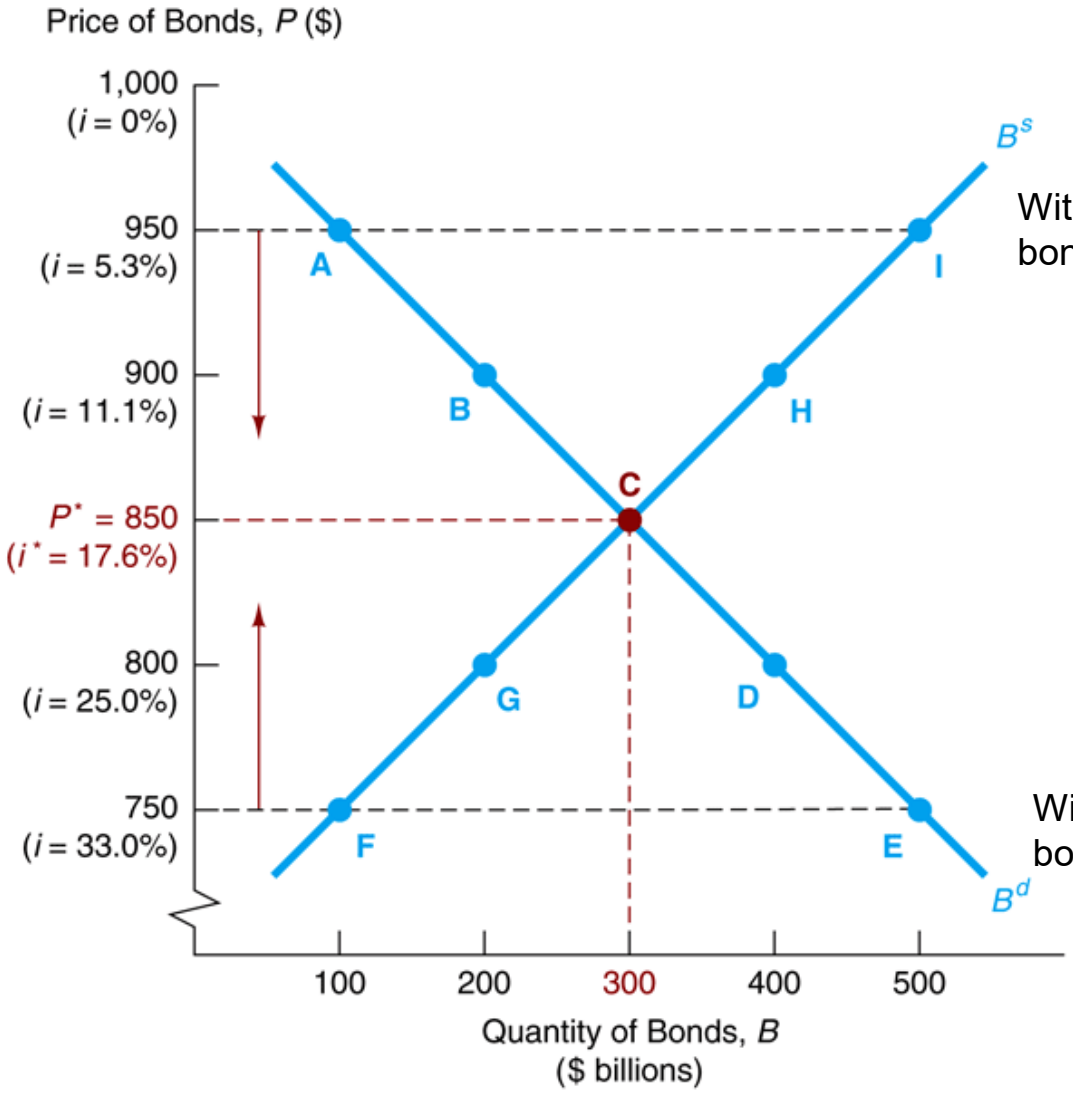
Variable	Change in Variable	Change in Quantity Demanded
Wealth	↑	↑
Expected return relative to other assets	↑	↑
Risk relative to other assets	↑	↓
Liquidity relative to other assets	↑	↑

Note: Only increases in the variables are shown. The effects of decreases in the variables on the quantity demanded would be the opposite of those indicated in the rightmost column.

Supply and Demand for Bonds

- At lower prices, ceteris paribus, the quantity demanded of bonds is higher: an inverse relationship
- At lower prices, ceteris paribus, the quantity supplied of bonds is lower: a positive relationship

FIGURE 1 Supply and Demand for Bonds (F=$1000)



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

With excess demand, the bond price rises to P^*

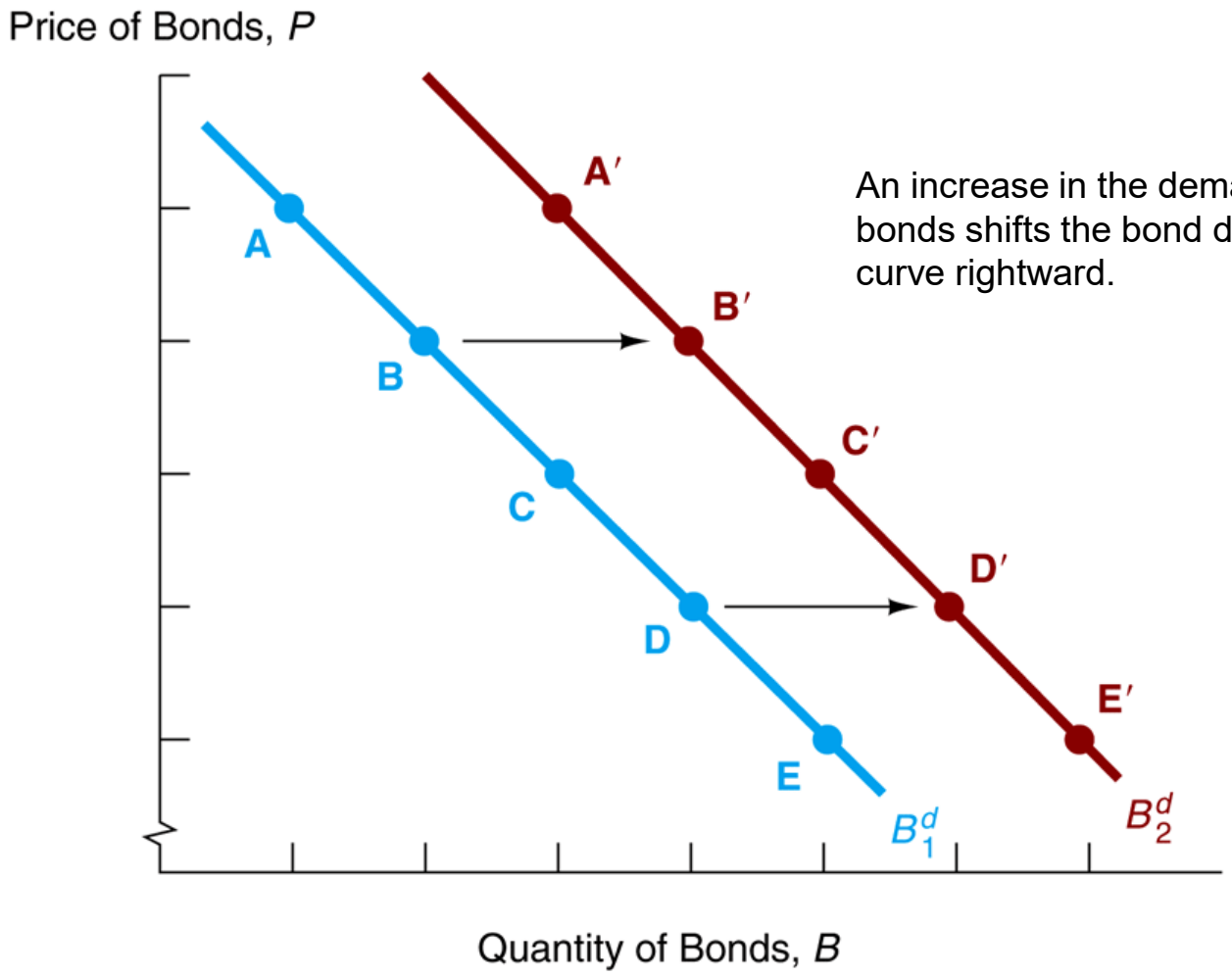
Market Equilibrium

- 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

Shifts in the Demand for Bonds

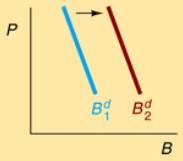
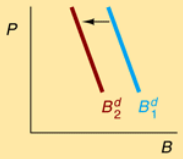
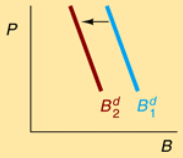
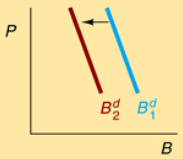
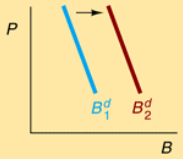
- **Wealth**: in an expansion with growing wealth, the demand curve for bonds shifts to the right
- **Expected Returns**: higher expected interest rates in the future lower the expected return for long-term bonds, shifting the demand curve to the left
- **Expected Inflation**: an increase in the expected 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

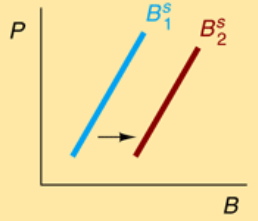
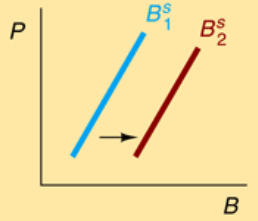
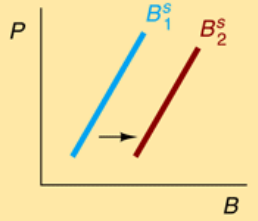
Variable	Change in Variable	Change in Quantity Demanded at Each Bond Price	Shift in Demand Curve
Wealth	↑	↑	
Expected interest rate	↑	↓	
Expected inflation	↑	↓	
Riskiness of bonds relative to other assets	↑	↓	
Liquidity of bonds relative to other assets	↑	↑	

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

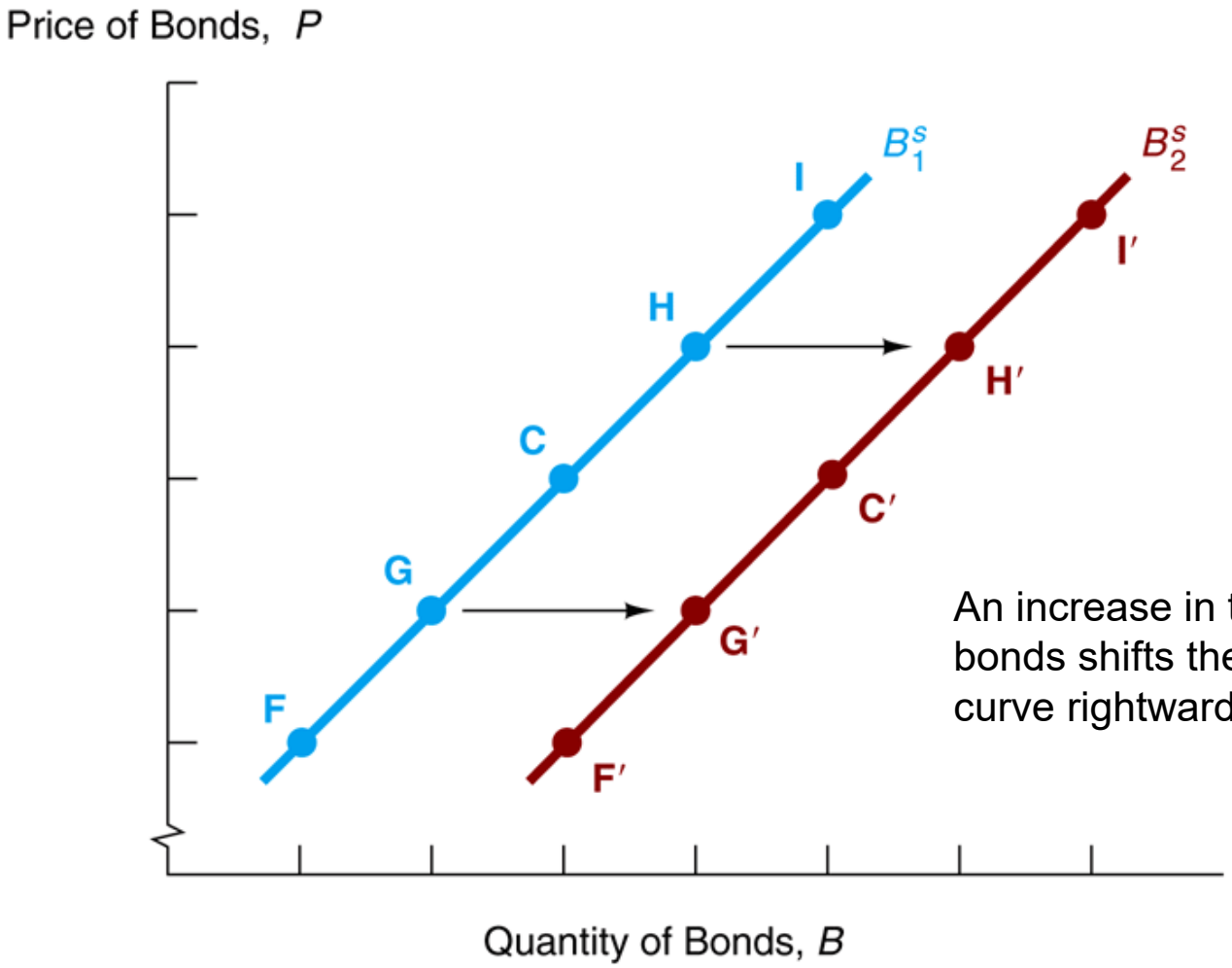
- Expected profitability of investment opportunities: in an expansion, the supply curve shifts to the right
- Expected inflation: an increase in expected inflation shifts the supply curve for bonds to the right
- Government budget: increased budget deficits shift the supply curve to the right

Summary Table 3 Factors That Shift the Supply of Bonds

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

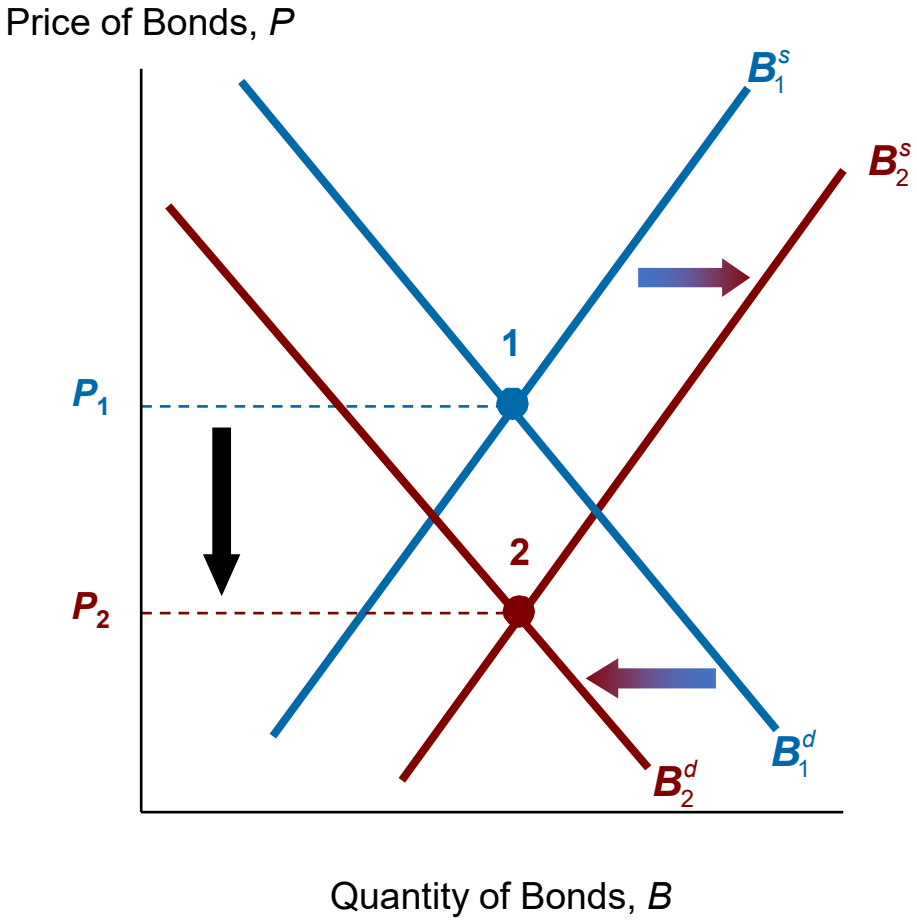
Note: Only increases in the variables are shown. The effect of decreases in the variables on the change in supply would be the opposite of those indicated in the remaining columns.

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

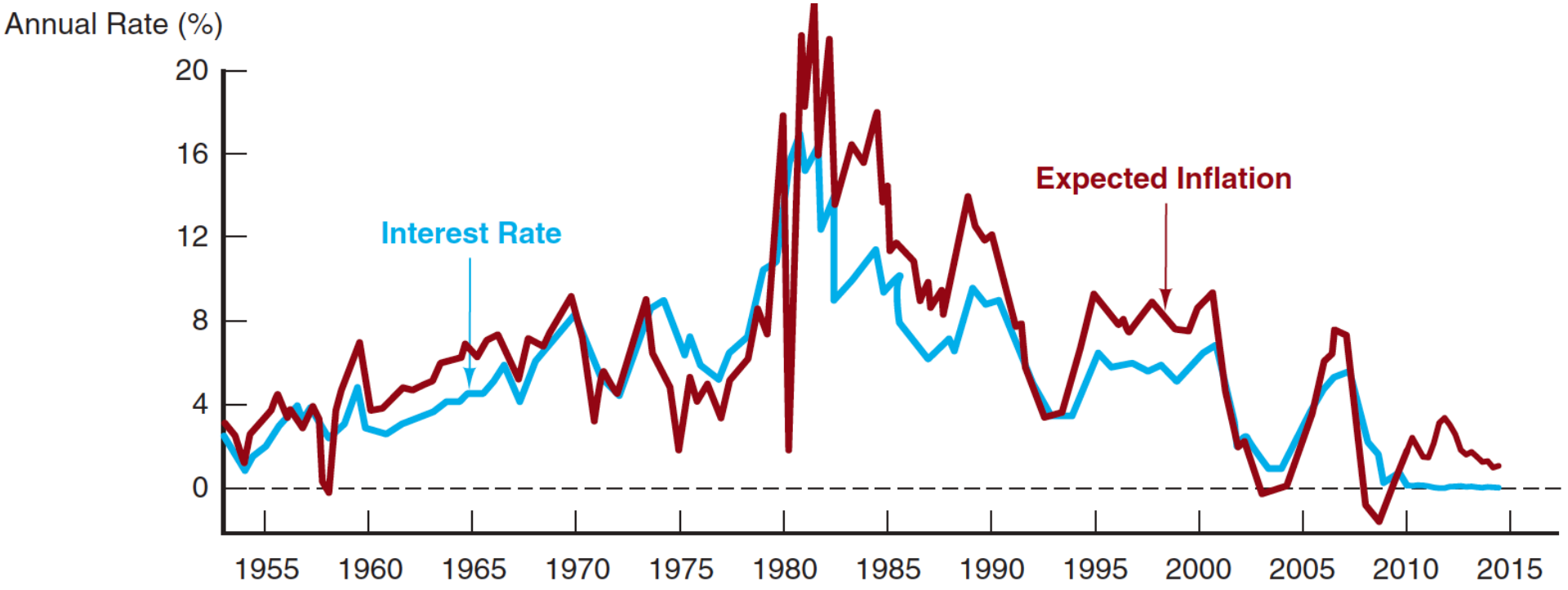


Step 1. A rise in expected inflation shifts the bond demand curve leftward . . .

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), 1953–2014



Sources: Federal Reserve Bank of St. Louis FRE D database: http://research.stlouisfed.org/fred2. Expected inflation calculated using procedures outlined in Frederic S. Mishkin, "The Real Interest Rate: An Empirical Investigation," Carnegie-Rochester Conference Series on Public Policy 15 (1981): 151–200. These procedures involve estimating expected inflation as a function of past interest rates, inflation, and time trends.

Fisher Equation

- Response to a Change in Expected Inflation

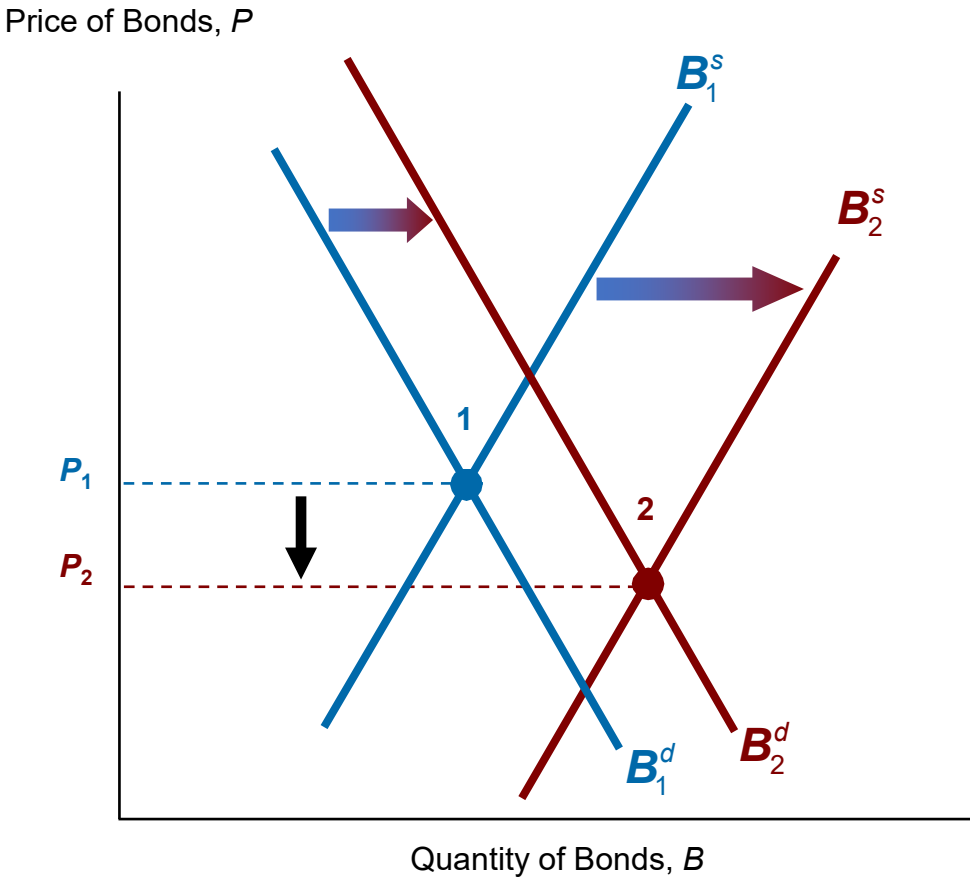
$$i = i_r + \pi^e$$

i = nominal interest rate

i_r = real interest rate

π^e = expected inflation rate

FIGURE 6 Response to a Business Cycle Expansion

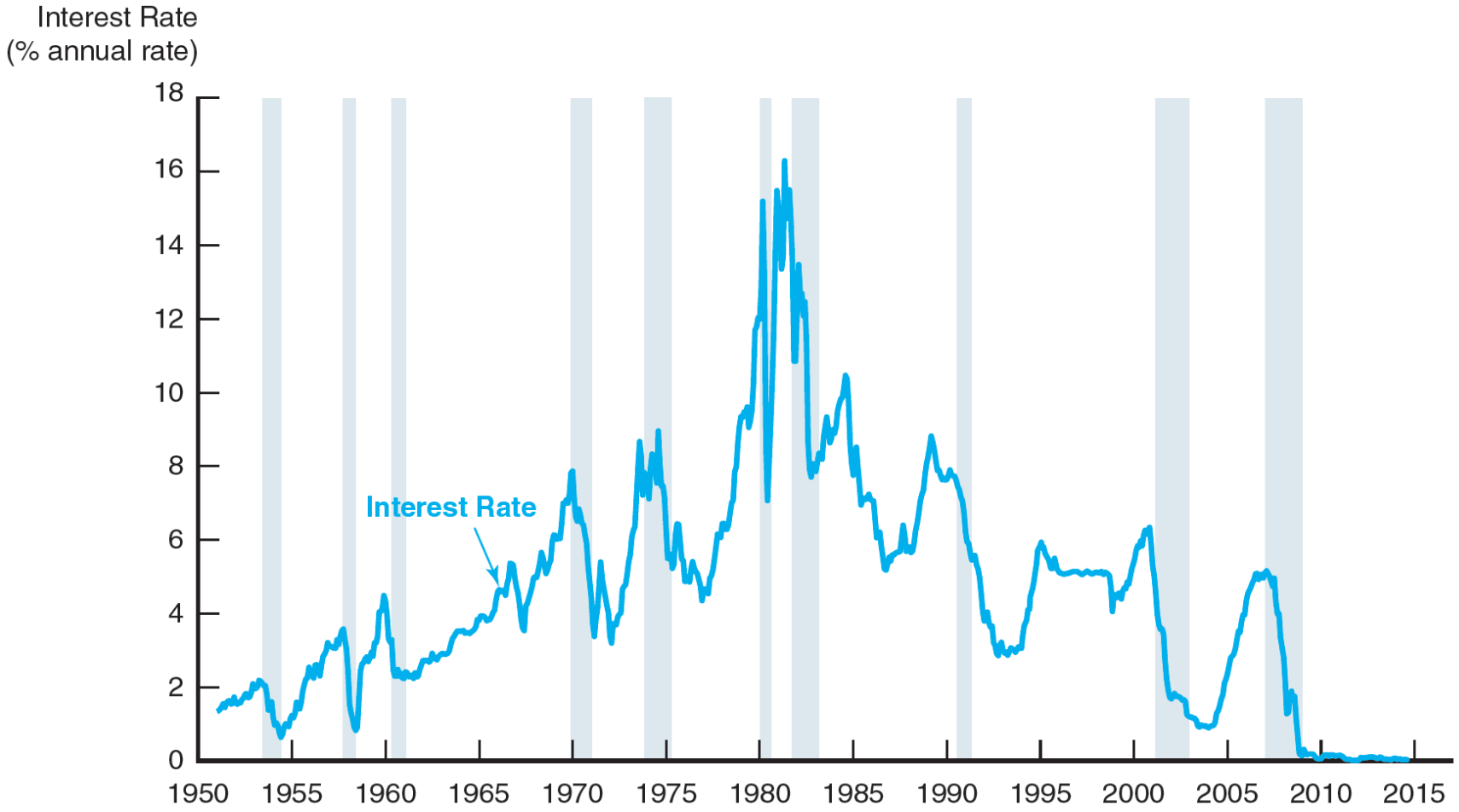


Step 1. A business cycle expansion shifts the bond supply curve rightward . . .

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), 1951–2014



- Source: Federal Reserve Bank of St. Louis FRE D database: http://research.stlouisfed.org/fred2

The Liquidity Preference Framework

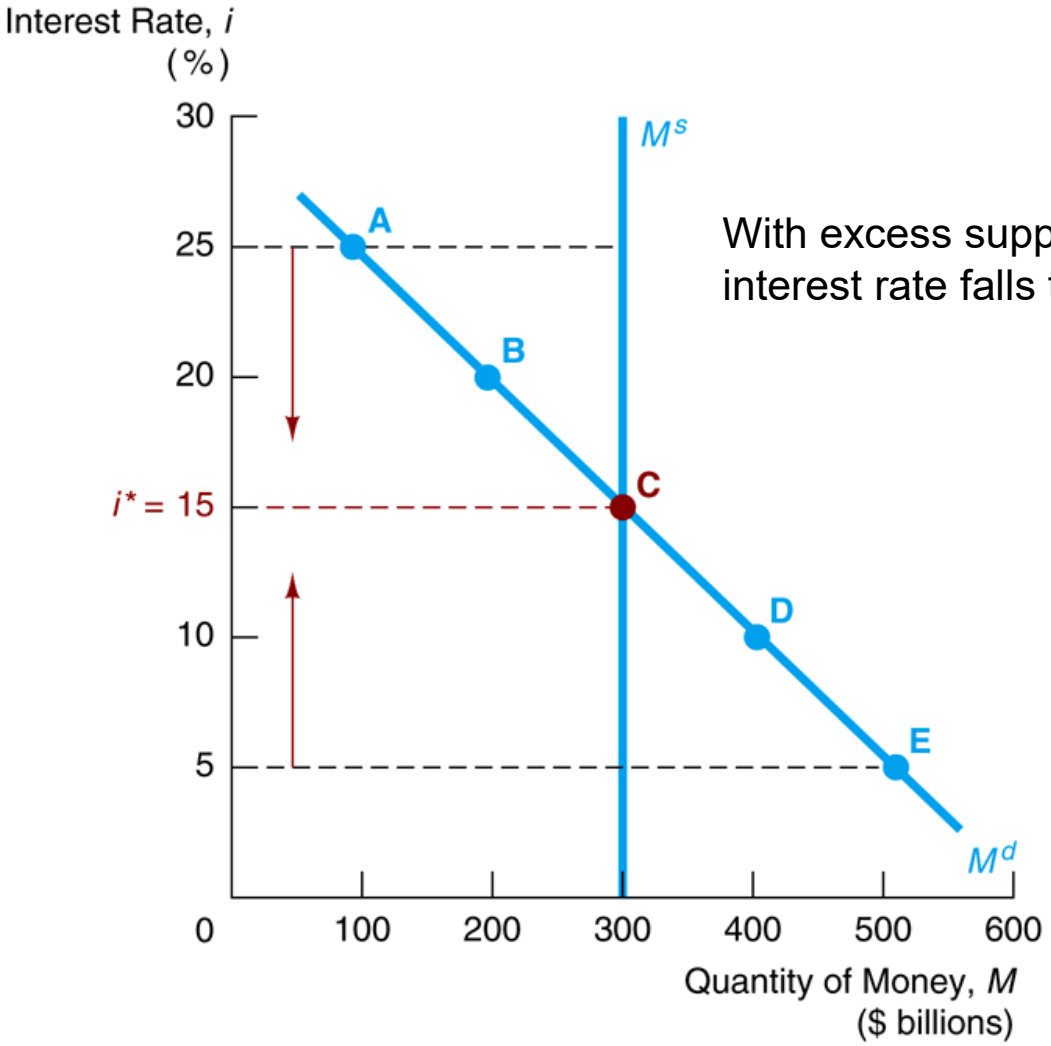
- Keynesian model that determines the equilibrium interest rate in terms of the supply of and demand for money.
- There are two main categories of assets that people use to store their wealth : money and bonds.
- Total wealth in the economy $= B^s + M^s = B^d + M^d$

  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



With excess supply, the interest rate falls to *i* *.

With excess demand, the interest rate rises to *i* *.

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.

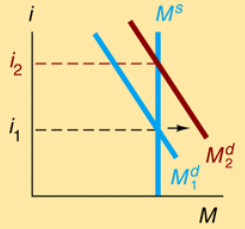
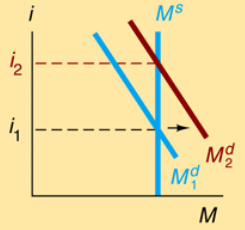
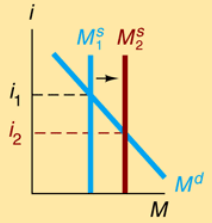
Shifts in the Demand for Money

- 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

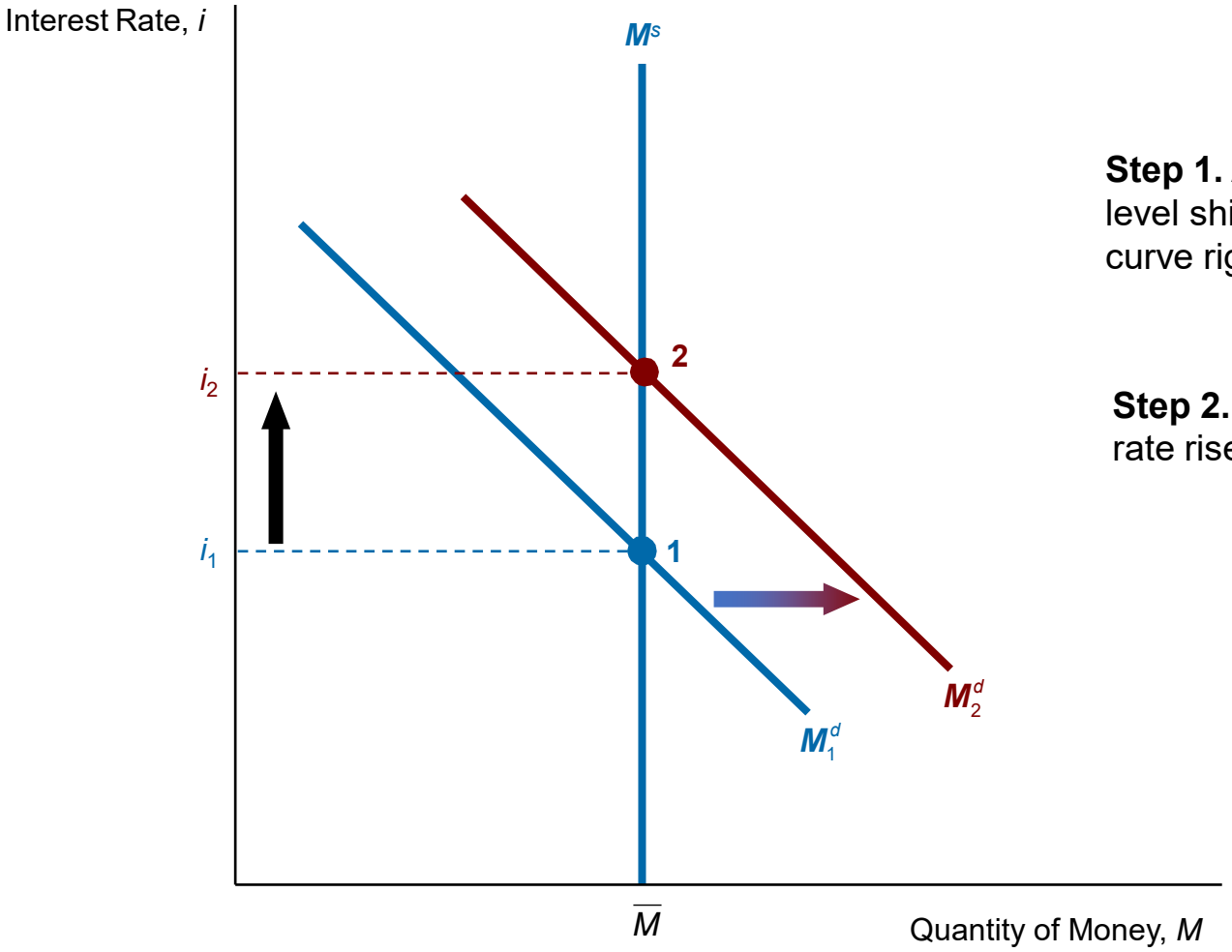
- Assume that the supply of money is controlled by the central bank
- An increase in the money supply engineered by the Federal Reserve will shift the supply curve for money to the right

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

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 ↑	↑	
Price level	↑	M^d ↑	↑	
Money supply	↑	M^s ↑	↓	

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.

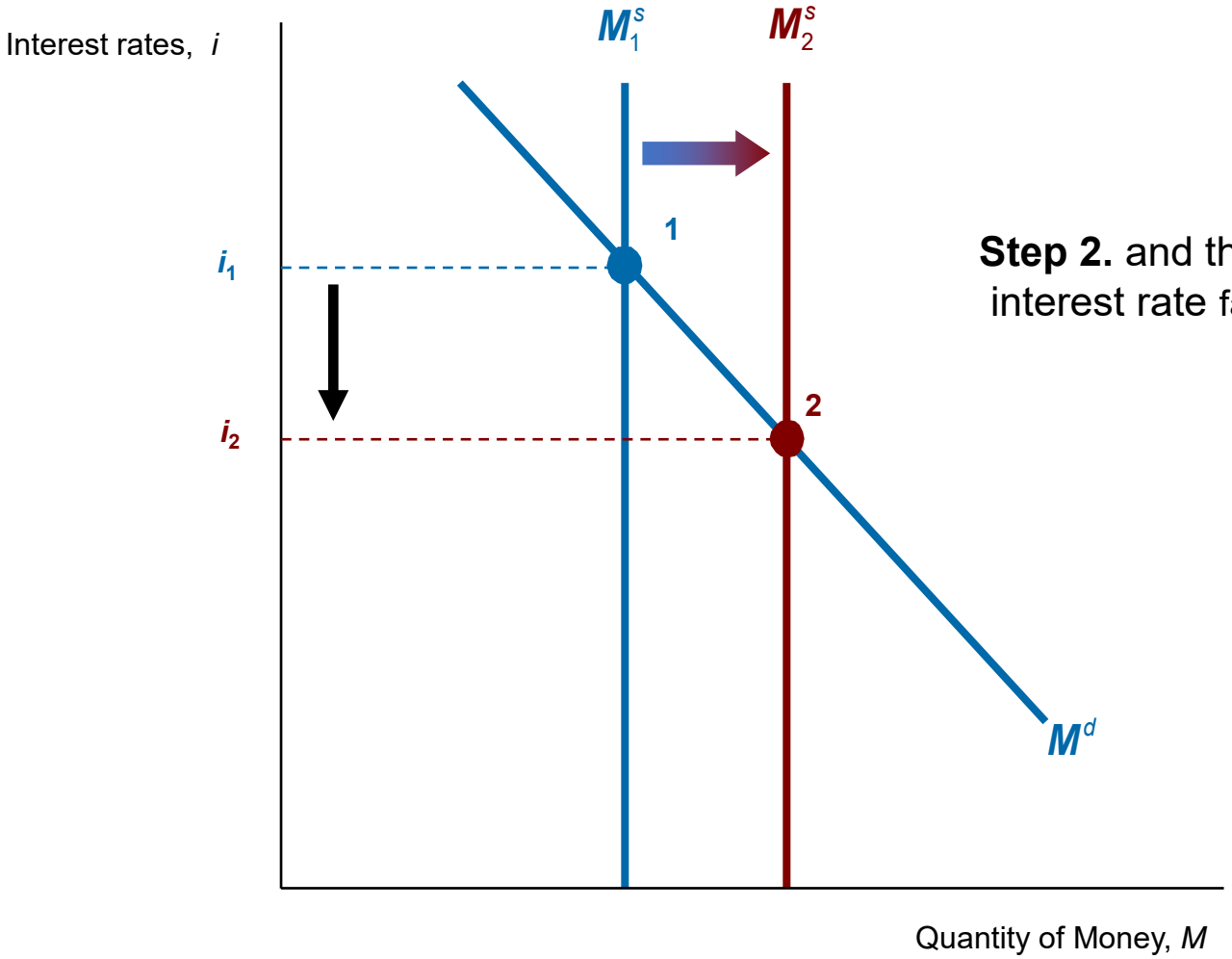
FIGURE 9 Response to a Change in Income or the Price Level



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 2. and the equilibrium interest rate falls.

Everything Else Remaining Equal?

- 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).

Everything Else Remaining Equal?

- 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).

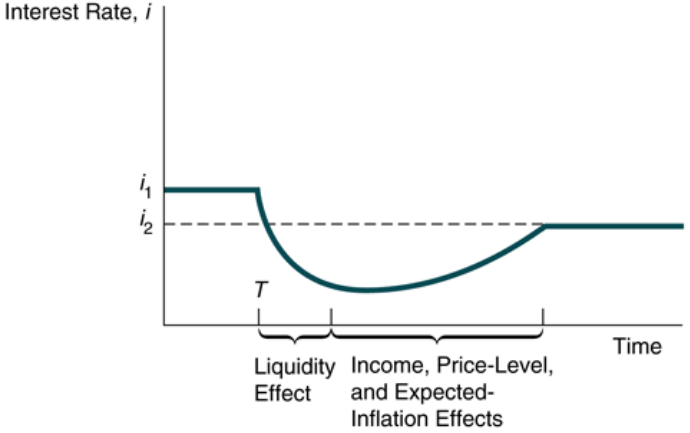
Price-Level Effect and Expected-Inflation Effect

- 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.

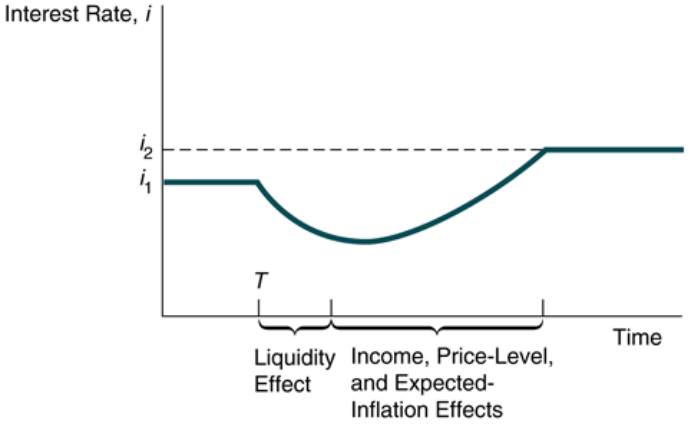
Ambiguous Effects of Money Supply

- Liquidity effect
- Income effect
- Price-level effect
- Expected-inflation effect

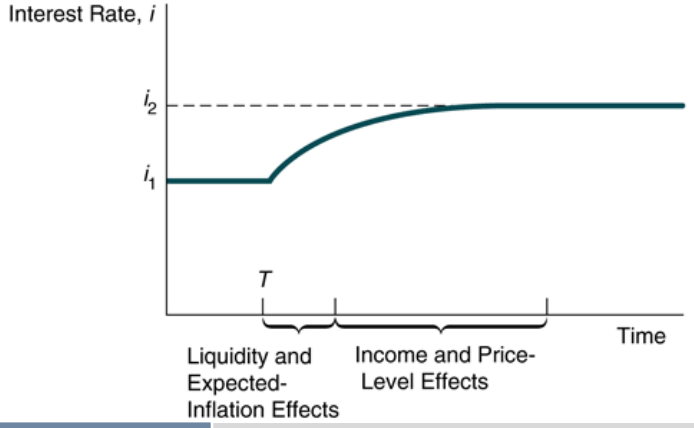
Response to an Increase in Money Supply



(a) Liquidity effect larger than other effects

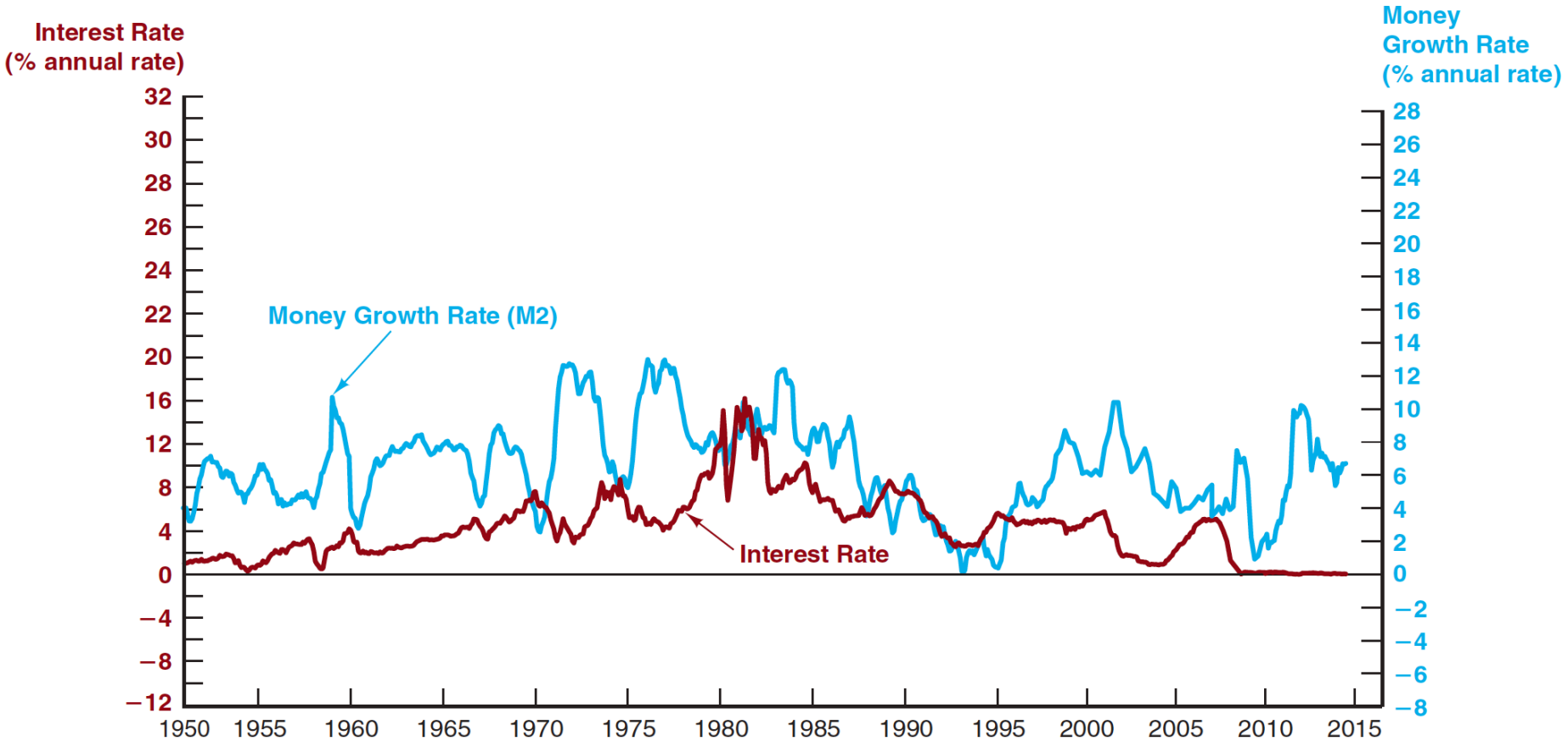


(b) Liquidity effect smaller than other effects and slow adjustment of expected inflation



(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),1950–2014



Source: Federal Reserve Bank of St. Louis FRE D database: http://research.stlouisfed.org/fred2

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Table 5 Correlation Coefficient Between the Growth Rate of Money Supply and Interest Rate

- G: growth rate of money supply
- FEDFUNDS: federal funds rate
- TB3MS: 3 months treasury bills

	G1	G2	G3	FEDFUNDS	TB3MS
G1	1.000000	0.369210	0.164614	0.100700	0.112753
G2	0.369210	1.000000	0.805463	0.099338	0.127919
G3	0.164614	0.805463	1.000000	0.204492	0.218256
FEDFUNDS	0.100700	0.099338	0.204492	1.000000	0.988999
TB3MS	0.112753	0.127919	0.218256	0.988999	1.000000

Table 6 Correlation Coefficient Between the Cyclical Component of Money Supply and Interest Rate

- M_C: cyclical component of money supply
- FEDFUNDS: federal funds rate
- TB3MS: 3 months treasury bills

	M1_C	M2_C	M3_C	FEDFUNDS	TB3MS
M1_C	1.000000	0.072082	-0.137616	-0.182845	-0.202429
M2_C	0.072082	1.000000	0.705094	-0.248153	-0.238174
M3_C	-0.137616	0.705094	1.000000	0.034713	0.013151
FEDFUNDS	-0.182845	-0.248153	0.034713	1.000000	0.989054
TB3MS	-0.202429	-0.238174	0.013151	0.989054	1.000000