Chapter Outline

• What Is Money?
• Portfolio Allocation and the Demand for Assets
• The Demand for Money
• Asset Market Equilibrium
• Money Growth and Inflation
What Is Money?

• Money: assets that are widely used and accepted as payment
• The functions of money
  – Medium of exchange
  – Unit of account
  – Store of value
What Is Money?

• The functions of money
  – Medium of exchange
    • Barter is inefficient—double coincidence of wants
    • Money allows people to trade their labor for money, then use the money to buy goods and services in separate transactions
    • Money thus permits people to trade with less cost in time and effort
    • Money allows specialization, so people don’t have to produce their own food, clothing, and shelter
What Is Money?

• The functions of money
  – Unit of account
    • Money is basic unit for measuring economic value
    • Simplifies comparisons of prices, wages, and incomes
    • The unit-of-account function is closely linked with the medium-of-exchange function
    • Countries with very high inflation may use a different unit of account, so they don’t have to constantly change prices
What Is Money?

• The functions of money
  – Store of value
    • Money can be used to hold wealth
    • Most people use money only as a store of value for a short period and for small amounts, because it earns less interest than money in the bank
What Is Money?

• Box 7.1: money in a prisoner-of-war camp
  – Radford article on the use of cigarettes as money
  – Cigarette use as money developed because barter was inefficient
  – Even nonsmokers used cigarettes as money
  – Characteristics of cigarettes as money: standardized (so value was easy to ascertain), low in value (so “change” could be made), portable, fairly sturdy
  – Problem with having a commodity money like cigarettes: can’t smoke them and use them as money at the same time
What Is Money?

• Measuring money—the monetary aggregates
  – Distinguishing what is money from what isn’t money is sometimes difficult
    • For example, MMMFs allow checkwriting, but give a higher return than bank checking accounts: Are they money?
    • There’s no single best measure of the money stock
What Is Money?

• Measuring money
  – The M1 monetary aggregate
    • Currency and traveler’s checks held by the public
    • Demand deposits (which pay no interest)
    • Other checkable deposits (which may pay interest)
  – All components of M1 are used in making payments, so M1 is the closest money measure to our theoretical description of money
What Is Money?

• Measuring money
  – The M2 monetary aggregate
    • $M2 = M1 + less moneylike assets
  – Additional assets in M2:
    • savings deposits
    • small (< $100,000) time deposits
    • noninstitutional MMMF balances
    • money-market deposit accounts (MMDAs)
Table 7.1 U.S. Monetary Aggregates (May 2006)

<table>
<thead>
<tr>
<th>Aggregate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>1392.3</td>
</tr>
<tr>
<td>Currency</td>
<td>741.8</td>
</tr>
<tr>
<td>Travelers’ checks</td>
<td>6.9</td>
</tr>
<tr>
<td>Demand deposits</td>
<td>327.0</td>
</tr>
<tr>
<td>Other checkable deposits</td>
<td>316.6</td>
</tr>
<tr>
<td>M2</td>
<td>6775.2</td>
</tr>
<tr>
<td>Components of M1</td>
<td>1392.3</td>
</tr>
<tr>
<td>Savings deposits, including MMDAs</td>
<td>3602.7</td>
</tr>
<tr>
<td>Small-denomination time deposits</td>
<td>1050.2</td>
</tr>
<tr>
<td>MMMFs (noninstitutional)</td>
<td>730.1</td>
</tr>
</tbody>
</table>

Note: Numbers may not add to totals shown owing to rounding.
Data are not seasonally adjusted.
What Is Money?

• Measuring money
  – The M2 monetary aggregate
    • Savings deposits include passbook savings accounts
    • Time deposits bear interest and have a fixed term (substantial penalty for early withdrawal)
    • MMMFs invest in very short-term securities and allow checkwriting
    • MMDAs are offered by banks as a competitor to MMMFs
What Is Money?

• Box 7.2: where have all the dollars gone?
  – In 2006, U.S. currency averaged about $2500 per person, but surveys show people only hold about $100
  – Some is held by businesses and the underground economy, but most is held abroad
  – Foreigners hold dollars because of inflation in their local currency and political instability
What Is Money?

• Box 7.2: where have all the dollars gone?
  – Since currency is 1/2 of M1 and over half of currency is held abroad, foreigners hold over 1/4 of M1
    • The data show large fluctuations in M1 when major events occur abroad, like military conflicts
  – The United States benefits from foreign holdings of our currency, since we essentially get an interest-free loan
What Is Money?

• The money supply
  – Money supply = money stock = amount of money available in the economy
What Is Money?

• The money supply
  – How does the central bank of a country increase the money supply?
    • Use newly printed money to buy financial assets from the public—an open-market purchase
    • To reduce the money supply, sell financial assets to the public to remove money from circulation—an open-market sale
    • Open-market purchases and sales are called open-market operations
What Is Money?

• The money supply
  – How does the central bank of a country increase the money supply?
    • Could also buy newly issued government bonds directly from the government (i.e., the Treasury)
      – This is the same as the government financing its expenditures directly by printing money
      – This happens frequently in some countries (though is forbidden by law in the United States)
What Is Money?

• The money supply

  Throughout text, use the variable \( M \) to represent money supply; this might be M1 or M2
Portfolio Allocation and the Demand for Assets

– How do people allocate their wealth among various assets?
The portfolio allocation decision
Portfolio Allocation and the Demand for Assets

• Expected return
  – Rate of return = an asset’s increase in value per unit of time
    • Bank account: Rate of return = interest rate
    • Corporate stock: Rate of return = dividend yield + percent increase in stock price
  – Investors want assets with the highest expected return (other things equal)
  – Returns not known in advance, so people estimate their expected return
Portfolio Allocation and the Demand for Assets

• Risk
  – Risk is the degree of uncertainty in an asset’s return
  – People don’t like risk, so they prefer assets with low risk (other things equal)
Portfolio Allocation and the Demand for Assets

• Liquidity
  – Liquidity: the ease and quickness with which an asset can be traded
  – Money is very liquid
  – Assets like automobiles and houses are very illiquid—long time and large transaction costs to trade them
  – Stocks and bonds are fairly liquid
  – Investors prefer liquid assets (other things equal)
Portfolio Allocation and the Demand for Assets

• Time to maturity
  – Time to maturity: the amount of time until an asset matures and the investor is repaid the principal
  – Expectations theory of the term structure of interest rates
    • The idea that investors compare returns on bonds with differing times to maturity
    • In equilibrium, holding different types of bonds over the same period yields the same expected return
Portfolio Allocation and the Demand for Assets

• Time to maturity
  – Because long-term interest rates usually exceed short-term interest rates, a risk premium exists: the compensation to an investor for bearing the risk of holding a long-term bond
Portfolio Allocation and the Demand for Assets

• Asset Demands
  – Trade-off among expected return, risk, liquidity, and time to maturity
  – Assets with low risk and high liquidity, like checking accounts, have low expected returns
  – Investors consider diversification: spreading out investments in different assets to reduce risk
  – The amount a wealth holder wants of an asset is his or her demand for that asset
  – The sum of asset demands equals total wealth
The Demand for Money

• The demand for money is the quantity of monetary assets people want to hold in their portfolios
  – Money demand depends on expected return, risk, and liquidity
  – Money is the most liquid asset
  – Money pays a low return
  – People’s money-holding decisions depend on how much they value liquidity against the low return on money
The Demand for Money

- Key macroeconomic variables that affect money demand
  - Price level
  - Real income
  - Interest rates
The Demand for Money

- Price level
  - The higher the price level, the more money you need for transactions
  - Prices are 10 times as high today as in 1935, so it takes 10 times as much money for equivalent transactions
  - Nominal money demand is thus proportional to the price level
The Demand for Money

- **Real income**
  - The more transactions you conduct, the more money you need
  - Real income is a prime determinant of the number of transactions you conduct
  - So money demand rises as real income rises
The Demand for Money

• Real income
  – But money demand isn’t proportional to real income, since higher-income individuals use money more efficiently, and since a country’s financial sophistication grows as its income rises (use of credit and more sophisticated assets)
  – Result: Money demand rises less than 1-to-1 with a rise in real income
The Demand for Money

• Interest rates
  – An increase in the interest rate or return on nonmonetary assets decreases the demand for money
  – An increase in the interest rate on money increases money demand
  – This occurs as people trade off liquidity for return
The Demand for Money

• Interest rates
  – Though there are many nonmonetary assets with many different interest rates, because they often move together we assume that for nonmonetary assets there’s just one nominal interest rate, \( i \)
The Demand for Money

• The money demand function
  \[ M^d = P \times L(Y, i) \]  
  - \( M^d \) is nominal money demand (aggregate)
  - \( P \) is the price level
  - \( L \) is the money demand function
  - \( Y \) is real income or output
  - \( i \) is the nominal interest rate on nonmonetary assets
The Demand for Money

• The money demand function
  – As discussed above, nominal money demand is proportional to the price level
  – A rise in $Y$ increases money demand; a rise in $i$ reduces money demand
  – We exclude $i^m$ from Eq. (7.1) since it doesn’t vary much
The Demand for Money

• The money demand function
  – Alternative expression:
    \[ M^d = P \times L(Y, r + \pi^e) \]  \hspace{1cm} (7.2)
  • A rise in \( r \) or \( \pi^e \) reduces money demand
  – Alternative expression:
    \[ M^d / P = L(Y, r + \pi^e) \]  \hspace{1cm} (7.3)
The Demand for Money

• Other factors affecting money demand
  – Wealth: A rise in wealth may increase money demand, but not by much
  – Risk
    • Increased riskiness in the economy may increase money demand
    • Times of erratic inflation bring increased risk to money, so money demand declines
The Demand for Money

• Other factors affecting money demand
  – Liquidity of alternative assets: Deregulation, competition, and innovation have given other assets more liquidity, reducing the demand for money
  – Payment technologies: Credit cards, ATMs, and other financial innovations reduce money demand
## Macroeconomic Determinants of the Demand for Money

<table>
<thead>
<tr>
<th>An increase in</th>
<th>Causes money demand to</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price level, $P$</td>
<td>Rise proportionally</td>
<td>A doubling of the price level doubles the number of dollars needed for transactions.</td>
</tr>
<tr>
<td>Real income, $Y$</td>
<td>Rise less than proportionally</td>
<td>Higher real income implies more transactions and thus a greater demand for liquidity.</td>
</tr>
<tr>
<td>Real interest rate, $r$</td>
<td>Fall</td>
<td>Higher real interest rate means a higher return on alternative assets and thus a switch away from money.</td>
</tr>
<tr>
<td>Expected inflation, $\pi^e$</td>
<td>Fall</td>
<td>Higher expected inflation means a higher return on alternative assets and thus a switch away from money.</td>
</tr>
<tr>
<td>Nominal interest rate on money, $i^m$</td>
<td>Rise</td>
<td>Higher return on money makes people more willing to hold money.</td>
</tr>
<tr>
<td>Wealth</td>
<td>Rise</td>
<td>Part of an increase in wealth may be held in the form of money.</td>
</tr>
<tr>
<td>Risk</td>
<td>Rise, if risk of alternative asset increases</td>
<td>Higher risk of alternative asset makes money more attractive.</td>
</tr>
<tr>
<td></td>
<td>Fall, if risk of money increases</td>
<td>Higher risk of money makes it less attractive</td>
</tr>
<tr>
<td>Liquidity of alternative assets</td>
<td>Fall</td>
<td>Higher liquidity of alternative assets makes these assets more attractive.</td>
</tr>
<tr>
<td>Efficiency of payments technologies</td>
<td>Fall</td>
<td>People can operate with less money.</td>
</tr>
</tbody>
</table>
The Demand for Money

• Elasticities of money demand
  – How strong are the various effects on money demand?
  – Statistical studies on the money demand function show results in elasticities
  – Elasticity: The percent change in money demand caused by a one percent change in some factor
The Demand for Money

- Elasticities of money demand
  - Income elasticity of money demand
    - Positive: Higher income increases money demand
    - Less than one: Higher income increases money demand less than proportionately
    - Goldfeld’s results: income elasticity $= 2/3$
  - Interest elasticity of money demand
    - Small and negative: Higher interest rate on nonmonetary assets reduces money demand slightly
  - Price elasticity of money demand is unitary, so money demand is proportional to the price level
The Demand for Money

- Velocity and the quantity theory of money
  - Velocity \( (V) \) measures how much money “turns over” each period
  - \[ V = \frac{PY}{M} \]  
    \[ (7.4) \]
  - Plot of velocities for M1 and M2 (Fig. 7.1) shows fairly stable velocity for M2, erratic velocity for M1 beginning in early 1980s
Figure 7.1 Velocity of M1 and M2, 1959-2005
The Demand for Money

• Velocity and the quantity theory of money
  – Quantity theory of money: Real money demand is proportional to real income
    • If so,
      \[ \frac{M^d}{P} = kY \]  (7.5)
    • Assumes constant velocity, where velocity isn’t affected by income or interest rates
The Demand for Money

• Velocity and the quantity theory of money
  • But velocity of M1 is not constant; it rose steadily from 1960 to 1980 and has been erratic since then
    – Part of the change in velocity is due to changes in interest rates in the 1980s
    – Financial innovations also played a role in velocity’s decline in the early 1980s
  • M2 velocity is closer to being a constant, but not over short periods
The Demand for Money

• Application: financial regulation, innovation, and the instability of money demand
  – Goldfeld (1973) found a stable money (M1) demand function
  – But late 1974 to early 1976, M1 demand fell relative to that predicted by the model
  – And in the early 1980s, M1 demand rose relative to that predicted by the model
The Demand for Money

• Application: instability of money demand
  – Why did money demand shift erratically?
  Increased innovation and changes in the financial system
  (see Fig. 7.2)
Figure 7.2 Growth Rates of M1 and M2, 1960-2005
The Demand for Money

• Application: instability of money demand
  – Why did money demand shift erratically?
    • New assets were invented in the 1970s, liquid assets that paid interest
    • People switched wealth from M1 to these assets, reducing M1 demand
      – MMMFs
      – Overnight repurchase agreements
    • New assets in the 1980s, interest-bearing checking accounts; their use brought wealth into M1, raising money demand
The Demand for Money

• Application: instability of money demand
  – Developments in the 1990s
    • Sweep programs reduce demand for reserves and M1
    • M2 erratic because of increased use of mutual funds
Asset Market Equilibrium

- Asset market equilibrium—an aggregation assumption
  - Assume that all assets can be grouped into two categories, money and nonmonetary assets
    - Money includes currency and checking accounts
      - Pays interest rate $i^m$
      - Supply is fixed at $M$
    - Nonmonetary assets include stocks, bonds, land, etc.
      - Pays interest rate $i = r + \pi^e$
      - Supply is fixed at $NM$
Asset Market Equilibrium

- Asset market equilibrium occurs when quantity of money supplied equals quantity of money demanded
  - \( m^d + nm^d = \text{total nominal wealth of an individual} \)
  - \( M^d + NM^d = \text{aggregate nominal wealth} \) (equation 7.6)
    (from adding up individual wealth)
  - \( M + NM = \text{aggregate nominal wealth} \) (equation 7.7)
    (supply of assets)
  - Subtracting Eq. (7.7) from Eq. (7.6) gives
    \[
    (M^d - M) + (NM^d - NM) = 0
    \] (equation 7.8)
Asset Market Equilibrium

- So excess demand for money \((M^d - M)\) plus excess demand for nonmonetary assets \((NM^d - NM)\) equals 0

- So if money supply equals money demand, nonmonetary asset supply must equal nonmonetary asset demand; then entire asset market is in equilibrium
Asset Market Equilibrium

- The asset market equilibrium condition
  \[
  \frac{M}{P} = L(Y, r + \pi^e)
  \]
  (7.9)

  real money supply = real money demand
  - \( M \) is determined by the central bank
  - \( \pi^e \) is fixed (for now)
  - The labor market determines the level of employment; using employment in the production function determines \( Y \)
  - Given \( Y \), the goods market equilibrium condition determines \( r \)
Asset Market Equilibrium

• The asset market equilibrium condition
  – With all the other variables in Eq. (7.9) determined, the asset market equilibrium condition determines the price level

\[ P = \frac{M}{L(Y, r + \pi^e)} \]  \hspace{1cm} (7.10)

• The price level is the ratio of nominal money supply to real money demand
• For example, doubling the money supply would double the price level
Money Growth and Inflation

• The inflation rate is closely related to the growth rate of the money supply
  – Rewrite Eq. (7.10) in growth-rate terms:
    \[ \frac{\Delta P}{P} = \frac{\Delta M}{M} - \frac{\Delta L(Y, r + \pi^e)}{L(Y, r + \pi^e)} \]  
  – If the asset market is in equilibrium, the inflation rate equals the growth rate of the nominal money supply minus the growth rate of real money demand
Money Growth and Inflation

• To predict inflation we must forecast both money supply growth and real money demand growth
  – In long-run equilibrium, we will have \( i \) constant, so let’s look just at growth in \( Y \)
  – Let \( \eta_Y \) be the elasticity of money demand with respect to income
  – Then from Eq. (7.11),
    \[
    \pi = \frac{\Delta M}{M} - \eta_Y \frac{\Delta Y}{Y}
    \]
    \( \text{(7.12)} \)
  – Example: \( \Delta Y/Y = 3\% \), \( \eta_Y = 2/3 \), \( \Delta M/M = 10\% \), then \( \pi = 8\% \)
Money Growth and Inflation

• Application: money growth and inflation in the European countries in transition
• Though the countries of Eastern Europe are becoming more market-oriented, Russia and some others have high inflation because of rapid money growth
Money Growth and Inflation

• Application: money growth and inflation in the European countries in transition
  – Both the growth rates of money demand and money supply affect inflation, but (in cases of high inflation) usually growth of nominal money supply is the most important factor
  • For example, if $\eta_Y = 2/3$ and $\Delta Y/Y = 15\%$, $\Delta L/L = 10\% (= 2/3 \times 15\%)$; or if $\Delta Y/Y = -15\%$, $\Delta L/L = -10\%$
  • So money demand doesn’t vary much, no matter how well or poorly an economy is doing
  • But nominal money supply growth differs across countries by hundreds of percentage points, so large inflation differences must be due to money supply, not money demand
Money Growth and Inflation

• Application: money growth and inflation in the European countries in transition
  – Fig. 7.3 shows the link between money growth and inflation in these countries; inflation is clearly positively associated with money growth
Figure 7.3 The relationship between money growth and inflation
Money Growth and Inflation

• Application: money growth and inflation in the European countries in transition
  – So why do countries allow money supplies to grow quickly, if they know it will cause inflation?
    • They sometimes find that printing money is the only way to finance government expenditures
    • This is especially true for very poor countries, or countries in political crisis
Money Growth and Inflation

- The expected inflation rate and the nominal interest rate
  - For a given real interest rate \( (r) \), expected inflation \( (\pi^e) \) determines the nominal interest rate \( (i = r + \pi^e) \)
Money Growth and Inflation

- The expected inflation rate and the nominal interest rate
  - What factors determine expected inflation?
    - People could use Eq. (7.12), relating inflation to the growth rates of the nominal money supply and real income
      - If people expect an increase in money growth, they would then expect a commensurate increase in the inflation rate
      - The expected inflation rate would equal the current inflation rate if money growth and income growth were stable
Money Growth and Inflation

- The expected inflation rate and the nominal interest rate
  - What factors determine expected inflation?
    - Expectations can’t be observed directly
      - They can be measured roughly by surveys
      - If real interest rates are stable, expected inflation can be inferred from nominal interest rates
      - Policy actions that cause expected inflation to rise should cause nominal interest rates to rise
Money Growth and Inflation

- The expected inflation rate and the nominal interest rate
  - Text Fig. 7.4 plots U.S. inflation and nominal interest rates
    - Inflation and nominal interest rates have tended to move together
    - But the real interest rate is clearly not constant
    - The real interest rate was negative in the mid-1970s, then became much higher and positive in the late-1970s to early-1980s
Figure 7.4 Inflation and the nominal interest rate in the United States, 1960–2006
Money Growth and Inflation

• Application: measuring inflation expectations
  – How do we find out people’s expectations of inflation?
    • We could look at surveys
    • But a better way is to observe implicit expectations from bond interest rates
  – The U.S. government issues nominal bonds and Treasury Inflation Indexed Securities (TIIS)
    • TIIS bonds make real interest payments by adjusting interest and principal for inflation
    • Compare nominal interest rate with real interest rate (Fig. 7.5)
Figure 7.5 Interest rates on nominal and TIIS ten-year notes, 1997-2006
Money Growth and Inflation

• Application: measuring inflation expectations
  – The interest rate differential: interest rate on nominal bonds minus real interest rate on TIIS bonds
    • The interest rate differential is a rough measure of expected inflation
    • TIIS bonds have lower inflation risk, so the measure of expected inflation may be too high
    • TIIS bonds do not have as liquid of a market, so the measure of expected inflation may be too low
    • The net effect of the two effects is likely to be small, so the measure of expected inflation may be about right
Money Growth and Inflation

• Application: measuring inflation expectations
  – The data show fluctuations in the expected inflation rate based on the interest rate differential (Fig. 7.6)
  • In contrast, the rate of expected inflation measured in surveys has been fairly constant
  • Either bond market participants have very different inflation expectations than forecasters, or else the degree of inflation risk and liquidity on TIIS bonds varied substantially from 1998 to 2006
Figure 7.6 Alternative measures of expected inflation, 1997-2006

[Graph showing expected inflation rates over the years, with two lines representing different measures: Survey of Professional Forecasters and Interest Rate Differential.]