PART

6

Monetary Theory

Crisis and Response: The Perfect Storm of 2007–2009

In 2007 and 2008, the U.S. economy was hit by a perfect storm of formidable shocks. By the end of 2007, oil prices had risen from $60 per barrel at the beginning of the year to $100, reaching a peak of over $140 per barrel in July 2008. The oil price shock was both contractionary and inflationary, and as a result led to both higher inflation and higher unemployment—not to mention many unhappy drivers at the gas pumps.

If this supply shock were not bad enough, the global financial crisis hit the economy starting in August 2007 and caused a contraction in both household and business spending. This shock led to a further rise in unemployment, with some weakening of inflationary pressure further down the road.

The result of this perfect storm of adverse shocks was the most severe economic contraction since the Great Depression, with unemployment rising from the 4.6% level in 2006 and 2007 to the 10% level by the end of 2009. Inflation also accelerated from 2.5% in 2006 to over 5% by the middle of 2008, but with the increase in the unemployment rate and the decline of oil and other commodity prices by the fall of 2008, inflation rapidly came back down again.

Although the Fed's aggressive monetary policy attempted to address the contractionary forces in the economy, lawmakers wanted additional action. In February 2008 and then again in February 2009, the U.S. Congress passed economic stimulus packages, first of $150 billion and then of $787 billion. However, although both stimulus packages helped boost GDP, they were overwhelmed by the continued worsening of the financial crisis, and the economy went into a tailspin.

The impact of the perfect storm of adverse shocks highlights the need to understand how monetary and other government policies affect inflation and economic activity. Chapter 20 discusses how the quantity theory of money explains inflation in the long run and how theories of the demand for money have evolved. Aggregate supply and demand analysis, the basic framework that will enable us to study the effects of monetary policy on output and inflation, is then developed in Chapters 21–24. In Chapter 25, we expand on aggregate supply and demand analysis in order to understand how monetary policy can be used to stabilize the economy and inflation. Chapter 26 outlines the transmission mechanisms through which monetary policy affects the aggregate economy.

20 Quantity Theory, Inflation, and the Demand for Money

Learning Objectives

- Assess the relationship between money growth and inflation in the short run and the long run, as implied by the quantity theory of money.
- Identify the circumstances under which budget deficits can lead to inflationary monetary policy.
- Summarize the three motives underlying the liquidity preference theory of money demand.
- Identify the factors underlying the portfolio choice theory of money demand.
- Assess and interpret the empirical evidence on the validity of the liquidity preference and portfolio theories of money demand.

Preview

In earlier chapters, we spent a lot of time and effort learning what the money supply is, how it is determined, and what part the Federal Reserve System plays in it. Now we are ready to explore the role of the money supply and monetary policy in determining inflation and total production of goods and services (aggregate output) in the economy. The study of the effects of money and monetary policy on the economy is called **monetary theory**, and we examine this branch of economics in the chapters of Part 6.

When economists mention *supply*, the word *demand* is sure to follow, and the discussion of money is no exception. Understanding the supply of money is an essential building block in understanding how monetary policy affects the economy, because understanding the supply of money suggests the factors that influences the quantity of money in the economy. Not surprisingly, another essential part of monetary theory is the demand for money.

After discussing the quantity theory of money and its link to the demand for money, we delve more deeply into the factors that determine the demand for money. A central question in monetary theory is whether or to what extent the quantity of money demanded is affected by changes in interest rates. Because this issue is crucial to how we view money's effects on aggregate economic activity, we will focus on the role of interest rates in the demand for money.

QUANTITY THEORY OF MONEY

Developed by the classical economists in the nineteenth and early twentieth centuries, the quantity theory of money explains how the nominal value of aggregate income is determined. Because the theory also tells us how much money is held for a given amount of aggregate income, it is a theory of the demand for money. The most important feature of this theory is that it suggests that interest rates have no effect on the demand for money.

Velocity of Money and Equation of Exchange

The clearest exposition of the classical quantity theory approach is found in the work of the American economist Irving Fisher, in his influential book *The Purchasing Power of*

Money, published in 1911. Fisher wanted to examine the link between the total quantity of money M (the money supply) and the total amount of spending on final goods and services produced in the economy $P \times Y$, where P is the price level and Y is aggregate output (income). (Total spending $P \times Y$ is also thought of as aggregate nominal income for the economy or as nominal GDP.) The concept that provides the link between M and $P \times Y$ is called the **velocity of money** (often abbreviated to *velocity*), the average number of times per year (turnover) that a dollar is spent in buying the total amount of goods and services produced in the economy. Velocity V is defined more precisely as total spending $P \times Y$ divided by the quantity of money M:

$$V = \frac{P \times Y}{M} \tag{1}$$

If, for example, nominal GDP ($P \times Y$) in a year is $10 trillion and the quantity of money (M) is $2 trillion, we can calculate velocity as follows:

$$V = \frac{\$10 \text{ trillion}}{\$2 \text{ trillion}} = 5$$

The value of 5 for velocity means that the average dollar bill is spent five times in purchasing final goods and services in the economy.

By multiplying both sides of Equation 1 by M, we obtain the **equation of exchange**, which relates nominal income to the quantity of money and velocity:

$$M \times V = P \times Y \tag{2}$$

The equation of exchange thus states that the quantity of money multiplied by the number of times this money is spent in a given year must equal nominal income (the total nominal amount spent on goods and services in that year).[1]

As it stands, Equation 2 is nothing more than an identity—a relationship that is true by definition. It does not tell us, for instance, that when the money supply M changes, nominal income ($P \times Y$) changes in the same direction; a rise in M, for example, might be offset by a fall in V, leaving $M \times V$ (and therefore $P \times Y$) unchanged. To convert the equation of exchange (an *identity*) into a *theory* of how nominal income is determined, we must first understand the factors that determine velocity.

Determinants of Velocity Irving Fisher reasoned that velocity is determined by the institutions within an economy that affect the ways in which individuals conduct transactions. If people use charge accounts and credit cards to conduct their transactions, as they often do today, and consequently use money less often when making purchases, less money is required to conduct the transactions generated by nominal income

[1]Fisher actually first formulated the equation of exchange in terms of the nominal value of transactions in the economy PT:

$$MV_T = PT$$

where P = average price per transaction
T = number of transactions conducted in a year
$V_T = PT/M$ = transactions velocity of money

Because the nominal value of transactions T is difficult to measure, the quantity theory has been formulated in terms of aggregate output Y as follows: T is assumed to be proportional to Y so that $T = vY$, where v is a constant of proportionality. Substituting vY for T in Fisher's equation of exchange yields $MV_T = vPY$, which can be written as Equation 2 in the text, in which $V = V_T/v$.

(M falls relative to $P \times Y$), and so velocity $(P \times Y)/M$ increases. Conversely, if it is more convenient for purchases to be paid for with cash, checks, or debit cards (all of which are money), more money is used to conduct the transactions generated by the same level of nominal income, and so velocity falls. Fisher took the view that the institutional and technological features of the economy would affect velocity only slowly over time, so velocity would normally be reasonably constant in the short run.

Demand for Money Fisher's quantity theory can also be interpreted in terms of the **demand for money**, the quantity of money that people want to hold.

Because the quantity theory of money tells us how much money is held for a given amount of nominal spending, it is, in fact, a theory of the demand for money. To illustrate, let's first divide both sides of the equation of exchange (Equation 2) by V to yield the following:

$$M = \frac{1}{V} \times PY$$

When the money market is in equilibrium, money supply equals money demand, so we can replace M in the equation by M^d. In addition, since velocity is assumed to be constant in the quantity theory of money, we can replace $1/V$ with a constant k. Substituting k for $1/V$ and M^d for M, we can rewrite the equation as

$$M^d = k \times PY \tag{3}$$

Equation 3 tells us that because k is constant, the level of transactions generated by a fixed level of nominal income PY determines the quantity of money M^d that people will demand. Therefore, Fisher's theory suggests that the demand for money is purely a function of income, and interest rates have no effect on the demand for money.[2]

From the Equation of Exchange to the Quantity Theory of Money

Fisher's view that velocity is fairly constant in the short run, so that $V = \overline{V}$ transforms the equation of exchange into the **quantity theory of money**, which states that nominal income (spending) is determined solely by movements in the quantity of money M.

$$P \times Y = M \times \overline{V} \tag{4}$$

The quantity theory equation above indicates that when the quantity of money M doubles, $M \times \overline{V}$ doubles, and so must $P \times Y$, the value of nominal income. To illustrate, let's assume that velocity is 5, nominal income (GDP) is initially \$10 trillion, and the money supply is \$2 trillion. If the money supply doubles to \$4 trillion, the quantity theory of money suggests that nominal income will double to \$20 trillion ($= 5 \times$ \$4 trillion).

[2]While Fisher was developing his quantity theory approach to the demand for money, a group of classical economists in Cambridge, England, led by Alfred Marshall and A. C. Pigou, came to similar conclusions, although via slightly different reasoning. They derived Equation 3 by recognizing that two properties of money motivate people to hold it: its utility as a medium of exchange, and its value as a store of wealth.

Quantity Theory and the Price Level

Because the classical economists (including Fisher) thought that wages and prices were completely flexible, they believed that the level of aggregate output Y produced in the economy during normal times would remain at the full-employment level. Hence Y in the equation of exchange could be treated as reasonably constant in the short run and thus could be assigned a fixed value of $\overline{Y}$ in Equation 4. Dividing both sides of Equation 4 by $\overline{Y}$, we can write the price level as follows:

$$P = \frac{M \times \overline{V}}{\overline{Y}} \tag{5}$$

The quantity theory of money as represented by Equation 5 implies that if M doubles, P must also double in the short run, because $\overline{V}$ and $\overline{Y}$ are constant. In our example, if aggregate output is \$10 trillion, velocity is 5, and the money supply is \$2 trillion, then the price level equals 1.0.

$$P = \frac{\$2 \text{ trillion} \times 5}{\$10 \text{ trillion}} = \frac{\$10 \text{ trillion}}{\$10 \text{ trillion}} = 1.0$$

When the money supply doubles to \$4 trillion, the price level must also double, to 2.0, because

$$P = \frac{\$4 \text{ trillion} \times 5}{\$10 \text{ trillion}} = \frac{\$20 \text{ trillion}}{\$10 \text{ trillion}} = 2.0$$

Classical economists relied on the quantity theory of money to explain movements in the price level. In their view, ***changes in the quantity of money lead to proportional changes in the price level.***

Quantity Theory and Inflation

We now transform the quantity theory of money into a theory of inflation. You might recall from high school the mathematical fact that the percentage change (%Δ) of a product of two variables is approximately equal to the sum of the percentage changes of the individual variables. In other words,

$$\begin{aligned}\text{Percentage Change in } (x \times y) = {} & (\text{Percentage Change in } x) \\ & + (\text{Percentage Change in } y)\end{aligned}$$

Using this mathematical fact, we can rewrite the equation of exchange as follows:

$$\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$$

Subtracting $\%\Delta Y$ from both sides of the preceding equation, and recognizing that the inflation rate π is equal to the growth rate of the price level $\%\Delta P$, we can write:

$$\pi = \%\Delta P = \%\Delta M + \%\Delta V - \%\Delta Y$$

Since we assume velocity is constant, its growth rate is zero, and so the quantity theory of money is also a theory of inflation:

$$\pi = \%\Delta M - \%\Delta Y \tag{6}$$

Because the percentage change in a variable at an annual rate is the same as the growth rate of that variable, Equation 6 can be stated in words as follows: ***the quantity theory of inflation indicates that the inflation rate equals the growth rate of the money supply minus the growth rate of aggregate output.*** For example, if the aggregate output is growing at 3% per year and the growth rate of money is 5%, then inflation is 2% (= 5% − 3%). If the Federal Reserve increases the money growth rate to 10%, then the quantity theory of inflation given by Equation 6 indicates that the inflation rate will rise to 7% (= 10% − 3%).

APPLICATION Testing the Quantity Theory of Money

Now that we have fully outlined the quantity theory of money, let's put it to the test with actual data over the long and short runs.

The Quantity Theory of Money in the Long Run The quantity theory of money provides a long-run theory of inflation because it is based on the assumption that wages and prices are flexible. Panel (a) of Figure 1 plots ten-year averages of U.S. inflation rates against the ten-year average rate of U.S. money growth (M2) from 1870 through 2013. Because the growth rate of aggregate output Y over ten-year periods does not vary very much, Equation 6 indicates that the ten-year inflation rate should be the ten-year money growth rate minus a constant (the rate of aggregate output growth). Thus a strong positive relationship should exist between inflation and money growth rates—and this relationship is borne out in panel (a). Decades with higher growth rates of the U.S. money supply typically see higher average inflation rates.

Does the quantity theory also explain differing long-run inflation rates across countries? It certainly does. Panel (b) of Figure 1 plots the average inflation rate over the ten-year period from 2003 to 2013 against the ten-year money growth rate for several countries. Note that countries with high money growth rates, such as Turkey, Ukraine, and Zambia, tend to have higher inflation rates.

The Quantity Theory of Money in the Short Run Does the quantity theory of money provide a good explanation of short-run inflation fluctuations as well? Figure 2 provides evidence of the link between money growth and inflation in the short run by plotting the annual U.S. inflation rate from 1965 to 2014 against the annual money (M2) growth rate from two years before. (The money growth rate lags by two years to allow for the time it takes for changes in money growth to affect inflation.) The relationship between inflation and money growth on an annual basis is not strong at all. There were many years—such as 1963–1967, 1985–1986, 2003–2005, 2010–2011, and 2013–2014—in which money growth was high but inflation was low. Indeed, it is hard to see any positive correlation at all between money growth and inflation in Figure 2.

The conclusion from that data given in Figure 2 is that ***the quantity theory of money is a good theory of inflation in the long run but not in the short run.*** We could also say that ***Milton Friedman's statement that "inflation is always and everywhere a monetary phenomenon" (mentioned in Chapter 1) is accurate in the long run, but is not supported by the data for the short run.*** This insight tells us that the classical assumption that wages and prices are completely flexible may not apply in the case of short-run fluctuations in inflation and aggregate output. For this reason, we relax this assumption in the following chapters of the book when we develop models of short-run inflation and output fluctuations. ◆

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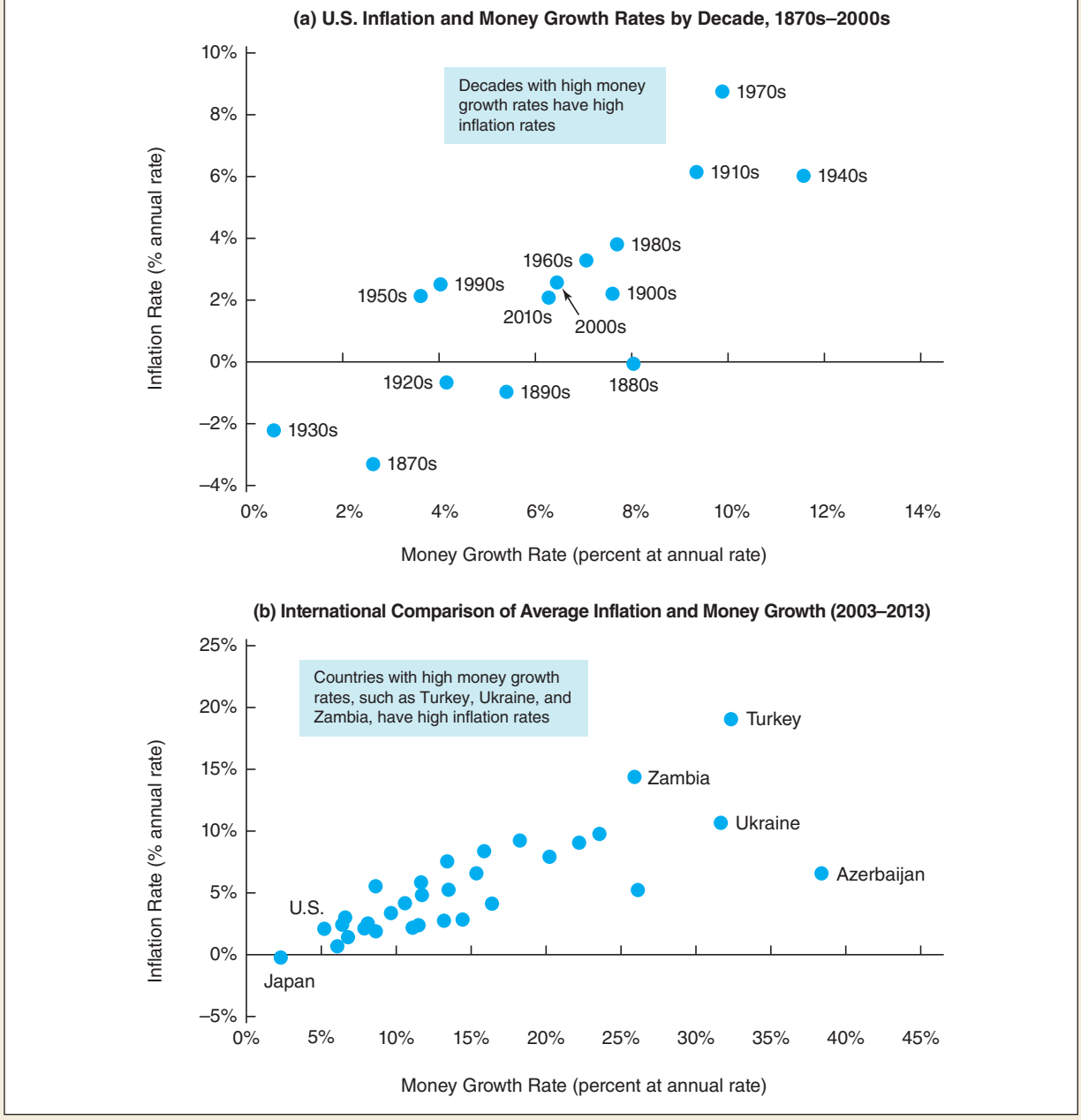

FIGURE 1 **Relationship Between Inflation and Money Growth**

In panel (a), decades with higher money growth rates (the 1910s, the 1940s, and the 1970s) typically have a higher average inflation rate. This relationship also holds in panel (b), where we examine the ten-year inflation and money growth rates from 2003–2013 for various countries.

Sources: For panel (a), Milton Friedman and Anna Schwartz, *Monetary Trends in the United States and the United Kingdom: Their Relation to Income, Prices, and Interest Rates, 1867–1975;* Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/. For panel (b), International Financial Statistics. International Monetary Fund, http://www.imfstatistics.org/imf/.

MyEconLab Mini-lecture MyEconLab Real-time data

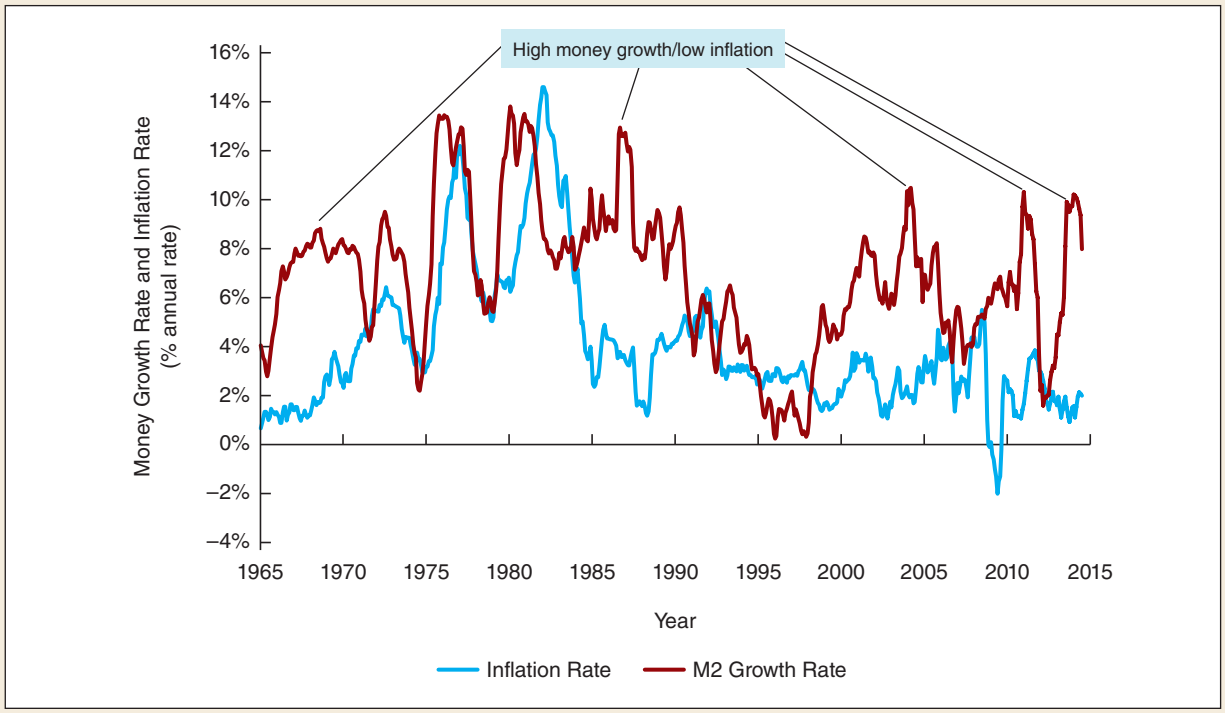

FIGURE 2 **Annual U.S. Inflation and Money Growth Rates, 1965–2013**

Plots of the annual U.S. inflation rate against the annual money (M2) growth rate from two years earlier (to allow for lag effects from money growth to inflation) do not support a short-run link between inflation and money growth. There were many years (1963–1967, 1983–1985, 2001–2002, 2008–2009, and 2011–2012) in which money growth was high yet inflation was low.

Sources: Federal Reserve Bank of St. Louis, FRED database: http://research.stlouisfed.org/fred2/.

BUDGET DEFICITS AND INFLATION

Budget deficits can be an important source of inflationary monetary policy. To see why this is the case, we need to look at the ways in which a government finances its budget deficits.

Government Budget Constraint

Because the government has to pay its bills just as we do, it has a budget constraint. We can pay for our spending in two ways: we can raise revenue (by working), or we can borrow. The government also enjoys these two options: it can raise revenue by levying taxes, or it can go into debt by issuing government bonds. Unlike us, however, it has a third option: The government can create money and use it to pay for the goods and services it buys.

The methods used to finance government spending are described by an expression called the **government budget constraint**, which states the following: The government budget deficit *DEF*, which equals the excess of government spending *G* over tax revenue *T*, must equal the sum of the change in the monetary base ΔMB and the change in government bonds held by the public ΔB. Algebraically, this expression can be written as follows:

$$DEF = G - T = \Delta MB + \Delta B \tag{7}$$

To see what the government budget constraint means in practice, let's look at the case in which the only government purchase is a $100 million supercomputer. If the government convinces the electorate that such a computer is worth paying for, it will probably be able to raise the $100 million in taxes to pay for it, and the budget deficit will equal zero. According to the government budget constraint, no issue of money or bonds is needed to pay for the computer because the budget is balanced. If taxpayers think the supercomputer is too expensive and refuse to pay taxes to sponsor its purchase, the budget constraint indicates that the government must pay for the computer by selling $100 million of new bonds to the public or by, in effect, printing $100 million of currency. In either case, the budget constraint is satisfied. The $100 million deficit is balanced by the change in the stock of government bonds held by the public (ΔB = $100 million) or by the change in the monetary base (ΔMB = $100 million).

The government budget constraint thus reveals two important facts: ***If the government deficit is financed by an increase in bond holdings by the public, there is no effect on the monetary base and hence no effect on the money supply. But if the deficit is not financed by increased bond holdings by the public, both the monetary base and the money supply increase.***

There are several ways to understand why a deficit leads to an increase in the monetary base when the public's bond holdings do not increase. The simplest case is the case in which a government's treasury has the legal right to issue currency to finance its deficit. Financing the deficit is then very straightforward: The government just pays for the spending that is in excess of its tax revenues by issuing new currency. Because this increase in currency adds directly to the monetary base, the monetary base rises, and the money supply rises with it through the process of multiple deposit creation described in Chapter 15.

In the United States, however, and in many other countries, the government does not have the right to issue currency to pay for its bills. In this case, the government must finance its deficit by first issuing bonds to the public. If these bonds do not actually end up in the hands of the public, however, the only alternative is for the central bank to purchase them. To keep the newly-issued government bonds from ending up in the hands of the public, the central bank must conduct an open market purchase, which, as we saw in Chapter 15, leads to an increase in the monetary base and in the money supply. This method of financing government spending is called **monetizing the debt** because, as indicated by the two-step process just described, government debt issued to finance government spending has been removed from the hands of the public and has been replaced by high-powered money. This method of financing is somewhat inaccurately referred to as **printing money** because high-powered money (the monetary base) is created in the process. The use of the word *printing* is misleading because no new currency is actually printed; instead, the monetary base increases when the central bank conducts open market purchases, just as it would increase if more currency were put into circulation.

We thus see that a budget deficit can lead to an increase in the money supply if it is financed by the creation of high-powered money. However, because the quantity theory of money explains inflation only in the long run, in order to produce inflation, the budget deficit must be *persistent*—that is, it must last for a substantial period of time. This leads us to the following conclusion: ***The financing of a persistent deficit by means of money creation will lead to sustained inflation.***

Hyperinflation

The analysis here can be used to explain **hyperinflations**, periods of extremely high inflation of more than 50% per month. Many economies—both poor and developed—have experienced hyperinflation over the past century, but the United States has been spared such turmoil. One of the most extreme examples of hyperinflation throughout world history occurred in Zimbabwe in the 2000s, and it is discussed in the application that follows.

APPLICATION The Zimbabwean Hyperinflation

We now use our analysis of the quantity theory of money to explain the Zimbabwean hyperinflation that started in the early 2000s.

After the government expropriation of farms in 2000, which were redistributed to supporters of Robert Mugabe, the president of the country, Zimbabwean agricultural output plummeted, and, along with it, tax revenue. As a result, the government's expenditures now massively exceeded revenues. The government could have obtained revenues to cover its expenditures by raising taxes, but given the depressed state of the economy, generating revenue in this way was both hard to do and would have been politically unpopular. Alternatively, the government could have tried to finance its expenditure by borrowing from the public, but given the public's distrust of the government, this was not an option. There was only one route left: the printing press. The government could pay for its expenditures by simply printing more currency (increasing the money supply) and using it to make payments to individuals and businesses. This is exactly what the Zimbabwean government did, and the money supply began to increase rapidly.

As predicted by the quantity theory, the surge in the money supply led to a rapidly rising price level. In February 2007, the Reserve Bank of Zimbabwe, the central bank, outlawed price increases on many commodities. Although this tactic has been tried before by governments in countries experiencing hyperinflations, it has never worked: Criminalizing inflation cannot stop inflation when the central bank keeps on printing money. In March 2007, the inflation rate hit a record of over 1,500%. By 2008, Zimbabwe's official inflation rate was officially over 2 million percent (but unofficially over 10 million percent). In July 2008, the Zimbabwean central bank issued a new $100 billion bank note and shortly later issued a $100 trillion dollar bill, the highest denomination dollar note on record. That's a lot of zeros, but don't be too impressed. Although holding one of these bills made you a trillionaire, such a bill could not even buy you a bottle of beer. Zimbabwean currency became worth less than toilet paper.

In 2009, the Zimbabwean government allowed the use of foreign currencies like the U.S. dollar for all transactions, but the damage had already been done. The hyperinflation wreaked havoc on the economy, and an extremely poor country became even poorer. ◆

KEYNESIAN THEORIES OF MONEY DEMAND

In his famous 1936 book *The General Theory of Employment, Interest and Money*, John Maynard Keynes abandoned the quantity theory view that velocity is a constant and developed a theory of money demand that emphasized the importance of interest rates. In his theory of the demand for money, which he called the **liquidity preference theory**, Keynes presented three motives behind the demand for money: the transactions motive, the precautionary motive, and the speculative motive.

Transactions Motive

In the quantity theory approach, individuals are assumed to hold money because it is a medium of exchange that can be used to carry out everyday transactions. Keynes initially accepted the quantity theory view that the transactions component is proportional to income. Later, he and other economists recognized that new methods of payment, referred to as **payment technology**, could also affect the demand for money. For example, credit cards enable consumers to make even very small purchases without needing to hold money. Electronic payments that can be made from investors' brokerage accounts also reduce money demand. In Keynes's view, as payment technology advanced, the demand for money would be likely to decline relative to income.

Precautionary Motive

Keynes also recognized that people hold money as a cushion against unexpected opportunities. Suppose you have been thinking about buying a new Wii entertainment system and now see that it is on sale at 25% off. If you are holding money as a precaution for just such an occurrence, you can immediately buy it. Keynes argued that the precautionary money balances people would want to hold would also be proportional to income.

Speculative Motive

Keynes also believed that people choose to hold money as a store of wealth, which he called the *speculative motive*. Because the definition of money in Keynes's analysis includes currency (which earns no interest) and checking account deposits (which typically earn little interest), he assumed that money earns no interest and hence its opportunity cost relative to holding other assets, such as bonds, is the nominal interest rate on bonds, i. As the interest rate i rises, the opportunity cost of money rises (it becomes more costly to hold money relative to bonds), and the quantity of money demanded falls.

Putting the Three Motives Together

In combining the three motives for holding money balances into a demand-for-money equation, Keynes was careful to distinguish between nominal quantities and real quantities. Money is valued in terms of what it can buy. If, for example, all prices in the economy doubled (the price level doubled), the same nominal quantity of money would be able to buy only half as many goods. Keynes thus reasoned that people want to hold a certain amount of **real money balances** (the quantity of money in real terms). By combining the three motives for holding money balances into a demand for

real money balances, Keynes formulated what is called the liquidity preference function, which is written as follows:

$$\frac{M^d}{P} = \underset{-}{L}(i, \underset{+}{Y}) \tag{8}$$

Equation 8 states that the demand for real money balances is negatively related to the nominal interest rate and is positively related with real income.

Later Keynesian economists, such as Nobel Prize winner James Tobin, expanded the analysis and showed that interest rates play a more important role in money demand than even Keynes supposed. These economists demonstrated that even the transactions and precautionary demands for money would be negatively related to the interest rate.[3]

An important implication of Keynesian theories of money demand is that velocity is not a constant but will fluctuate with changes in interest rates. To illustrate, we write the liquidity preference function as follows:

$$\frac{P}{M^d} = \frac{1}{L(i,Y)}$$

Multiplying both sides of this equation by Y and recognizing that we can replace M^d by M (because they must be equal in money market equilibrium), we can solve for velocity:

$$V = \frac{PY}{M} = \frac{Y}{L(i,Y)} \tag{9}$$

We know that the demand for money is negatively related to interest rates; when i goes up, $L(i,Y)$ declines, and therefore velocity rises. Because interest rates undergo substantial fluctuations, Keynesian theories of the demand for money indicate that velocity undergoes substantial fluctuations as well. Thus Keynesian theories cast doubt on the classical quantity theory view that nominal income is determined primarily by movements in the quantity of money.

PORTFOLIO THEORIES OF MONEY DEMAND

Related to Keynes's analysis of the demand for money are so-called portfolio theories of money demand, in which people decide how much of an asset such as money they want to hold as part of their overall portfolio of assets.[4]

[3]Three famous papers that elaborated on Keynes's approach to the demand for money are as follows: William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," *Quarterly Journal of Economics* 66 (1952): 545–556; James Tobin, "The Interest Elasticity of the Transactions Demand for Cash," *Review of Economics and Statistics* 38 (1956): 241–247; and James Tobin, "Liquidity Preference as Behavior Towards Risk," *Review of Economic Studies* 25 (1958): 65–86. For further discussion of the models outlined in these papers, see the first appendix to this chapter, which can be found on the Companion Website at http://www.pearsonglobaleditions.com/Mishkin.

[4]This is the approach taken by Milton Friedman in his famous paper, "The Quantity Theory of Money: A Restatement," in *Studies in the Quantity Theory of Money*, ed. Milton Friedman (Chicago: University of Chicago Press, 1956), 3–21.

Theory of Portfolio Choice and Keynesian Liquidity Preference

In Chapter 5, we developed the theory of portfolio choice, which stated that the demand for an asset is positively related to wealth, the expected return on the asset relative to other assets, and relative liquidity, whereas it is negatively related to its risk relative to other assets. This theory of portfolio choice can justify the conclusion from the Keynesian liquidity preference function that the demand for real money balances is positively related to income and negatively related to the nominal interest rate.

Because income and wealth tend to move together, when income is higher, wealth is likely to be as well. Hence, higher income means greater wealth, and the theory of portfolio choice then indicates that the demand for the money assets will rise and the demand for real money balances will be higher.

As interest rates rise, the expected return on money does not change. However, the return on bonds, an alternative asset, goes up. Thus, although the expected *absolute* return on money did not change, money's expected return *relative* to bonds went down. In other words, as the theory of portfolio choice indicates, higher interest rates make money less desirable, and the demand for real money balances falls.

Other Factors That Affect the Demand for Money

The theory of portfolio choice indicates that other factors besides income and the nominal interest rate can affect the demand for money. We look at each of these in turn.

Wealth The theory of portfolio choice posits that as wealth increases, investors have more resources with which to purchase assets, increasing the demand for money. However, when income is held constant, greater wealth has only a small effect on the demand for money. In general, investors will hold only a small amount of money in their investment portfolio, preferring interest-bearing assets with similar risk and liquidity profiles, such as money market mutual funds, that are not included in measures of money such as M1. Currency and checkable deposits are sometimes said to be **dominated assets**, because investors can hold other assets that pay higher returns and yet are perceived to be just as safe.

Risk It's hard to imagine an asset less risky than money. Currency will always be accepted, unless there's a revolution and the new government does not accept the old government's currency. And bank deposits are safe as long as deposit insurance exists. In the theory of portfolio choice, however, risk is always measured relative to another asset. Thus, if the stock market becomes more volatile, money can become less risky relative to stocks and demand for it will increase. In addition, although money is extremely safe on a nominal basis, its real return (the nominal return minus expected inflation) can become highly variable when inflation becomes very variable. Higher variability in the real return of money lowers the demand for money, as people shift into alternative assets known as **inflation hedges**, whose real returns are less affected than that of money when inflation varies. Popular inflation hedges include TIPS (Treasury Inflation Protected Securities), gold, and real estate.

Liquidity of Other Assets In recent years, financial innovation has led to the development of new liquid assets, such as money market mutual funds or home equity lines of credit, that allow households to write checks that are backed by their homes. As these alternative assets become more liquid, the relative liquidity of money falls, and so the demand for money falls as well.

SUMMARY TABLE 1

Factors That Determine the Demand for Money

Variable	Change in Variable	Money Demand Response	Reason
Interest rates	↑	↓	Opportunity cost of money rises
Income	↑	↑	Higher value of transactions
Payment technology	↑	↓	Less need for money in transactions
Wealth	↑	↑	More resources to put into money
Riskiness of other assets	↑	↑	Money relatively less risky and so more desirable
Inflation risk	↑	↓	Money relatively more risky and so less desirable
Liquidity of other assets	↑	↓	Money relatively less liquid and so less desirable

Note: Only increases (↑) in the factors are shown; the effects of decreases in the variables on the exchange rate are the opposite of those indicated in the "Response" column.

Summary

Our analysis of the demand for money using Keynesian and portfolio theories indicates that seven factors affect the demand for money: interest rates, income, payment technology, wealth, riskiness of other assets, inflation risk, and liquidity of other assets. As a study aid, Summary Table 1 indicates the response of money demand to changes in each of these factors and gives a brief synopsis of the reasoning behind each response.

EMPIRICAL EVIDENCE FOR THE DEMAND FOR MONEY

Here we examine the empirical evidence on the two key issues that distinguish different theories of money demand and affect their conclusions about whether the quantity of money is the primary determinant of aggregate spending: Is the demand for money sensitive to changes in interest rates, and is the demand-for-money function stable over time?[5]

Interest Rates and Money Demand

We have established that if interest rates do not affect the demand for money, velocity is more likely to be constant—or at least predictable—and so the quantity

[5]If you are interested in a more detailed discussion of the empirical research on the demand for money, you can find it in a second appendix to this chapter on the Companion Website, http://www.pearsonglobaleditions.com/Mishkin.

theory view that aggregate spending is determined by the quantity of money is more likely to be true. However, the more sensitive to interest rates the demand for money is, the more unpredictable velocity will be, and the less clear the link between the money supply and aggregate spending becomes. Indeed, there exists an extreme case of ultrasensitivity of the demand for money to interest rates, called the **liquidity trap**, in which conventional monetary policy has no direct effect on aggregate spending because a change in the money supply has no effect on interest rates.[6]

The evidence for the interest sensitivity of the demand for money is remarkably consistent. Neither extreme case is supported by the data: In situations in which nominal interest rates have not hit a floor of zero, the demand for money is sensitive to interest rates, and little evidence is present that a liquidity trap has ever existed. However, when nominal interest rates fall to zero, they can go no lower. In this situation, a liquidity trap occurs because the demand for money is now completely flat. Indeed, this is exactly the situation that has occurred in the United States in recent years, which is why the Federal Reserve has had to resort to nonconventional monetary policy.

Stability of Money Demand

If the money demand function, like the one in Equation 8, is unstable and undergoes substantial, unpredictable shifts, as Keynes believed, then velocity is unpredictable, and the quantity of money may not be tightly linked to aggregate spending as it is in the quantity theory. The stability of the money demand function is crucial to whether the Federal Reserve should target interest rates or the money supply. If the money demand function is unstable and so the money supply is not closely linked to aggregate spending, then the level of interest rates set by the Fed will provide more information about the stance of monetary policy than will the money supply.

Until the early 1970s, the evidence strongly supported the stability of the money demand function. However, after 1973, the rapid pace of financial innovation, which changed the items that could be used as money, led to substantial instability in estimated money demand functions. The instability of the money demand function calls into question whether our theories and empirical analyses are adequate. It also has important implications for the conduct of monetary policy, because it casts doubt on the usefulness of the money demand function as a tool for providing guidance to policymakers. In particular, because the money demand function has become unstable, velocity is now harder to predict. Monetary policymakers have found that the money supply does not provide reliable information on the future course of the economy, leading them to think of monetary policy in terms of the setting of interest rates. The instability of money demand has thus led to a downgrading of the focus on money supply in the conduct of monetary policy.

[6]If the demand for money is ultrasensitive to interest rates, a tiny change in interest rates produces a very large change in the quantity of money demanded. Hence, in this case, the demand for money would be completely flat in the supply and demand diagrams of Chapter 5. Therefore, a change in the money supply that shifts the money supply curve to the right or left causes it to intersect the flat money demand curve at the same unchanged interest rate.

SUMMARY

1. The quantity theory of money as expressed by the equation of exchange, $M \times V = P \times Y$, indicates that nominal spending is determined solely by movements in the quantity of money. The quantity theory indicates that (1) changes in the quantity of money lead to proportional changes in the price level, because $P = (M \times \overline{V})/\overline{Y}$, and (2) the inflation rate is the growth rate of the money supply minus the growth rate of aggregate output—that is, $\pi = \%\Delta M - \%\Delta Y$. These implications of the quantity theory are borne out by the data in the long run, but not in the short run.
2. The government budget constraint indicates that a deficit must be financed by either money creation or by the issuance of government bonds. That is, $DEF = G - T = \Delta MB + \Delta B$. Combining this fact with the quantity theory indicates that financing a persistent deficit by money creation will lead to sustained inflation. This analysis helps explain hyperinflations, in which inflation and money growth rise to extremely high levels because of massive budget deficits.
3. John Maynard Keynes suggested three motives for holding money: the transactions motive, the precautionary motive, and the speculative motive. His resulting liquidity preference theory views the transactions and precautionary components of money demand as proportional to income. However, the speculative component of money demand is viewed as sensitive to interest rates as well as to expectations about the future movements of interest rates. This theory, then, implies that velocity is unstable and cannot be treated as a constant.
4. Portfolio theories of money demand indicate that the demand for money is determined not only by interest rates, income, and payment technology, as in the Keynesian analysis, but also by wealth, riskiness of other assets, inflation risk, and liquidity of other assets.
5. Two main conclusions can be reached from the research on the demand for money: The demand for money is sensitive to interest rates, but little evidence exists that it is or ever has been ultrasensitive (liquidity trap). Since 1973, money demand has been found to be unstable, with the most likely source of the instability being the rapid pace of financial innovation. Because the money demand function is found to be both unstable and sensitive to interest rates, velocity cannot be viewed as constant and is not easily predicted. These conclusions have led to a downgrading of the focus on money supply and a greater emphasis on interest rates in the conduct of monetary policy.

KEY TERMS

demand for money, p. 528
dominated assets, p. 537
equation of exchange, p. 527
government budget constraint, p. 533
hyperinflations, p. 534
inflation hedges, p. 537
liquidity preference theory, p. 535
liquidity trap, p. 539
monetary theory, p. 526
monetizing the debt, p. 533
payment technology, p. 535
printing money, p. 533
quantity theory of money, p. 528
real money balances, p. 535
velocity of money, p. 527

QUESTIONS

Select questions are available in MyEconLab *at* http://www.myeconlab.com.

1. How would you expect velocity to typically behave over the course of the business cycle?
2. If velocity and aggregate output are reasonably constant (as the classical economists believed), what will happen to the price level when the money supply increases from $1 trillion to $4 trillion?
3. If credit cards were made illegal by congressional legislation, what would happen to velocity? Explain your answer.
4. "If nominal GDP rises, velocity must rise." Is this statement true, false, or uncertain? Explain your answer.
5. Why would a central bank be concerned about persistent, long-term budget deficits?

6. "Persistent budget deficits always lead to higher inflation." Is this statement true, false, or uncertain? Explain your answer.

7. Suppose a new "payment technology" allows individuals to make payments using U.S. Treasury bonds (i.e., U.S. Treasury bonds are immediately cashed when needed to make a payment, and that balance is transferred to the payee). How do you think this payment technology would affect the transaction components of the demand for money?

8. Some payment technologies require infrastructure (e.g., merchants need to have access to credit card swiping machines). In most developing countries, this infrastructure is either nonexistent or very costly. Everything else being equal, would you expect the transaction component of the demand for money to be greater or smaller in a developing country than in a rich country?

9. What three motives for holding money did Keynes consider in his liquidity preference theory of the demand for real money balances? On the basis of these motives, what variables did he think determined the demand for money?

10. In many countries, people hold money as a cushion against unexpected needs arising from a variety of potential scenarios (e.g., banking crises, natural disasters, health problems, unemployment, etc.) that are not usually covered by insurance markets. Explain the effect of such behavior on the precautionary component of the demand for money.

11. In Keynes's analysis of the speculative demand for money, what will happen to money demand if people suddenly decide that the normal level of the interest rate has fallen? Why?

12. Why is Keynes's analysis of the speculative demand for money important to his view that velocity will undergo substantial fluctuations and thus cannot be treated as constant?

13. According to the portfolio theories of money demand, what are the four factors that determine money demand? What changes in these factors can increase the demand for money?

14. Explain how the following events will affect the demand for money according to the portfolio theories of money demand:

a. The economy experiences a business cycle contraction.

b. Brokerage fees decline, making bond transactions cheaper.

c. The stock market crashes. (*Hint:* Consider both the increase in stock price volatility following a market crash and the decrease in wealth of stockholders.)

15. Suppose a given country experienced low and stable inflation rates for quite some time, but then inflation picked up and over the past decade has been relatively high and quite unpredictable. Explain how this new inflationary environment would affect the demand for money according to portfolio theories of money demand. What would happen if the government decided to issue inflation-protected securities?

16. Consider the portfolio choice theory of money demand. How do you think the demand for money would be affected during a hyperinflation (i.e., monthly inflation rates in excess of 50%)?

17. Both the portfolio choice and Keynes's theories of the demand for money suggest that as the relative expected return on money falls, demand for it will fall. Why does the portfolio choice approach predict that money demand is affected by changes in interest rates? Why did Keynes think that money demand *is* affected by changes in interest rates?

18. Why does the Keynesian view of the demand for money suggest that velocity is unpredictable?

19. What evidence is used to assess the stability of the money demand function? What does the evidence suggest about the stability of money demand, and how has this conclusion affected monetary policymaking?

20. Suppose that a plot of the values of M2 and nominal GDP for a given country over 40 years shows that these two variables are very closely related. In particular, a plot of their ratio (nominal GDP/M2) yields very stable and easy-to-predict values. On the basis of this evidence, would you recommend that the monetary authorities of this country conduct monetary policy by focusing mostly on the money supply rather than on setting interest rates? Explain.

APPLIED PROBLEMS

Select applied problems are available in MyEconLab *at* http://www.myeconlab.com.

21. Suppose the money supply M has been growing at 10% per year, and nominal GDP, PY, has been growing at 20% per year. The data are as follows (in billions of dollars):

	2015	2016	2017
M	100	110	121
PY	1,000	1,200	1,440

Calculate the velocity for each year. At what rate is the velocity growing?

22. Calculate what happens to nominal GDP if velocity remains constant at 4 and the money supply increases from $250 billion to $375 billion.

23. What happens to nominal GDP if the money supply grows by 20% but velocity declines by 30%?

24. If velocity and aggregate output remain constant at 5 and $1,000 billion, respectively, what happens to the price level if the money supply declines from $400 billion to $300 billion?

25. Suppose the liquidity preference function is given by

$$L(i,Y) = \frac{Y}{8} - 1{,}000i$$

Use the money demand equation, along with the following table of values, to calculate the velocity for each period.

	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7
Y (in billions)	12,000	12,500	12,250	12,500	12,800	13,000	13,200
Interest rate	0.05	0.07	0.03	0.05	0.07	0.04	0.06

DATA ANALYSIS PROBLEMS

The Problems update with real-time data in MyEconLab *and are available for practice or instructor assignment.*

1. Go to the St. Louis Federal Reserve FRED database, and find data on the M1 Money Stock (M1SL), M1 Money Velocity (M1V), and Real GDP (GDPC1). Convert the M1SL data series to "quarterly" using the *frequency* setting, and for all three series, use the "Percent Change from Year Ago" setting for *units*.

a. Calculate the average percentage change in real GDP, the M1 money stock, and velocity since 2000:Q1.

b. Based on your answer to part (a), calculate the average inflation rate since 2000 as predicted by the quantity theory of money.

c. Next, find the data on the GDP deflator price index (GDPDEF), download the data using the 'Percent Change from Year Ago' setting, and calculate the average inflation rate since 2000:Q1. Comment on the value relative to your answer in part (b).

2. Go to the St. Louis Federal Reserve FRED database, and find data on the budget deficit (FYFSD), the amount of federal debt held by the public (FYGFDPUN), and the amount of federal debt held by the Federal Reserve (FDHBFRBN). Convert the two "debt held" series to "Annual" using the *frequency* setting. Download all three series into a spreadsheet. Make sure that the rows of data align properly to the correct dates. Note that for the deficit series, a negative number indicates a deficit; multiply the series by −1 so that a deficit is indicated by a positive number. Manipulate the three series so that all data are given in terms of the same units (either millions or billions of dollars). To do this, if a series is in millions and you are converting it to billions, divide the series by 1000. Finally, for each year, convert the two "debt held" series into one "changes in debt holdings by the public and the Federal Reserve" series by calculating, for each year, the difference in bond holdings from the preceding year.

a. Create a scatter plot showing the deficit on the horizontal axis and the change in bond holdings by the public on the vertical axis, using the data from 1980 through the most recent period of data available. Insert a fitted line into the scatter plot, and comment on the relationship between the deficit and the change in public bond holdings.

b. Create a scatter plot showing the deficit on the horizontal axis and the change in bond holdings by the Federal Reserve on the vertical axis, using the data from 1980 through the most recent period of data available. Insert a fitted line into the scatter plot, and comment on the relationship between the deficit and the change in Federal Reserve bond holdings.

c. Based on your results in parts (a) and (b), comment on how, if at all, the monetizing of the debt is exhibited in the data. Do you think the relationship between the deficit and the change in bond holdings of the Federal Reserve has changed since 2008? Why or why not?

WEB EXERCISES

1. John Maynard Keynes is among the most well-known economic theorists. Go to http://en.wikipedia.org/wiki/John_Maynard_Keynes and write a one-page summary of his life and contributions.

WEB REFERENCES

http://www.usagold.com/gildedopinion/puplava/20020614.html

A summary of how various factors affect the velocity of money.

WEB APPENDICES

Please visit the Companion Website at http://www.pearsonglobaleditions.com/Mishkin to read the Web appendices to Chapter 20.

Appendix 1: **The Baumol-Tobin and the Tobin Mean-Variance Models of the Demand for Money**

Appendix 2: **Empirical Evidence for the Demand for Money**