In this appendix, we develop a framework for evaluating empirical evidence and then use this framework to understand why deep disagreements about the importance of money to economic fluctuations still exist.

FRAMEWORK FOR EVALUATING EMPIRICAL EVIDENCE

First we need to recognize that there are two basic types of empirical evidence in economics and other scientific disciplines: Structural model evidence examines whether one variable affects another by using data to build a model that explains the channels through which this variable affects the other; reduced-form evidence examines whether one variable has an effect on another simply by looking directly at the relationship between the two variables.

Suppose you are interested in learning whether drinking coffee leads to heart attacks. Structural model evidence would involve developing a model that analyzes data on how coffee is metabolized by the human body, how the metabolized product affects the operation of the heart, and whether these effects on the heart lead to heart attacks. Reduced-form evidence would involve looking directly at whether coffee drinkers tend to experience heart attacks more frequently than non–coffee drinkers.

How you look at the evidence—whether you focus on structural model evidence or reduced-form evidence—can lead you to different conclusions. This is particularly true regarding the debate on the importance of money to economic fluctuations.

Structural Model Evidence

The components analysis of aggregate demand discussed in Chapter 23 is very specific about the channels through which the money supply affects economic activity (called the transmission mechanisms of monetary policy). This approach examines the effect of changes in the money supply on economic activity by building a structural model, a description of how the economy operates that uses a collection of equations to describe the behavior of firms and consumers in many sectors of the economy. These equations then show the channels through which monetary and fiscal policy affect aggregate output and spending. A structural model might include behavioral equations that describe the workings of monetary policy. The following schematic diagram is an example of such a model:

\[ M \rightarrow i \rightarrow I \rightarrow Y \]
The model describes the transmission mechanism of monetary policy as follows: The change in the money supply \( M \) affects interest rates \( i \), which in turn affect investment spending \( I \), which in turn affects aggregate output or aggregate spending \( Y \). Structural model evidence for the relationship between \( M \) and \( Y \) evaluates empirical evidence on the specific channels of monetary influence, such as the link between interest rates and investment spending.

**Reduced-Form Evidence**

The quantity theory approach to aggregate demand does not describe the specific ways in which the money supply affects aggregate spending. Instead, it suggests that the effect of money on economic activity should be examined by looking at whether movements in \( Y \) are tightly linked to (have a high correlation with) movements in \( M \). Reduced-form evidence analyzes the effect of changes in \( M \) on \( Y \) as if the economy were a black box whose inner workings cannot be seen. The reduced-form way of looking at the evidence can be represented by the following schematic diagram, in which the economy is drawn as a black box with a question mark:

![Diagram](M \rightarrow ? \rightarrow Y)

**Advantages and Disadvantages of Structural Model Evidence**

The structural model approach has the advantage of giving us a detailed understanding of how the economy works. If the structure is correct—if it includes all the transmission mechanisms and channels through which monetary policy can affect economic activity—then the structural model approach has three major advantages over the reduced-form approach.

1. Because we can evaluate each transmission mechanism separately to see whether it is plausible, we can gather more evidence on whether monetary policy has an important effect on economic activity. If we find that monetary policy significantly affects economic activity, for example, we will have more confidence that changes in monetary policy actually cause the changes in economic activity; that is, we will have more confidence on the direction of causation between \( M \) and \( Y \).

2. Knowing how changes in monetary policy affect economic activity may help us predict the effect of changes in \( M \) on \( Y \) more accurately. For example, expansions in the money supply might be found to be less effective when interest rates are low. Then, when interest rates are higher, we would be able to predict that an expansion in the money supply would have a larger impact on \( Y \) than would otherwise be the case.

3. By knowing how the economy operates, we may be able to predict how institutional changes in the economy might affect the link between changes in \( M \) and \( Y \). For instance, before 1980, when Regulation Q was still in effect, restrictions on interest payments on savings deposits meant that the average consumer would not earn more on savings when interest rates rose. Since the termination of Regulation Q, the average consumer now earns more on savings when interest rates rise. If we understand how changes in the interest rates paid on savings affect consumer spending, we might be able to say that a change in monetary policy, which affects interest rates, will have a different effect today than it would have had before 1980. Because of the rapid pace of financial innovation, the advantage of being able to predict how institutional changes affect the link between changes in \( M \) and \( Y \) may be more important now than it was in the past.
These three advantages of the structural model approach suggest that it is better than the reduced-form approach if we know the correct structure of the model. Put another way, structural model evidence is only as good as the structural model it is based on; it is the best choice only if all the transmission mechanisms are fully understood. This is a big if, as failing to include one or two relevant transmission mechanisms of monetary policy in the structural model might result in a serious misjudgment about the impact of changes in $M$ on $Y$.

A structural model may unintentionally ignore the transmission mechanisms of monetary policy that are most important. For example, if the most important monetary transmission mechanisms involve consumer spending rather than investment spending, a structural model (such as the $M \Rightarrow i \Rightarrow I \Rightarrow Y$ model we used earlier) that focuses on investment spending as its primary monetary transmission mechanism may underestimate the effects of an increase in the money supply on economic activity.

**Advantages and Disadvantages of Reduced-Form Evidence**

The main advantage of reduced-form evidence over structural model evidence is that the reduced-form model does not impose preconceived restrictions on the mechanisms through which monetary policy affects the economy. If we are not sure that all of the monetary transmission mechanisms have been included in our structural model, we may be more likely to miss the full effect of changes in $M$ on $Y$. By using a reduced-form model, we are likely to notice that movements in $Y$ correlate highly with movements in $M$ and thus we are more likely to spot the full effect of changes in $M$ on $Y$.

The most notable objection to reduced-form evidence is that it can be misleading; for example, reduced-form evidence may suggest that changes in $M$ cause changes in $Y$ when that is not the case. A basic principle applicable to all scientific disciplines, including economics, states that correlation does not necessarily imply causation. The fact that two variables move together doesn't necessarily mean that a change in one variable causes the change in the other.

For example, suppose you notice that wherever criminal activity abounds, more police patrol the street. Should you conclude from this evidence that police patrols cause criminal activity, leading you to recommend pulling the police off the street in order to lower the crime rate? The answer is clearly no. Police patrols do not cause criminal activity; rather, criminal activity leads to police patrols. This type of situation is called reverse causation, and it can produce misleading conclusions, especially when interpreting correlations (see the FYI box, “The Perils of Reverse Causation: A Russian Folk Tale”).

Reverse causation can be a problem when examining the link between changes in money and changes in aggregate output or spending. Our discussion in Web Appendix 2 to Chapter 17 of the conduct of monetary policy suggested that when the Federal Reserve sets an interest-rate target, higher output may lead to a higher money supply. If most of the correlation between $M$ and $Y$ occurs because of the Fed’s interest-rate target, the Fed will not be able to control aggregate output by controlling the money supply because it is actually changes in $Y$ that are causing changes in $M$, rather than the other way around.

Another facet of the correlation–causation question is that an outside factor, as yet unknown, could be the driving force behind the linked movements of two variables. Coffee drinking might be associated with heart attacks not because coffee drinking causes heart attacks but because coffee drinkers tend to be people who are under a lot of stress, and stress causes heart attacks. Getting people to stop drinking coffee, then, would not lower the incidence of heart attacks. Similarly, if there is an unknown
outside factor that causes $M$ and $Y$ to move together, better control of $M$ will not improve control of $Y$ (see the FYI box, “The Perils of Ignoring an Outside Driving Factor: How to Lose a Presidential Election”).

**Conclusions**

No clear-cut case can be made that reduced-form evidence is preferable to structural model evidence, or vice versa. The structural model approach offers a more detailed understanding of how the economy works. If a structure of the model is correct, it predicts the effects of monetary policy more accurately than the reduced-form model does, it allows for predictions of the effects of monetary policy when institutions change, and it provides more confidence regarding the direction of causation between $M$ and $Y$. If the structure of the model is not accurately specified because it leaves out important transmission mechanisms of monetary policy, the model can produce very misleading information.

The reduced-form approach does not impose restrictions on the ways in which monetary policy might affect the economy and thus may make it easier to identify the

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**FYI**  The Perils of Ignoring an Outside Driving Factor: How to Lose a Presidential Election

Ever since Muncie, Indiana, was dubbed “Middletown” in two sociology studies over half a century ago, it has produced a vote for president that has closely mirrored the national vote; that is, in every election, there has been a very high correlation between Muncie’s vote and the national vote. Noticing this correlation, a political adviser to a presidential candidate recommends that the candidate’s election will be assured if all the candidate’s campaign funds are spent in Muncie. Should the presidential candidate promote or fire this adviser? Why?

It is very unlikely that the vote in a small town like Muncie drives the vote in a national election. Rather, it is more likely that national preferences are a third driving factor that determines the vote in Muncie and also determines the vote in the national election. Changing voter preferences in Muncie may break the long-standing correlation between that town’s vote and national preferences, but it will have almost no impact on the election itself. Spending all of the candidate’s campaign money in this town will therefore be a waste of money. The presidential candidate should definitely fire the adviser.
full effect of changes in $M$ on $Y$. However, reduced-form evidence is subject to the problem of reverse causation. For example, reduced-form evidence may indicate that changes in money cause changes in output when, in fact, the reverse is true. A high correlation between money and output will be misleading because the evidence will wrongly suggest that controlling the money supply will help control the level of output. Also, the reduced-form approach does not take into account the possibility that an outside factor is driving the joint changes in output and money.

Armed with the framework we have just outlined, we can now evaluate the empirical debate about the importance of monetary policy in economic fluctuations.

**APPLICATION**

**The Debate Over the Importance of Monetary Policy to Economic Fluctuations**

We can apply our understanding of the advantages and disadvantages of the structural and reduced-form evidence models to a debate that has been going on for more than 70 years: How important is monetary policy to economic fluctuations? The followers of Milton Friedman, known as monetarists, tended to focus on reduced-form evidence and found that changes in the money supply are very important to economic fluctuations. Early followers of John Maynard Keynes, known as Keynesians, focused on structural model evidence based on the components approach to the determination of aggregate demand, and this approach found that monetary policy does not play a large role in economic fluctuations. We now use the analysis we developed in the previous section to evaluate the evidence that monetarists and Keynesians brought to bear on the importance of monetary policy.

**Early Keynesian Evidence on the Importance of Money**

Although Keynes proposed his theory for analyzing aggregate economic activity in 1936, his views reached their peak popularity among economists in the 1950s and early 1960s, by which time the majority of economists had accepted Keynes’s framework. Although most Keynesians currently believe that monetary policy has important effects on economic activity, the early Keynesians of the 1950s and early 1960s characteristically held the view that monetary policy does not matter at all to movements in aggregate output and hence to the business cycle.

The early Keynesians’ belief in the ineffectiveness of monetary policy stemmed from three pieces of structural model evidence:

1. During the Great Depression, interest rates on U.S. Treasury securities fell to extremely low levels; the three-month Treasury bill rate, for example, declined to below 1%. Early Keynesians believed that monetary policy affected aggregate demand solely through its effect on nominal interest rates, which in turn affected investment spending. They believed that low interest rates during the Great Depression indicated that monetary policy was easy (expansionary) because these low rates encouraged investment spending and so could not have played a contractionary role during this period. Because monetary policy could not explain the worst economic contraction in U.S. history, early Keynesians concluded that changes in the money supply have no effect on aggregate output—in other words, money doesn’t matter.
2. Early empirical studies found no link between movements in nominal interest rates and investment spending. Because early Keynesians saw this link as the channel through which changes in the money supply affected aggregate demand, their conclusion that the link was weak led them to conclude that changes in the money supply have no effect on aggregate output.

3. Surveys of business people revealed that their decisions on how much to invest in new physical capital were not influenced by market interest rates. This evidence further confirmed the weak link between interest rates and investment spending, strengthening the conclusion that money doesn’t matter. As a result, most economists paid only scant attention to monetary policy before the mid-1960s.

Objections to Early Keynesian Evidence

While Keynesian economics was reaching its ascendancy in the 1950s and 1960s, a small group of economists at the University of Chicago, led by Milton Friedman, adopted the then-unfashionable view that money does matter to aggregate demand. Friedman and his disciples, who later became known as monetarists, objected to the early Keynesian interpretation of the evidence on the grounds that the structural model used by the early Keynesians was severely flawed. Because structural model evidence is only as good as the model it is based on, the monetarist critique of this evidence had to be taken seriously.

In 1963, Friedman and Anna Schwartz, a researcher at the National Bureau of Economic Research, published their classic monetary history of the United States, which showed that, contrary to early Keynesian beliefs, monetary policy during the Great Depression was not easy; indeed, it had never been more contractionary.¹ Friedman and Schwartz documented the massive bank failures of this period and the resulting decline in the money supply—the largest ever experienced in the United States. Hence monetary policy could explain the worst economic contraction in U.S. history, and the Great Depression could not be characterized as a period that demonstrates the ineffectiveness of monetary policy.

A Keynesian could still counter Friedman and Schwartz’s argument that monetary policy was contractionary during the Great Depression by citing the low level of interest rates. But were these interest rates really so low? Referring to Figure 1 in Chapter 6, you will note that although interest rates on U.S. Treasury securities and high-grade corporate bonds were low during the Great Depression, interest rates on lower-grade bonds, such as Baa corporate bonds, rose to unprecedentedly high levels during the sharpest part of the contraction phase (1930–1933). By the standard of these lower-grade bonds, then, interest rates were high and monetary policy was tight.

There is a moral to this story. Although much aggregate economic analysis proceeds as though there is only one interest rate, we must always be aware that there are many interest rates, and these different rates may tell different stories. During normal times, most interest rates move in tandem, and so lumping them all together and then making conclusions from one representative interest rate will not be misleading. But this is not always the case. Unusual periods (like the Great Depression) during which interest rates on different securities begin to diverge do occur. This is exactly the kind of situation in which a structural model (like that of the early Keynesians) that looks only at the interest rates on a low-risk security such as a U.S. Treasury bill or bond can be very misleading.

There is a second, potentially more important reason why the early Keynesian structural model’s focus on nominal interest rates provided a misleading picture of the tightness of monetary policy during the Great Depression. In a period of deflation, when the price level is declining, low nominal interest rates do not necessarily indicate that the cost of borrowing is low and that monetary policy is easy—in fact, the cost of borrowing might be quite high. If, for example, the public expects the price level to decline at a 10% rate, then even if nominal interest rates are at zero, the real cost of borrowing might be as high as 10%. (Recall from Chapter 4 that the real interest rate equals the nominal interest rate, zero in this case, minus the expected rate of inflation, $-10\%$ in this case, so that the real interest rate equals $0 - (-10\%) = 10\%$.)

You can see in Figure 1 that this is exactly what happened during the Great Depression: Real interest rates on U.S. Treasury bills were far higher during the 1931–1933 contraction phase of the depression than they were throughout the next 40 years. Thus movements of real interest rates indicate that, contrary to the early Keynesians’ beliefs, monetary policy was extremely tight during the Great Depression. Because the importance of monetary policy during this depressed period could no longer be ruled out, most economists were forced to rethink their position regarding whether money matters.

Monetarists also objected to the early Keynesian structural model’s view that a weak link between nominal interest rates and investment spending indicates that investment spending is unaffected by monetary policy. A weak link between nominal interest rates and investment spending does not rule out a strong link between real interest rates and investment spending. As depicted in Figure 1, nominal interest rates are often a very misleading indicator of real interest rates—not only during the Great Depression, but in later periods as well. Because real interest rates more accurately reflect the true cost of borrowing, they should be more relevant to investment decisions than nominal interest rates. Accordingly, the two pieces of early Keynesian evidence indicating that nominal interest rates have little effect on investment spending do not rule out a strong effect of changes in the money supply on investment spending and hence on aggregate demand.

Monetarists also asserted that interest-rate effects on investment spending might be only one of many channels through which monetary policy affects aggregate demand. Monetary policy then might have a major impact on aggregate demand even if interest-rate effects on investment spending were small, as was suggested by the early Keynesians.

**Early Monetarist Evidence on the Importance of Money**

In the early 1960s, Milton Friedman and his followers published a series of studies based on reduced-form evidence that promoted the case for a strong effect of money on economic activity. In general, reduced-form evidence can be broken down into three categories: *timing evidence*, which looks at whether movements in one variable typically

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occur before movements in another; statistical evidence, in which formal statistical tests are performed on the correlation between the movements of one variable and those of another; and historical evidence, which examines specific past episodes to see whether movements in one variable appear to have caused movements in another. Let’s look at the monetarist evidence that falls into each of these three categories.

**Timing Evidence**  Monetarist timing evidence reveals how the rate of money supply growth moves relative to the business cycle. The evidence on this relationship was first presented by Friedman and Schwartz in a famous paper published in 1963. Friedman and Schwartz found that in every business cycle they studied, spanning nearly a century, the money growth rate always declined before output did. On average, the peak in the rate of money growth occurred 16 months before the peak in the level of output. However, this lead time varied, ranging from a few months to more than two years.

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On the basis of this evidence, Friedman and Schwartz concluded that money growth causes business cycle fluctuations, but its effects on the business cycle operate with “long and variable lags.”

Timing evidence is based on the philosophical principle first stated in Latin as post hoc, ergo propter hoc, which means that if one event occurs after another, the second event must have been caused by the first. This principle is valid only if we are sure that the first event is an exogenous event, an event resulting from an independent action that could not possibly have been caused by the event following it or by some outside factor that might affect both events. If the first event is exogenous, then we can be more confident that the first event has indeed caused the second event.

An example of an exogenous event is a controlled experiment. A chemist working in a tightly controlled environment mixes two chemicals; suddenly, her lab blows up and she with it. We can be absolutely sure that the cause of the chemist’s demise was the act of mixing the two chemicals together. The principle of post hoc, ergo propter hoc is extremely useful in scientific experimentation.

Unfortunately, economics does not enjoy the precision of hard sciences like physics and chemistry. Often, we cannot be sure that an economic event, such as a decline in the rate of money growth, is an exogenous event—the event could have been caused by an outside factor or even by the event it is supposedly causing. When a second event (such as a decline in output) typically follows the first event (a decline in money growth), we cannot conclude with certainty that one has caused the other. Timing evidence is clearly of a reduced-form nature because it looks directly at the relationship between the movements of two variables. Money growth might lead output, or both might be driven by an outside factor.

Because timing evidence is of a reduced-form nature, there is also the possibility of reverse causation, in which output growth causes money growth. How can this reverse causation occur if, according to the evidence, money growth leads output? This can happen in several ways, but we will deal with just one example.4

Suppose we are living in a hypothetical economy with a very regular business cycle movement, plotted in panel (a) of Figure 2, that is four years long (four years from peak to peak). Let’s assume that in our hypothetical economy, there is reverse causation from output to the money supply, and movements in the money supply and output are perfectly correlated; that is, the money supply $M$ and output $Y$ move up and down together. Then the peaks and troughs of the $M$ and $Y$ series in panels (a) and (b) will occur at exactly the same time. Therefore, no lead or lag relationship exists between them.

Now let’s construct the rate of money supply growth from the money supply series in panel (b). This is shown in panel (c). What is the growth rate of the money supply at its peaks in years 1 and 5? At these points, the money supply is not growing at all; its rate of growth is zero. Similarly, at the trough in year 3, the growth rate is zero. While the money supply is declining from its peak in year 1 to its trough in year 3, it has a negative growth rate, and its decline is fastest sometime between years 1 and 3 (year 2). Translating to panel (c), the rate of money growth is below zero from years 1 to 3, with its most negative value reached at year 2. By similar reasoning, we can see

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4A famous article by James Tobin, “Money and Income: Post Hoc, Ergo Propter Hoc,” Quarterly Journal of Economics 84 (1970): 301–317, describes an economic system in which changes in aggregate output cause changes in the growth rate of money but changes in the growth rate of money have no effect on output. Tobin shows that such a system with reverse causation could yield timing evidence similar to that found by Friedman and Schwartz.
that the growth rate of money is positive in years 0 to 1 and 3 to 5, with the highest values reached in years 0 and 4. When we connect all of these points together, we get the money growth series in panel (c), in which the peaks are at years 0 and 4, with a trough in year 2.
Now let’s look at the relationship between the money growth series in panel (c) and the level of output in panel (a). As you can see, the peaks and troughs of the money growth series consistently occur exactly one year before the peaks and troughs of the output series. We conclude that in our hypothetical economy, the rate of money growth always decreases one year before output does. This evidence does not imply, however, that money growth drives output. In fact, by our original assumption, we know that this economy is one in which causation actually runs from output to the level of money supply, and that there is no lead or lag relationship between the two variables. Only by our judicious choice of the growth rate of the money supply as our variable, rather than its level, have we found a leading relationship.

This example shows how easy it is to misinterpret timing relationships. Furthermore, by searching for what we hope to find, we might focus on the wrong variable (such as a growth rate rather than a level), which will lead us to form an inaccurate conclusion. Timing evidence can be a dangerous tool for determining causation.

Stated even more forcefully, “one person’s lead is another person’s lag.” For example, you could just as easily interpret the relationship between money growth and output in Figure 2 as implying that the money growth rate lags output by three years—after all, the peaks in the money growth series occur three years after the peaks in the output series. In short, you could infer that output leads money growth.

We have seen that timing evidence is extremely hard to interpret. Unless we can be sure that changes in the leading variable are exogenous events, we cannot be sure that the movements in the leading variable are actually causing movements in the following variable. And it is all too easy to find what we seek when looking for timing evidence. Perhaps the best way of describing this danger is to say that “timing evidence may be in the eyes of the beholder.”

**Statistical Evidence** Monetarist statistical evidence examined the correlation between money and aggregate output or aggregate spending through formal statistical tests. Again in 1963 (obviously a vintage year for the monetarists), Milton Friedman and David Meiselman published a paper that proposed the following test of a monetarist model against a model used by early Keynesians. In the Keynesian components framework, investment and government spending were sources of fluctuations in aggregate demand, so Friedman and Meiselman constructed a “Keynesian” autonomous expenditure variable \(A\) equal to investment spending plus government spending. They characterized the Keynesian components model as stating that \(A\) should be highly correlated with aggregate spending \(Y\), whereas the money supply \(M\) should not. In the monetarist model, the money supply was the source of fluctuations in aggregate spending, and \(M\) should be highly correlated with \(Y\), whereas \(A\) should not.

A logical way to determine the better model would be to ascertain which variable was more highly correlated with \(Y\): \(M\) or \(A\). When Friedman and Meiselman conducted this test for many different periods of U.S. data, they discovered that the monetarist model won! They concluded that monetarist analysis gives a more accurate description than Keynesian analysis of how aggregate spending is determined.

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6 Friedman and Meiselman did not actually run their tests using the \(Y\) variable because they felt that this would give an unfair advantage to the Keynesian model, because \(A\) was included in \(Y\). Instead, they subtracted \(A\) from \(Y\) and tested for the correlation of \(Y - A\) with \(M\) or \(A\).
Several objections were raised against the Friedman–Meiselman evidence:

1. The standard criticisms of this reduced-form evidence were the ones we have already discussed: Reverse causation could be present, or an outside factor might be driving both series.

2. The test might not be fair because the Keynesian components model is characterized too simplistically. Keynesian structural models commonly include hundreds of equations. The one-equation “Keynesian” model that Friedman and Meiselman tested may not have adequately captured the effects of autonomous expenditure. Furthermore, Keynesian models usually include the effects of other variables. By ignoring these other variables, the model may have overestimated the effects of monetary policy and underestimated the effects of autonomous expenditure.

3. The Friedman–Meiselman measure of autonomous expenditure A might have been constructed poorly, preventing the “Keynesian” model from performing well. For example, orders for military hardware affect aggregate demand before they appear as spending in the autonomous expenditure variable that Friedman and Meiselman used. A more careful construction of the autonomous expenditure variable would have taken into account the placing of orders for military hardware. When the autonomous expenditure variable was constructed more carefully by critics of the Friedman–Meiselman study, they found that the results were reversed: The “Keynesian” model won.\(^7\) A later study on the appropriateness of various ways of determining autonomous expenditure did not give a clear-cut victory to either the “Keynesian” or the monetarist model.\(^8\)

**Historical Evidence** The monetarist historical evidence found in Friedman and Schwartz’s *A Monetary History* has been very influential in gaining support for the monetarist position. We have already seen that the book was extremely important as a criticism of early Keynesian thinking, showing as it did that the Great Depression was not a period of easy monetary policy and that the depression could be attributed to the sharp decline in the money supply caused by bank panics from 1930 to 1933. In addition, the book documented in great detail evidence that the growth rate of money leads business cycles, because the evidence suggests that this rate declines before every recession. This timing evidence is, of course, subject to all of the criticisms raised earlier.

The historical evidence contains one feature, however, that makes it different from the other monetarist evidence we have discussed so far. Throughout U.S. history, several episodes have occurred in which changes in the money supply appear to have been exogenous events. These episodes were similar to controlled experiments, so the *post hoc, ergo propter hoc* principle is far more likely to be valid: If during these episodes the decline in the growth rate of the money supply was followed soon after by a decline in output, we can state that the evidence is much stronger that money growth is the driving force behind the business cycle.

One of the best examples of such an episode is the increase in reserve requirements that occurred from 1936 to 1937 (discussed in Web Appendix 2 to Chapter 17), which led to a sharp decline in the money supply and its rate of growth. The increase in


reserve requirements was implemented because the Federal Reserve wanted to improve its control of monetary policy; it was not implemented in response to economic conditions. We can thus rule out reverse causation from output to the money supply. In addition, it is hard to think of an outside factor that could have driven the Fed to increase reserve requirements and that also could have directly affected output. Therefore, the decline in the money supply during this episode can probably be classified accurately as an exogenous event with the characteristics of a controlled experiment. Soon after this experiment, the very severe recession of 1937–1938 occurred. We can conclude with confidence that during this episode, the change in the money supply caused by the Fed’s increase in reserve requirements was indeed the source of the business cycle contraction that followed.

A Monetary History also documented other historical episodes, such as the bank panics of 1907 and other years, in which the decline in money growth appears to have been an exogenous event. The fact that recessions have frequently followed apparently exogenous declines in money growth is very strong evidence that changes in the growth rate of the money supply do have an impact on aggregate output. Christina and David Romer, both of the University of California, Berkeley, used more sophisticated statistical techniques to apply the historical approach to more recent data and found that monetary policy shifts have had an important impact on the aggregate economy.9

Overview of the Monetarist Evidence  Where does this discussion of the monetarist evidence leave us? We have seen that because of reverse causation and outside-factor possibilities, some serious doubts remain about the accuracy of the conclusions that can be drawn from timing and statistical evidence alone. However, some of the historical evidence, in which exogenous declines in money growth are followed by business cycle contractions, provides stronger support for the monetarist position. When historical evidence is combined with timing and statistical evidence, the conclusion that monetary policy does indeed matter seems warranted.

As you can imagine, the economics profession was shaken by the disclosure of the monetarist evidence, because up until that time most economists believed that money does not matter at all. Monetarists demonstrated that this early Keynesian position was probably wrong, and their research won them a lot of converts. Recognizing the fallacy of the idea that money does not matter does not necessarily mean that we must accept the position that money is *all* that matters. Many Keynesian economists shifted their views toward the monetarist position, but not all the way. Instead, they adopted an intermediate position: They allowed that money, fiscal policy, net exports, and “animal spirits” all contributed to fluctuations in aggregate demand. The result has been a convergence of the differing views on the importance of monetary policy to economic activity. However, proponents of a new theory of aggregate fluctuations, called real business cycle theory, are critical of the monetarist reduced-form evidence that money is important to business cycle fluctuations because they believe there is reverse causation from the business cycle to money (see the FYI box, “Real Business Cycle Theory and the Debate on Money and Economic Activity").

Some newer entrants to the debate over the relationship between money and economic activity are advocates of *real business cycle theory*, which states that real shocks to tastes and technology (rather than monetary shocks) are the driving forces behind business cycles. Proponents of this theory are critical of the monetarist view that money matters to business cycles because they believe that the correlation of output with money reflects reverse causation; that is, the business cycle drives money, rather than the other way around. An important piece of evidence they offer to support their reverse causation argument is that almost none of the correlation between money and output comes from the monetary base, which is controlled by the monetary authorities.* Instead, the money–output correlation stems from other sources of money supply movements that, as we saw in Chapter 15, are affected by the actions of banks and depositors and are more likely to be influenced by the business cycle.