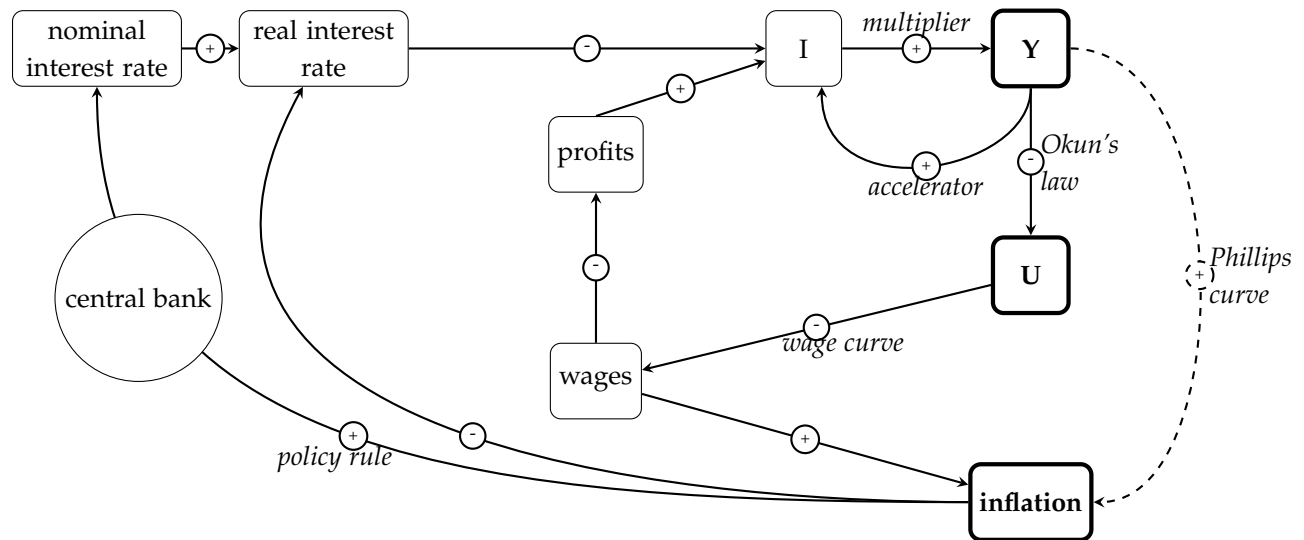


The figure below shows some of the links between macroeconomic aggregates that are most important for business cycles in a closed economy.



I is investment.

Y is output (usually measured by GDP).

U is unemployment.

A + in the line between two aggregates means there is a positive relationship between them, that is, a rise in the first will cause a rise in the second, and a fall in the first will cause a fall in the second.

A - in the line between two aggregates means there is a negative relationship, that is, a rise in the first will cause a fall in the second, and a fall in the first will cause a rise in the second.

Much of macroeconomics consists of establishing cause-and-effect relationships between various economic aggregates. It can be helpful to think about these relationships using a flowchart.

When we think there is some regular pattern linking two observable quantities, we say there is a *functional relationship* between them. Much of macroeconomics consists of describing and explaining the most important functional relationships between *economic aggregates* like output, inflation, and unemployment. It's important to distinguish statements about functional relationships among variables, from statements about the variables themselves. When we say that one variable tends to rise when another falls, that does not mean that either one actually is rising or falling. Rather, it describes a pattern we can observe over an extended period in which the variables sometimes rise and sometimes fall.

With most functional relationships, we have an idea about which variable is cause and which is effect. In the case of output and unem-

ployment, we think that unemployed people get jobs because more stuff is being purchased and produced. The *direction of causality* is from output to unemployment. It can be helpful to present these causal links in a flowchart, so we can see at a glance how a change in one aggregate affects others, both directly or indirectly. You often find flowchart diagrams similar to the one here in the documentation of the macroeconomic models used by professional forecasters in government and business.

In this class, we will look at a number of flowcharts presenting the causal links between various macroeconomic aggregates. In these flowcharts, the *targets* of macroeconomic policy are in bold to help focus attention on the outcomes that normally guide policy decisions. where an increase in one aggregate causes an increase in another, there is a small plus sign (+) in the line. Where an increase in one variable causes a decrease in another, there is a small minus sign (-) next to the line. This kind of *negative relationship* between two variables also means that a decrease in the first one, causes an increase in the second.

Many causal relationships have names. Here we see that the link from investment to output is called the *multiplier*, the link from output to investment is called the *accelerator*, and the link from output to unemployment is called *Okun's law*.¹ The *Phillips curve* is often used to refer to the link from output to inflation, which may take place via unemployment and wages, or by some other channel. Some of these links, like Okun's law, can be *quantified* – that is, we can make a definite prediction, based on statistical evidence, for how much one variable will change in response to a given change in the other. For other links, we have an idea of the direction of the resulting change but we can't put an exact number on it.

¹ Strictly speaking, the accelerator describes a link from the growth of output to investment, but we can ignore that detail here.

When a change in one variable produces changes in other variables that induce further change in the first variable, that is called a feedback loop. Feedback loops may be negative or positive.

When we see a loop on a flowchart, that means that a change in one variable will affect other variables in a way that results in a further change in the first variable. This is called a *feedback loop*. Positive feedbacks are cases when an increase in a variable leads, via other variables, to a further increase; negative feedbacks are cases where an initial increase leads, via other variables, to a decrease back toward the original variable. Another way of describing this is that when there is a positive feedback, a change in the variable is *amplified*, while when there is a negative feedback, a change in the variable is

dampened.

A fundamental challenge in thinking about the economy is that, in reality, everything is connected to everything else. But to be able to tell a coherent story or build a usable model, we need to focus on a few relationships and ignore the others. And this task is made harder by the fact that relative strength of the different relationships varies depending on the country and the historical period, and on the length of time we are interested in. So it is never a question of finding the “right” model, but only the best one for a particular purpose.

Business cycles are alternating periods in which output, inflation, and employment rise and fall together.

Business cycles are more or less regular changes that we can observe cross a number of macroeconomic aggregates. A business cycle *expansion* generally involves rising output, falling unemployment, and high and/or rising inflation. A business cycle *recession* involves falling (or more slowly growing) output, rising unemployment, and lower and/or falling inflation or even deflation. Business cycles are generally understood to involve changes in desired spending by households and businesses. They are not the result of changes in the productive capacity of the economy, but rather, of changes – for whatever reason – in people’s willingness to spend money.

Many other factors affect output growth, unemployment and inflation. Not all of the changes in these aggregates are linked to each other. In the case of unemployment, cyclical or demand-deficiency unemployment is linked to output but structural and frictional unemployment are not.

The goal of macroeconomic policy is generally understood to be the smoothing out of business-cycle fluctuations. The idea is to adjust aggregate spending such that output is at potential, unemployment is at the *full employment* level, and inflation is at the *price stability* level. One important question in macroeconomics is whether these three goals are always compatible.

Investment affects output via the multiplier.

When businesses decide to expand, they must purchase new capital equipment, buildings and other structures, and software. These purchases of *capital equipment* are sales for other businesses. As a result, the businesses producing the capital equipment will earn more (increasing capital income), must hire new workers (increasing labor income), and purchase inputs from still other businesses, creating sales for them in turn. The labor and capital income are spent on consumption goods, causing those businesses to earn more, hire

“Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. ... Good economists are scarce because the gift for using ‘vigilant observation’ to choose good models ... appears to be very rare. ”

- John Maynard Keynes

more workers, and increase purchases from still other businesses. As this process works its way through the economy, each dollar of new investment spending may eventually result in several dollars of additional final goods purchases. The ratio between the initial increase in investment spending and the eventual increase in GDP is known as the *multiplier*. The multiplier will be larger when more goods are produced domestically and when people consume a large fraction of additional income, rather than saving it. It will be smaller when imports and/or savings are high.

The multiplier applies to any *autonomous* increase in spending, but for purposes of thinking about business cycles, investment is usually most important.

Investment is influenced by the growth rate of output (via the accelerator), by the profit rate, and by the availability of credit.

In general, a business will expand when its existing capacity cannot produce as much as it could potentially sell; when its business is profitable; and when it can finance the expansion with its own *retained earnings* or with borrowed funds. Unless all three of these conditions are met, a business is unlikely to undertake new investment spending.² For example, a restaurant is unlikely to expand into a new space unless it is regularly filling all the tables in its existing space, *and* its current operations are making money, *and* it can get the funds needed for expansion on reasonable terms.

These influences are represented by the three lines leading to investment ("I") on the flowchart. The link from output ("Y") to investment is called the *accelerator*. Strictly speaking, this is not a link from the level of output, but from the *change* in output. When output is rising rapidly, more businesses are likely to find their existing capacity is insufficient to produce as much as they can sell; expanding will require investment spending. When output is rising more slowly or falling, more businesses are likely to find that they have more capacity than they need, and have no need to invest. Higher profits also make investment more likely, for two reasons. First, when profits are high in general, businesses will see good opportunities to expand, introduce new products, or enter new markets. Second, profits are an important source of finance for investment. A business that can may for expansion out of its own retained earnings does not need to seek a loan. This link is shown by the line from profits to investment.

The third factor influencing investment is the available of credit. Since most businesses cannot finance all their desired investment projects out of their own retained earnings, they have to borrow money from banks or by issuing bonds. When credit is abundant

² Of course many other factors - like the need to compete with rivals, the desire to enter new markets, or the obsolescence of existing assets, also influence investment. But these are more microeconomic factors, having to do with the specific characteristics of specific business or industry. For macroeconomic purposes the three listed here are most important.

and cheap, more investment will be carried out than when it is scarce and expensive. The availability of credit includes many factors in addition to the interest rate – the terms on which loans will be made, the collateral and other conditions demanded, and whether banks are willing to lend at all. But to keep things simple, we often focus on the interest rate alone. In this story, scarce credit means high interest rates, and abundant credit means low interest rates. This is represented as the link from real interest rates to investment. Since high interest rates discourage investment, there is a minus sign in this link. Note that it is *real* interest rates that matter for business. The borrower doesn't care about how many dollars they will have to pay back, but how much that will be relative to their own sales or earnings. If high inflation means that future dollars are worth less than today's, paying back the loan will be easier, so it will be more tempting to carry out investment funded with debt.

Output and employment are linked via Okun's law.

Okun's law says that when output grows rapidly, unemployment will fall, and when output grows more slowly or falls, unemployment will rise. The exact relationship varies between countries, but within countries it seems to be quite stable over time. If we write the change in unemployment as ΔU and the real (inflation-adjusted) growth rate of output as g , then for the US Okun's law is:

$$\Delta U = -0.5(g - 2.5)$$

In other words, the change in unemployment is equal to negative 0.5 times the percentage growth rate minus 2.5. So it takes around 2.5 points of real GDP growth to hold unemployment constant. For example, if GDP grew by 4.5% in one year, we would expect the change in the unemployment rate to be $-0.5(4.5 - 2.5) = -0.5 * 2 = -1$ – we would expect unemployment to fall by one point. On the other hand, if real GDP were to fall by one point, we would expect the change in unemployment to be $-0.5(-1 - 2.5) = -0.5 * -3.5 = 1.75$ – we would expect the unemployment rate to increase by 1.75 point.

Note that this equation doesn't say what the change in the unemployment rate (ΔU) or the growth rate (g) actually are. Rather, it describes a *function* linking the two. It says that *if* growth is high, unemployment is probably falling; and *if* growth is low or negative, unemployment is probably rising. So if you have an idea about what will happen to one of the variables, you can make a good guess about what must happen to the other. The numbers that appear in a function like this are called its *parameters*. In the case of Okun's law, while

the basic form of the law is the same across countries, the parameters vary. In general, the first parameter (-0.5) depends on labor market institutions, while the second depends on the growth rates of the laborforce and labor productivity. In the US, the laborforce grows by roughly 1 percent a year while labor productivity grows at around 1.5 percent, so it takes a total of 2.5 percent additional production just to hold the unemployment rate constant.

Output and inflation are linked via the Phillips curve.

The *Phillips curve* usually refers to the link from output to inflation, which may take place via but it is also often used to mean the link from unemployment to inflation. When the Phillips curve is drawn on a graph, it is drawn with the inflation rate (or price level) on the vertical axis, and either output (GDP) or unemployment on the horizontal axis. If output is on the horizontal axis, the curve slopes upward, to show that inflation tends to rise with output; if unemployment is on the horizontal axis, the curve slopes downward, to show that inflation tends to fall when unemployment rises.³ A steep Phillips curve means that inflation will change a lot in response to a small change in output or unemployment; a flat or shallow Phillips curve means that inflation changes on a little in response to output or unemployment.

Unlike Okun's law, the Phillips curve there does not seem to have stable parameters. How much additional inflation you get for a one point acceleration in GDP growth, or a one point fall in unemployment, depends on the current values of the variables, as well as on the country and historical period we are looking at, and how long a time period we are interested in. Many economists believe that the curve is steeper over long periods. That is, one year of high GDP growth may not raise inflation very much at all, but if the high growth rate is sustained year after year, eventually inflation will rise. Some economists believe that the Phillips curve is vertical in the very long run – that is, there is only one level of unemployment that is consistent with constant inflation. This unique unemployment rate is called the *natural rate of unemployment* or *Non Accelerating Inflation Rate of Unemployment* (NAIRU). In the 1990s, economists and policy-makers put a lot of energy into trying to determine the NAIRU so that central banks could try to hold unemployment at that level. But the concept has become less popular since then – most economists no longer believe that there is one unique level of unemployment at which inflation is stable. But the more general idea of the Phillips curve – that lower unemployment tends to lead to higher inflation, and high unemployment to low inflation or deflation – continues to

³ When the curve was first drawn by New Zealand economist A. W. Phillips in the 1950s, he was looking only at the link from unemployment to nominal wage growth. Today, the link from unemployment to wages is sometimes called the *wage curve*.

be widely accepted.

The multiplier-accelerator cycle is a positive feedback loop between investment and output.

The link from output to investment is called the *accelerator*. Strictly speaking, the accelerator relationship says that the level of investment tends to be determined by the increase in output, as opposed to the level – businesses are likely to expand only when demand for their products increases beyond the level they can meet with their existing capacity. As you can see, there is a positive feedback loop linking investment to output via the multiplier, and output to investment via the accelerator. In this story, a rise in investment spending by businesses increases incomes for their workers, and for other businesses they purchase inputs from. This leads to higher spending, and businesses increase investment to meet the new demand. Higher investment increases incomes in turn. This process continues until something interrupts the increase in investment – perhaps *supply constraints*, perhaps a fall in profitability or a shift toward more pessimistic *expectations* about future demand or profits. But when investment falls, the multiplier means that total spending falls more, leaving other businesses with excess capacity and causing investment to fall still further. This process continues until either new investment drops to zero and cannot fall any further (as happened in the 1930s) or until something intervenes to boost demand – perhaps a shift toward more *expansionary* policy by the central bank. Then investment and output begin to rise again.

This loop was first described by the British economist Roy Harrod in the 1940s, and was the most important theory of business cycles in the 1950s and 1960s. Harrod pointed out that there will be some combination of investment output growth that can remain constant, but if the economy moves away from that stable point, the multiplier-accelerator feedback loop tends to carry it even further away. Harrod described this problem of instability as the *knife edge*. While the multiplier-accelerator feedback loops is not as central in macroeconomic thought, as it once was, it can still be a useful way of thinking about why modern economies tend to go through recurring booms and busts rather than growing steadily.

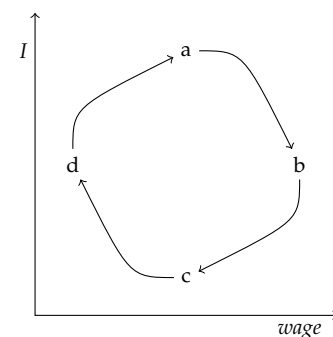
The Goodwin cycle is a negative feedback loop involving investment, employment and profits.

An important factor affecting investment, in addition to credit conditions and demand, is profitability. This is the focus of a story about

business cycles and macroeconomic instability often – but not only – proposed by Marxist economists. In this story, we are interested in the feedback loop from investment, to output, to unemployment, to the distribution between wages and profits, and back to investment. The idea is that a rise in investment leads to higher investment, which in turn brings down unemployment and, by improving workers’ bargaining position, raises wages. Then what? It could be that the change in nominal wages is fully passed on to higher prices, leaving real wages and the wage share unchanged. (This is what happens in the standard textbook model.) But even if faster wage growth is associated with higher inflation, it’s unlikely that *all* wage increases are passed on to higher prices. It seems likely that when low unemployment leads to bigger wage gains, at least some of the higher wages come at the expense of capital owners – in other words, that they increase the share of the total product going to workers and reduce the share going to capital-owners. A lower share of output going to owners normally means a lower profit rate. And if profits fall enough, that will discourage further investment. A fall in investment, in turn, will bring output back down and unemployment back up. Here, we are looking at a negative feedback loop. But that does not guarantee that the system will reach a stable *equilibrium*; instead, it may show repeated cycles.

This type of feedback loop is called a *Goodwin cycle*, after Richard Goodwin. Goodwin cycles are primarily discussed by Marxist economists, since they focus more on the conflict between workers and owners than most other economists do. But there is good reason to think that these type of cycles play an important role in real economies. It is a well-established statistical fact in the US and most other advanced economies that the profit share rises early in expansions but falls in the year or two before the recession begins. And changes in investment spending normally follow changes in profitability.

The logic of a Goodwin cycle is shown in the diagram. Let’s start with an economy at the height of boom, represented in the diagram by a point like *a*. During the boom, high investment leads to high output and low unemployment. Low unemployment causes wages to rise – shown as a move to the right in the diagram. But as wages rise, profits decline, and falling profits eventually cause investment to fall, moving the economy downward in the diagram to a point like *b*. This is the start of a recession. The decline in investment has now led unemployment to rise, weakening workers bargaining position. During the recession, both wages and investment decline, bringing the economy to point *c*. The decline in wages is eventually sufficient to restore profitability, and investment begins to rise again, even while unemployment remains high. Eventually, unemployment falls



Goodwin cycle. High investment leads to low unemployment and rising wages, but rising wages eventually reduce profits so much that investment declines.

enough that wages can again begin to rise – this is point *d*. Finally, during the expansion, both investment and wages are rising, until the economy reaches the peak of the cycle at point *a* once again.

The Wicksell cycle, or “cumulative process,” is a positive feedback loop involving investment, inflation and real interest rates.

Along with profits and demand, business investment may also be influenced by the interest rate. For businesses, what matters is the *real* interest rate, since they are not concerned with the absolute number of dollars they sell but with the the repayment relative to their expected earnings. This creates another potential source of instability, first identified by the Swedish economist Knut Wicksell in the late 19th century. The problem Wicksell saw is that because inflation leads to lower real rates, it may feed on itself rather than dying out.

The key point for Wicksell is that the nominal interest rate is set by the banking system. While the banks may have good reasons for setting a particular rate, there is no reason to think that the rate that maximizing their profits will be the rate consistent with price stability for the economy as whole. Suppose, for instance, that banks decide to reduce the interest rates they charge (presumably in the hopes of attracting more borrowers.) The result will be more borrowing, and more investment. The increased investment will increase total spending in the economy via the multiplier, and the increased spending will sooner or later lead to higher inflation via the Phillips curve. As inflation rises, real rates will fall further, encouraging even more borrowing and investment, leading to more spending and still higher investment, leading to higher inflation and still lower real rates. This positive feedback loop could continue indefinitely.

In Wicksell’s view, the solution to this problem was to have a *central bank* that would adjust interest rates up or down to guarantee price stability. When inflation rises, the central bank should raise nominal rates by even more, so that the real rate goes up, not down.

Wicksell was mostly worried about runaway inflation, but the same positive feedback loop can also operate in reverse: A rise in interest rates leads to a fall in investment, which leads to a fall in output and employment, which leads to lower inflation or deflation, which leads to a further rise in the real interest rate, causing a further fall in investment, and so on. It is widely believed that this negative version of Wicksell’s “cumulative process” played an important role in the Great Depression of the 1930s. Between 1929 and 1933, prices in the US fell by about 7 percent per year. (Price declines were similar in most European countries.) This *deflation* meant that even very low nominal interest rates implied quite high real interest rates. These

high real rates made it difficult for households and businesses to service existing loans, and made new borrowing prohibitively expensive. The result was declining spending, declining incomes, and a wave of bankruptcies and bank failures. According to Irving Fisher – perhaps the leading American economist in the early 20th century – this *debt deflation* process explained the economic collapse of the 1930s.

The macroeconomy may be stabilized by a central bank following an appropriate policy rule.

The possibility of macroeconomic instability has been recognized since at least the mid 19th century.⁴ Many solutions have been proposed to stabilize spending at a level consistent with price stability and full employment. But since the 1980s, the dominant view has been that all that is needed to eliminate macroeconomic instability, is to have a central bank follow an appropriate *policy rule*. While the details vary, the basic idea is that when inflation rises (or more generally, when the economy is “overheating”), the central bank should raise interest rates by enough to bring output back down to sustainable level.

⁴ The first recession in the modern sense is often considered to be the British trade crisis of 1825.

The overwhelming consensus among economists and policy-makers today is that the macroeconomy is not stable. Economists disagree on many questions. But only a tiny minority believe that economic outcomes would stay within acceptable bounds without a central bank actively managing the availability of credit.

While very few economists believe that full employment and price stability are possible without active management of the economy by central banks, there are more economists, especially since 2007, who believe that the tools normally used by central banks are inadequate for this purpose. One concern is that central banks cannot reliably control the terms on which banks lend to the private sector. Another is that interest rates don't have a strong enough effect on business investment. A third concern is that central bank intervention may do more harm than good. This concern is based on the idea, expressed by Milton Friedman among others, is that there are “long and variable lags” in the effects of monetary policy. As a result, by the time the central bank's actions influence the real economy, conditions may have changed so much that the bank may be pushing in the wrong direction. In this view, the negative feedback loop from investment, to output, to inflation, to the interest rate, to investment, produces cycles rather than convergence to equilibrium.

In the US, the Federal Reserve tends to follow a policy rule called the *Taylor rule*, which gives equal weight to divergences of inflation

and of unemployment from their target values. In most other rich countries, central banks follow policy rules that focus exclusively on inflation. But no central bank follows a rule strictly and mechanically; there is always room for *discretion* by the authorities.

Orthodox macroeconomics focuses on one particular causal chain – from interest rates, to investment, to output, to unemployment, to wages, to inflation.

In recent years, macroeconomic policy has been conducted primarily by central banks. By law or in practice, central bankers' top concern in normal times is low and stable inflation. And while central banks have many tools with which to influence the financial system and the larger economy, their primary tool in recent decades has been changes in the short-term interest rate that they more or less directly control. As a result, macroeconomics textbooks have come to focus on one particular causal chain – from interest rates, to investment, to output, to unemployment, to wages, to inflation.

We will be exploring this chain in more detail later, but here is a summary.

1. The central bank takes actions (we'll talk later about what exactly) to change the *policy rate* of interest – in this case, the *Federal funds rate*, the interest rate banks charge each other for very short-term loans.
2. Changes to the Federal funds rate are passed on to other nominal interest rates, including the rates offered to nonfinancial businesses and households. With inflation given, changes in nominal rates are also changes in real rates.
3. Changes in the rate of interest affect businesses' decisions about how much to borrow and invest. When interest rates fall, businesses borrow and invest more; when interest rates rise, they borrow and invest less.
4. Changes to business investment affect the total level of spending in the economy. An additional dollar of investment normally produces more than one additional dollar of total spending. The ratio between the increase in investment and the total resulting increase in GDP is called the *multiplier*.
5. Higher GDP reduces unemployment, as described by Okun's law. Lower GDP, similarly, increases unemployment.
6. Lower unemployment tends to raise wages, as workers have more bargaining power relative to employers. Higher unemployment tends to reduce wages.

7. Changes in wages tend to get passed on to other prices. In the simplest version of this story, businesses simply set their prices as a fixed *markup* over wages. So when wages rise faster, inflation will be higher; when wages rise more slowly, inflation will be lower.

This standard story captures several important facts about the world. First, it is true that there is often a close link between output, unemployment and inflation. *Expansionary* policy tends to raise output and inflation, and reduce unemployment. *Contractionary* policy does the opposite, reducing output and inflation and raising unemployment. Second, the component of output that varies most of the business cycle is investment. Booms and busts usually result from rises and falls in investment spending. Consumption and government spending tend to follow the overall state of the economy; they don't normally drive it. And in the US, net exports are too small to play a central role in the business cycle. (In other countries they are more important.) Third, credit conditions are one of the three main factors affecting business investment. And finally, macroeconomic policy is normally carried out by a central bank trying to make credit more or less available, as measured by the prevailing interest rate.

But while the standard story describes one important piece of the picture, in the real world things are more complicated. First, the central bank does not have perfect control over the actual terms on which businesses and households can borrow. There are many interest rates in the economy, and they do not all move in lockstep. And the interest rate is not the whole story – most businesses and households cannot borrow as much as they want at the prevailing interest rate, so the terms on which credit is available matter as well as its price. Second, monetary policy may work through other channels besides business borrowing. Households also borrow; in fact, mortgage borrowing may be more sensitive to monetary policy than is borrowing for investment. And as we'll see, changes in the policy interest rate also can have important effects on *asset prices* and on the *exchange rate* with other currencies. Third, there are many other factors beside credit conditions that influence flows of spending in the economy. Investment often rises or falls for reasons that have nothing to do with monetary policy.

Nonetheless, it's important to understand the standard story, partly because of the important element of truth in it, and partly because it is how most macroeconomic policymakers, at central banks and elsewhere, talk about their decisions.