Module 3: Monetary Policy and the Real Economy

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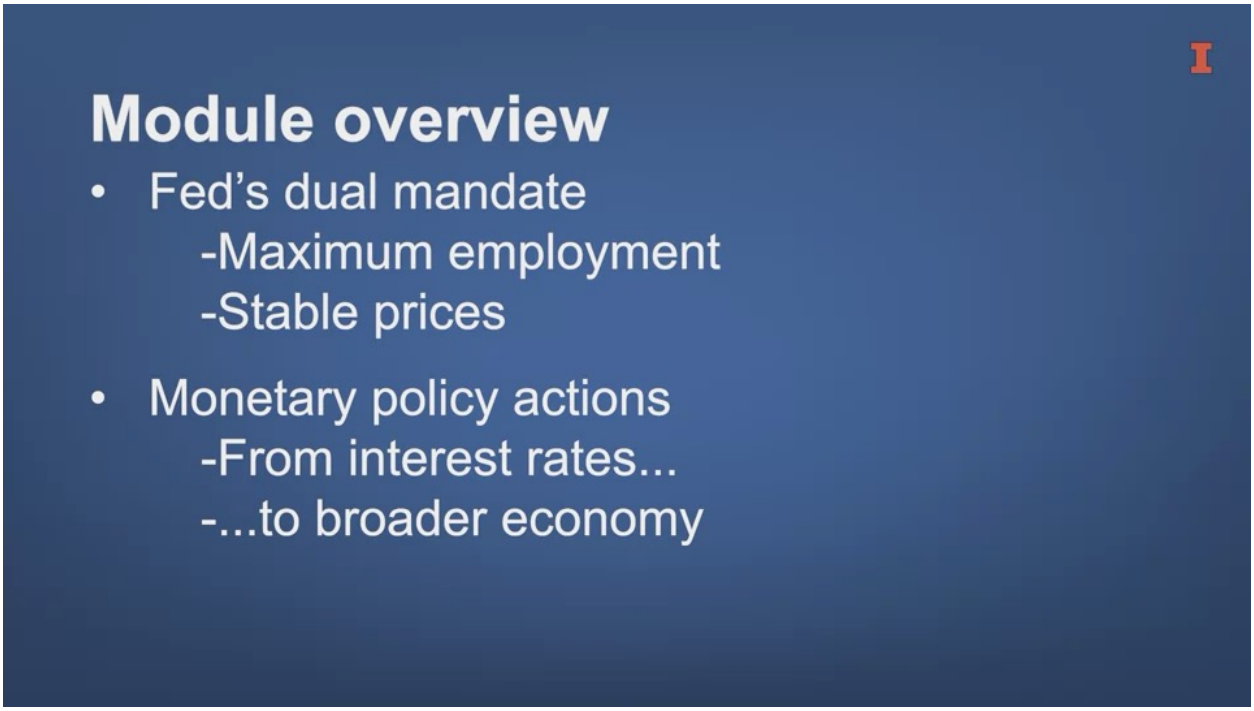
Module 3: Information

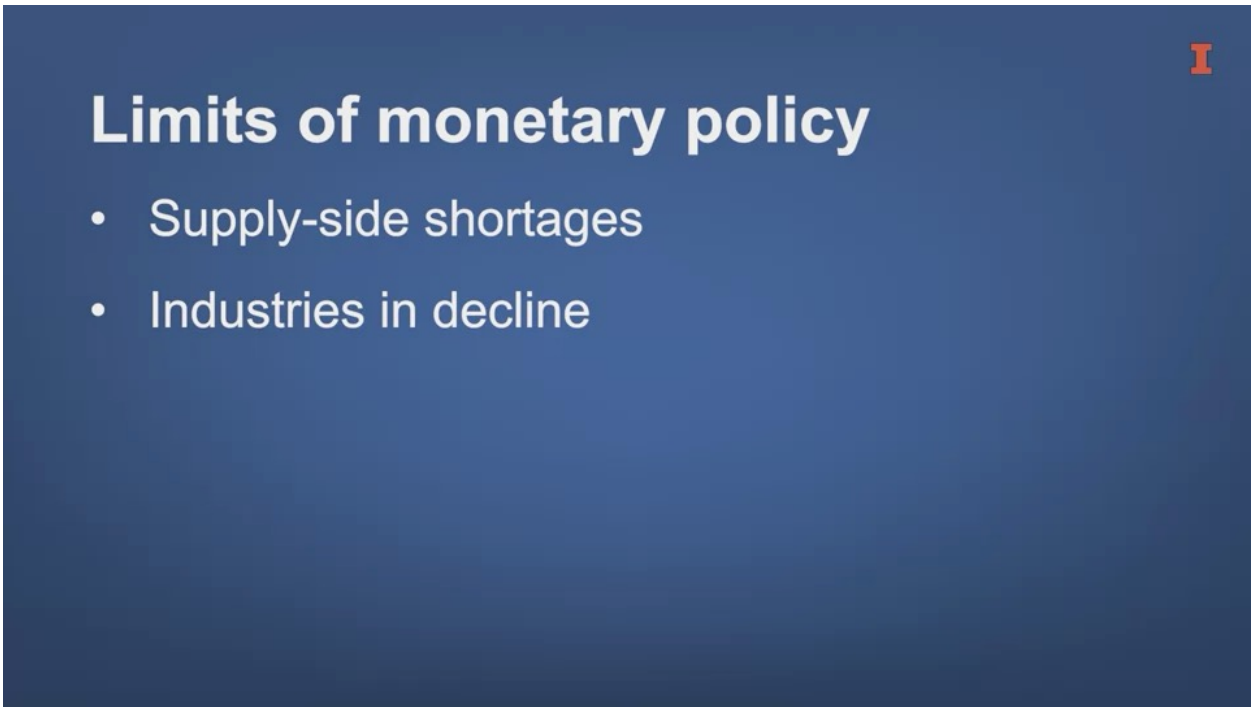
Lesson 3-0.1: Module Overview Lecture



Hello and welcome, I hope you're doing well from wherever it is you're joining us. The purpose of the Federal Reserve is to achieve maximum employment and stable prices. This is called the Fed's dual mandate in an ideal world, the economy would have minimal inflation and everybody would have a job, however, this is not always the case. Okay, but how do the Fed monetary policy actions affect the economy? This is the goal of this module, we will look at connections between monetary policy actions that bring about changes in the most important macroeconomic outcomes.

We will also discuss how these changes happen, we will start with the idea of maximum employment. While the dual mandate is stated in terms of jobs, many central banks, including the Federal Reserve, talk a lot about economic growth. To explain why we will first study the relationship between gross domestic product or GDP and unemployment. We will then see how decreases in the Fed's target interest rate can increase GDP and therefore decrease unemployment. As part of this discussion, we will see what the goal of maximum employment means in the context of the United States.

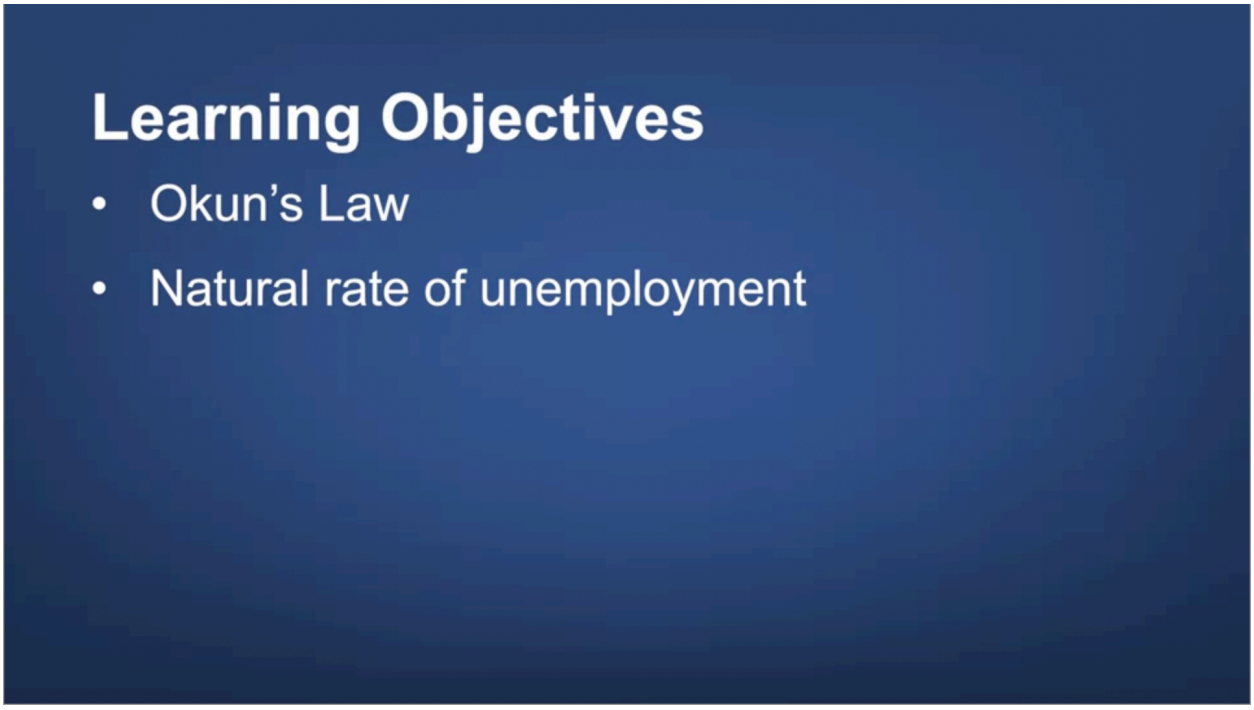
Next we will study the link between unemployment, wages and inflation, we will see that there is a tradeoff between unemployment and inflation. By easing monetary policy a central bank can lower unemployment at least in the short run, but this may come at the cost of higher inflation. This tradeoff between unemployment and inflation is central to decision making at the Federal Reserve. We will see how this trade-off is embedded in the monetary policy rules such as the celebrated Taylor rule. These rules dictate exactly how interest rates should be set depending on the state of the economy. With this tradeoff between inflation and unemployment in mind, we will then study how monetary policy works. That is through which channels to changes in the interest rate affect economic growth and thereby inflation and unemployment. We start with a high level overview that shows you the effects of monetary policy on the economy as a whole. We then drill down on how monetary policy affects credit supply by banks and therefore money supply in the economy. The next lesson discusses how monetary policy affects firms and households which in turn affects investment and consumption decisions. Both consumption and investment are part of the GDP, and these decisions are going to affect unemployment. Monetary policy can mitigate harmful boom and bust in the economic cycle by raising the interest rates during expansions and reducing the interest rate during contractions. This is what Central banks hope to achieve.



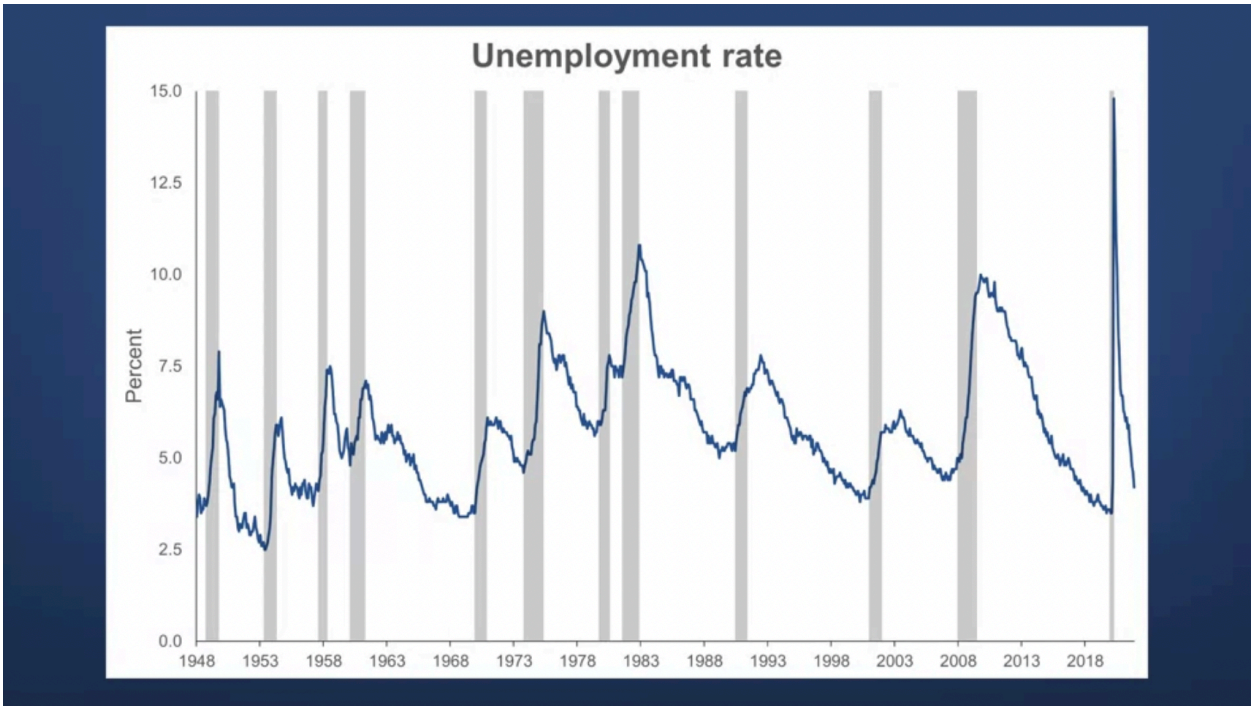
The last two lessons are case studies that illustrates the limits of monetary policy. We will see that monetary policy can do little to offset supply-side shocks such as spikes in oil prices. It cannot do much to support employment in Industries that are in permanent decline due to structural changes in the economic environment. In sum, the previous module discussed which monetary policy tools are available to central banks and how they are affecting the interest rates. In this module, we look at how interest rate changes affect the economy, and how this helps the Federal Reserve to choose its dual mandate of stable prices and maximum employment.

Lesson 3-1: The Link Between Inflation and Unemployment

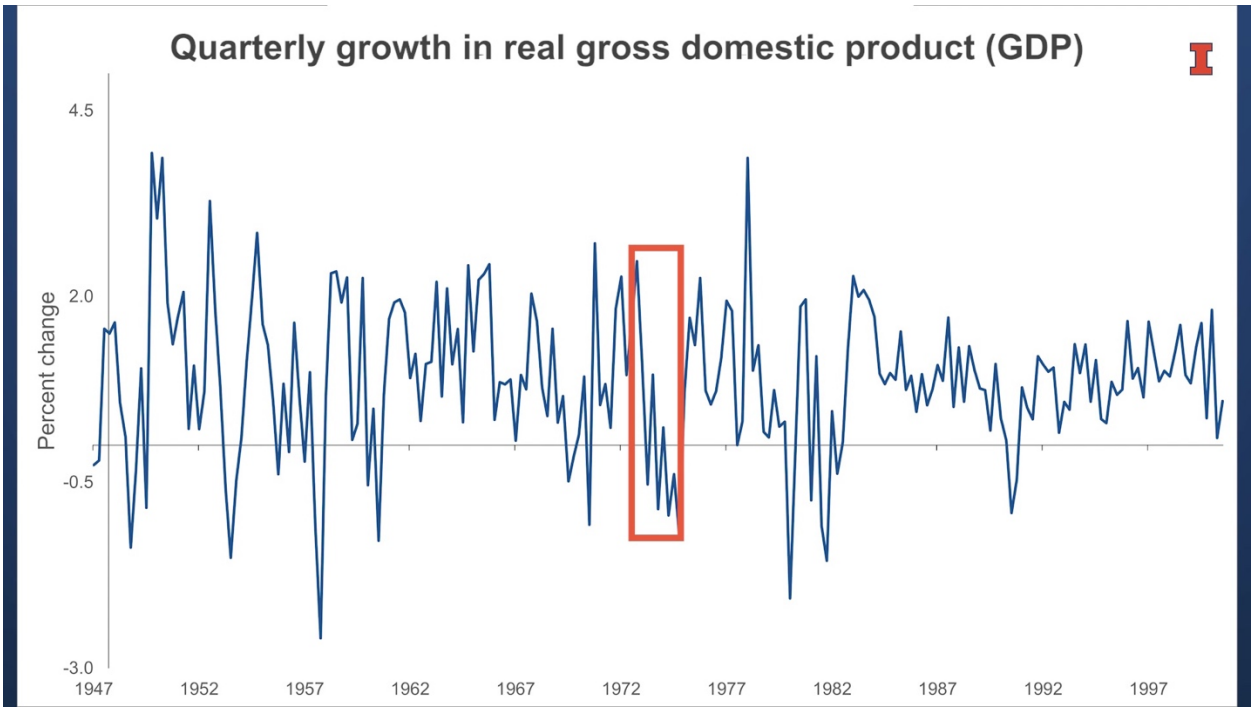
Lesson 3-1.1: The Natural Rate of Unemployment and Okun's Law



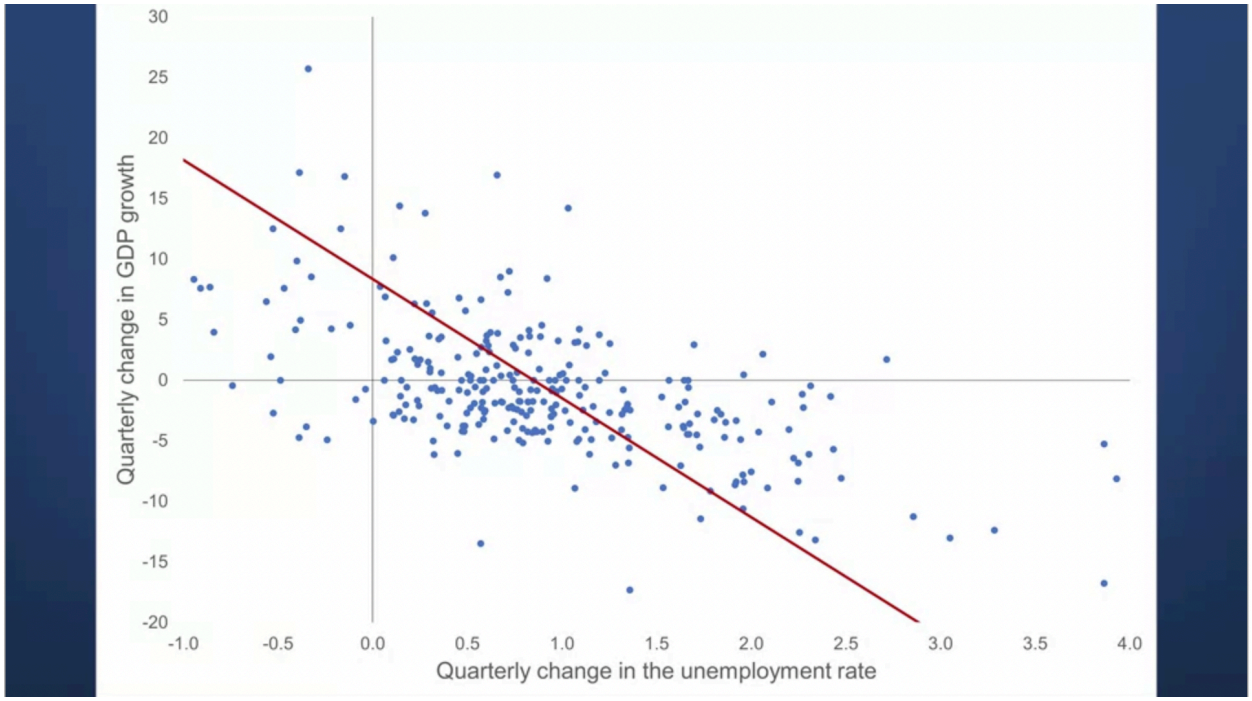
Hello, and welcome to this lecture on Okun's Law and the natural rate of unemployment. In this class, we will discuss the relationship between growth and gross domestic product and changes in employment. We will then examine the natural rate of unemployment, that is the unemployment rate when the economy is considered to be at full employment. Recall that the Federal Reserve's mandate is not only stable prices, but also maximum employment. Today, we will focus on the relationship of output growth and unemployment and explore how low unemployment could increase inflation. Let's start with the relationship of unemployment and output growth.



In the graph, you can see the US unemployment rate from the end of World War II to 2000. We will discuss the 2008 financial crisis and the COVID-19 recession at the end of this lecture. The shaded areas in the graph indicate recessions. You can see that unemployment increases rapidly during a recession indicated by the shaded areas and spikes around the end of a recession. For instance, from October, 1973 to May, 1975, the unemployment rate nearly doubled, increasing from 4.6% to 9%. At the same time, unemployment falls rapidly after the end of a recession. By March,1976, the unemployment rate had already dropped to 7.6%. During recessions, real gross domestic product, the total value of all goods and services produced adjusted for inflation falls.

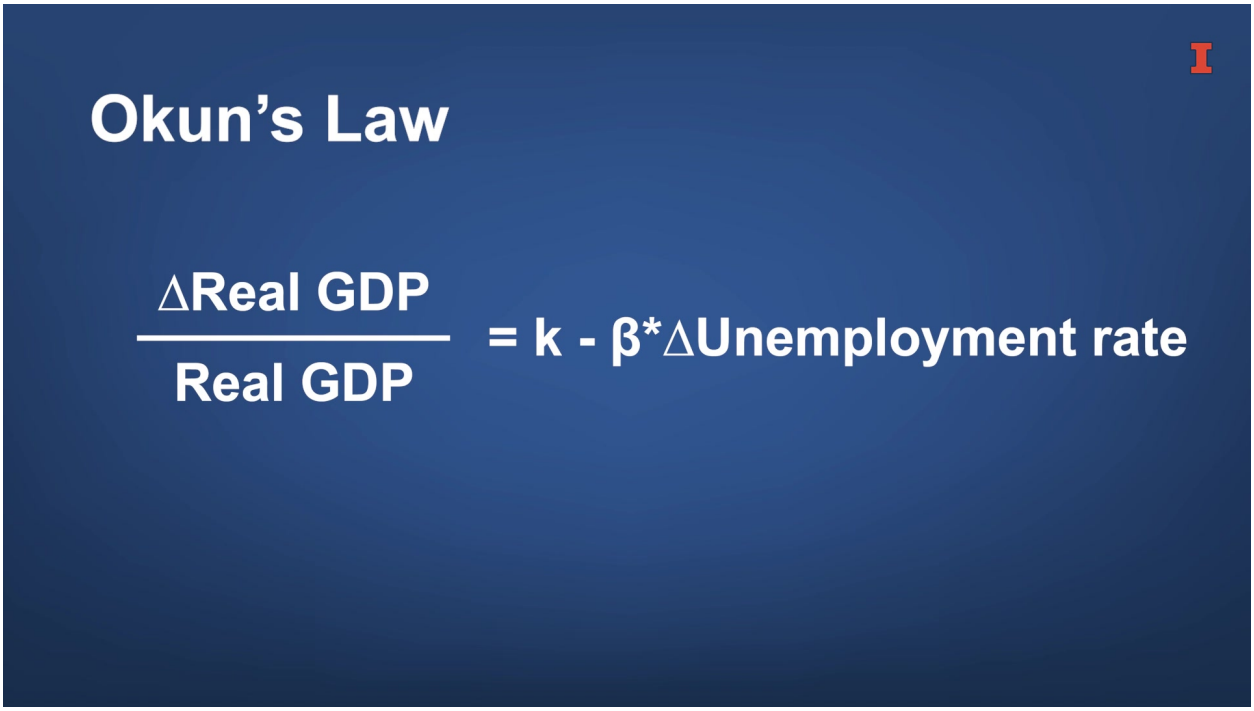


You can see in the graft that GDP fell up to 1% per quarter during 1974. Based on the unemployment and Real GDP charts, we find there is an empirical regularity. Real GDP growth and changes in the unemployment rate are negatively correlated.

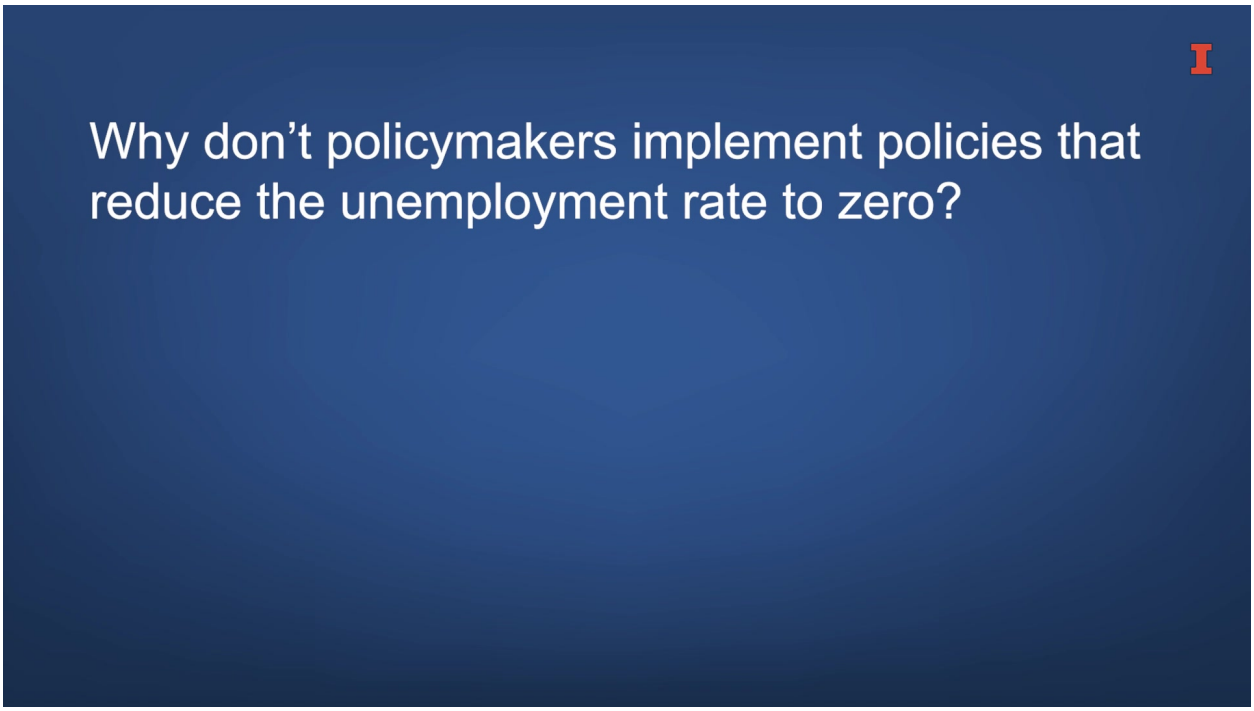


When we plot the changes in the unemployment rate against changes in Real GDP, we can see how closely related these two are. The average relationship is indicated by the

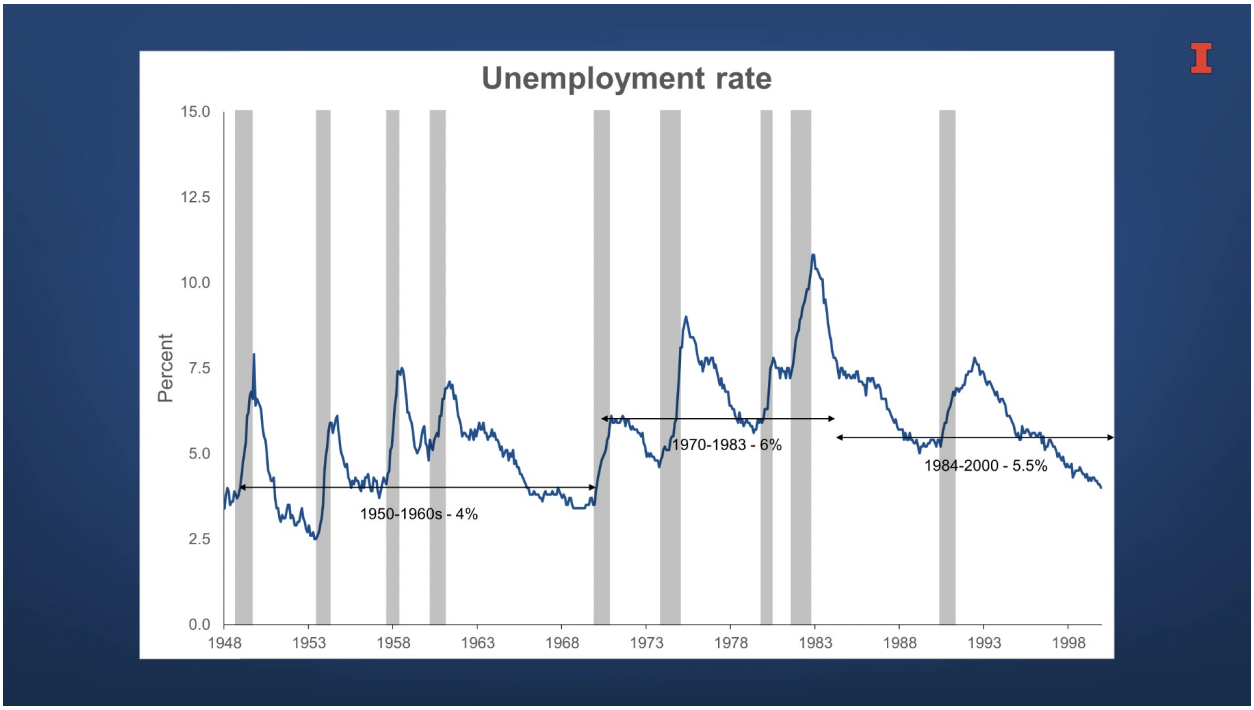
red line. This empirical regularity was first stated by Arthur Okun, and is known as Okun's Law.



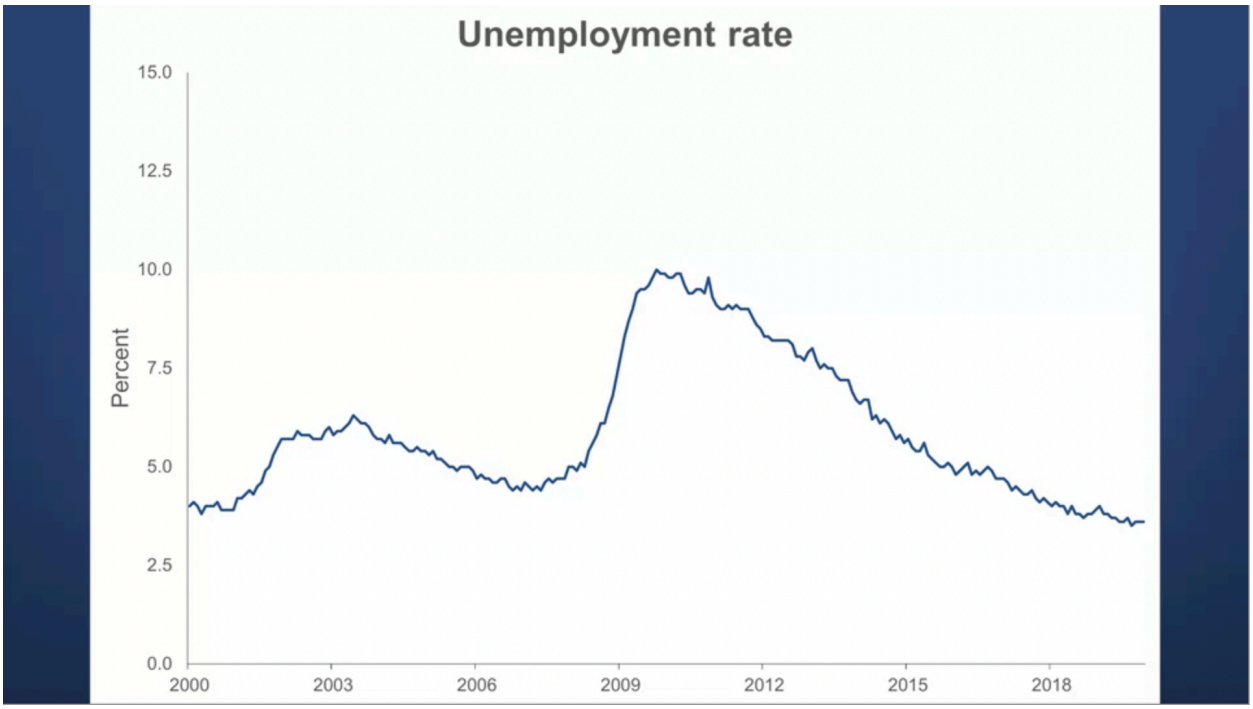
Okun's Law can be summarized in a simple formula, percent changes in Real GDP is equal to a constant k minus β times changes in the unemployment rate, where k is the intercept and β is the slope of the red line. Estimates for the US suggests that one extra percentage point of unemployment rate costs about 2% of Real GDP. That is β in Okun's law formula is about two. Why do monetary policymakers find Okun's Law so interesting? Because Okun's Law gives them some guidance how much unemployment will decline when they cut the interest rate to stimulate the economy. Once you have an estimate for how much Real GDP is going to increase after an interest rate cut, then you also know by how much unemployment is going to decline.



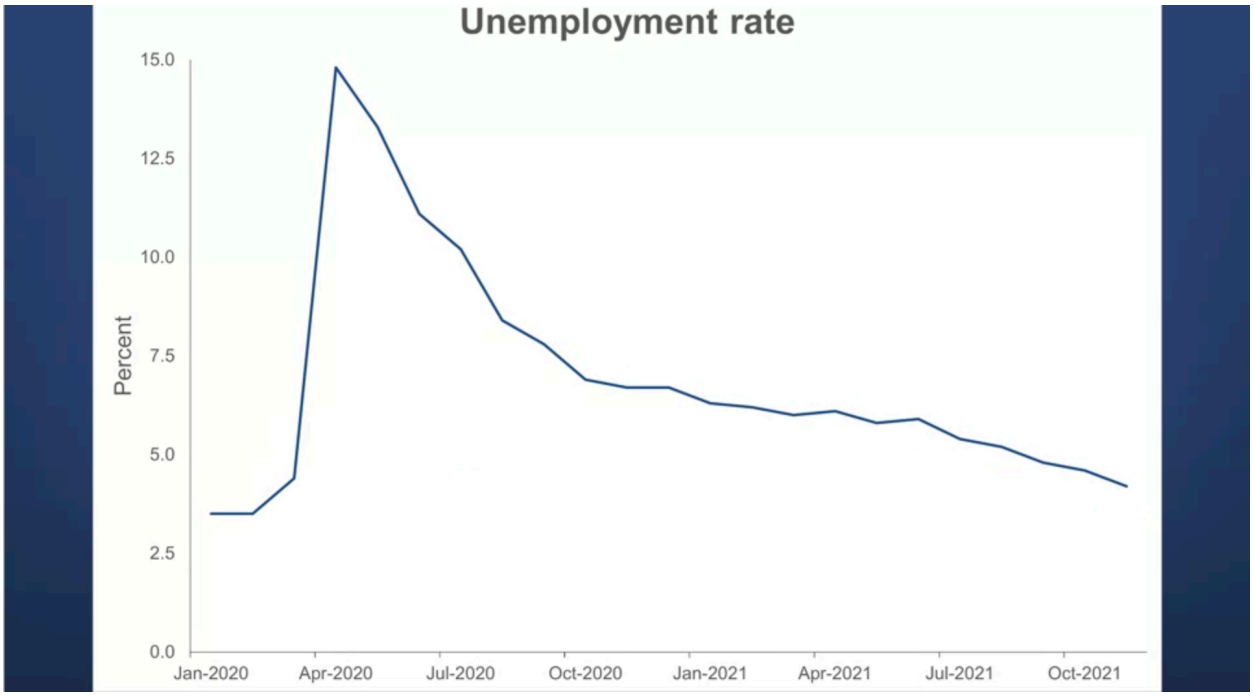
So, why then don't policymakers implement policies that reduce the unemployment rate to zero? The answer is, that there is a natural rate of unemployment. This means that even when the economy is at full employment, some workers will still be unemployed. One reason for this natural rate of unemployment is, that it takes time to find a good job fit. This is called search or frictional unemployment. More generally, the pool of unemployed people consists of people who just joined the labor force. For instance, recent college graduates, people who quit their jobs to look for new opportunities, people who were laid off, which is typically temporary, and people who lost their job either because they were fired or because their employers ceased operations. It is easy to see that there will always be some transition time before unemployed start and find new jobs even when economic conditions are good. However, frictional unemployment is only one component of the unemployment rate, cyclical unemployment is the other.



Let's look again at the time series of the unemployment rate in the US. You can see that there are large cyclical fluctuations, during recessions unemployment is way higher than during good economic times. The chart raises another question, what exactly is the natural rate of unemployment and what determines it? Estimates suggest that in the 1950s and 1960s, the natural rate of unemployment was 4%. For the period between 1970 and 1983, the natural rate was estimated to be 6%. And from 1984-2000, the estimate went down to 5.5%. The difference between these natural rate of unemployment estimates and the actual unemployment rate is cyclical unemployment. What accounts for the changes in the natural rate estimates? There are two key factors that contribute to the natural rate of unemployment. One is changes in the structure of the labor market, for instance, when a new technology makes a certain skill set obsolete. Another factor, a labor market institutions, consider unemployment benefits, higher unemployment benefits give unemployed more time to find a better fitting job. Monetary policy can only respond to cyclical unemployment. Trying to employ monetary policy to push the unemployment rate below the natural rate is ineffective as monetary policy does not affect the structure of the labor market or labor market institutions. For this reason, it is important to understand what the natural rate of unemployment is.



This brings us back to the first three recessions in the new millennium. Let's start by looking at what happened to the unemployment rate in the early 2000s before the COVID-19 pandemic. After the 9/11 recession in 2001, the unemployment rate recovered only slowly. This prompted speculations that the natural rate of unemployment had increased. Similarly, after the 2008 financial crisis, the unemployment rate did not drop as sharply as in recessions in the second half of the 20th century. However, in December 2019, close to the end of the longest economic expansion in US history, the unemployment rate was 3.6%, way below prior estimates of the natural rate of unemployment.



The COVID-19 pandemic ended this run, with the lockdowns, unemployment spiked to levels not seen since the Great Depression in the 1930s. However, once the economy reopened, shops did not recover as quickly. What can account for changes in the new millennium?

Natural unemployment rate in 21st century?

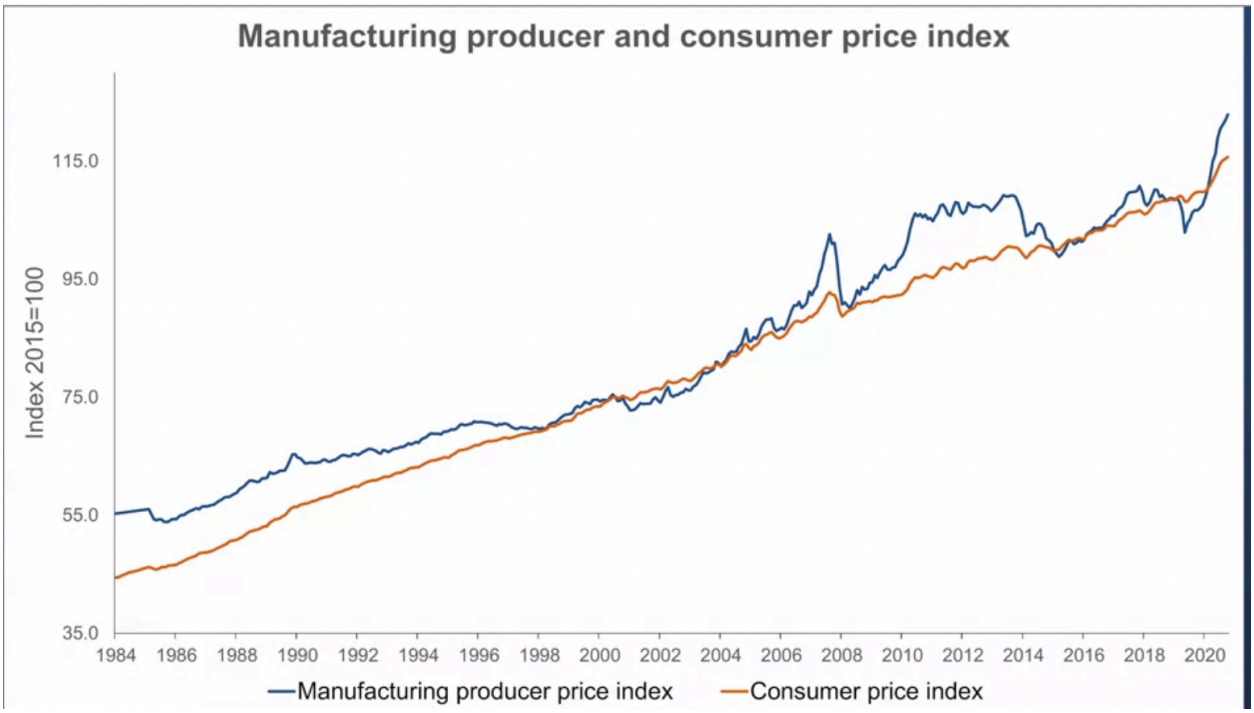
- Structural changes in labor market
- Tech sector jobs
- Technology

One suggestion has been structural changes in the labor market. Certain skills have become or are becoming obsolete. Just consider what autonomous driving will mean for

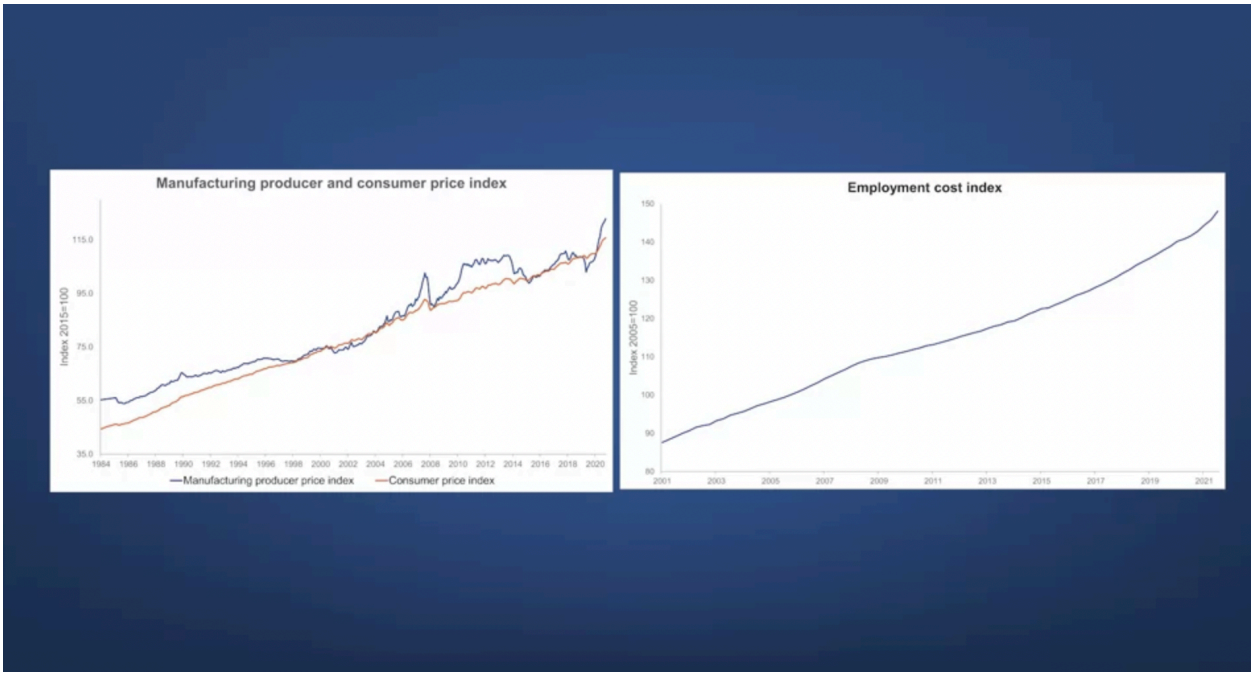
truck drivers. Other skills, mostly driven by the growing tech sector, have been more in demand than ever. At the same time, technology has made it easier to find a job, instead of local newspaper classifieds, you can search for jobs, country or worldwide in the Internet. But like most large scale changes, the full effects of these developments can only be observed over time, making it hard to know what the current natural rate of unemployment is.

What have you learned in this lesson? First, Okun's Law is an empirical regularity that states that changes in the unemployment rate and Real GDP are negatively correlated. Second, even with an economy at full employment, some people will be unemployed due to frictions in the labor market. Third, the natural rate of unemployment is the unemployment rate at full employment.

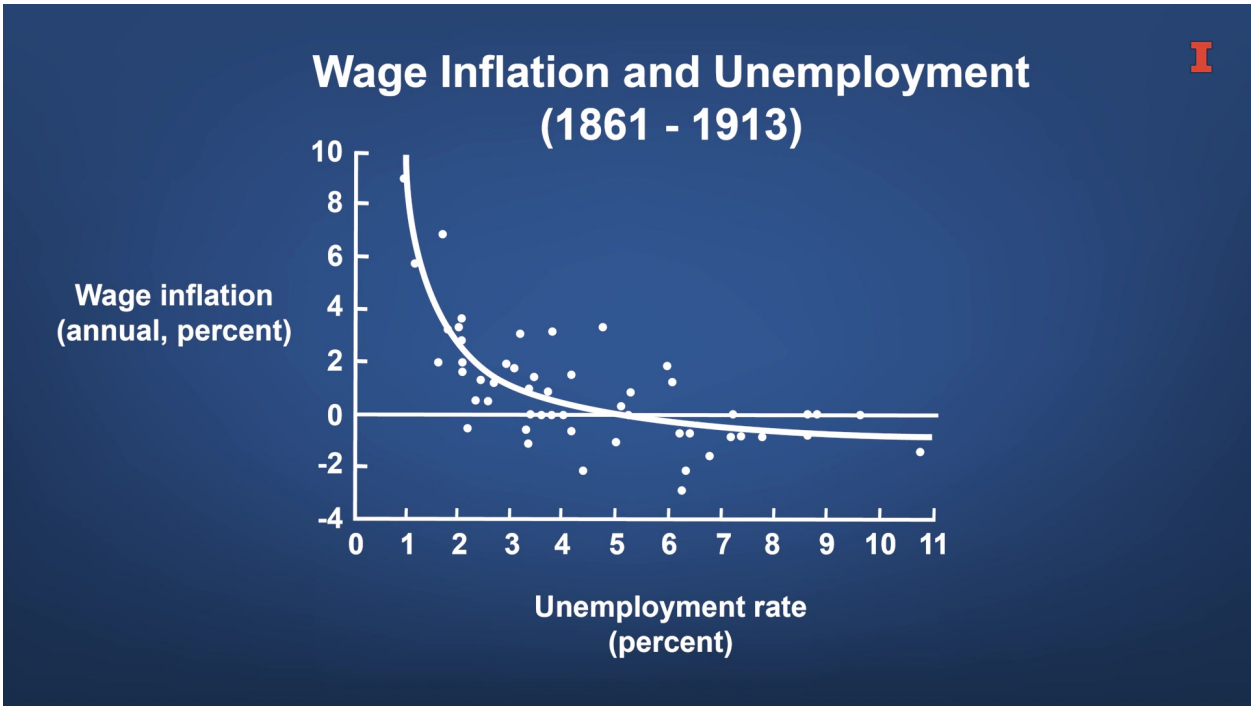
Lesson 3-1.2: Phillips Curve



Hello. Welcome to this lecture on the relationship between unemployment and inflation, and the Phillips curve. In this class, we will be discussing the relationship between wages, unemployment, and inflation. For that, we will introduce the concept of the Phillips curve. When economists, policymakers, or the press talks about inflation, they usually refer to consumer price inflation, that is, how prices for bundle of consumer goods have changed. However, you may wonder what can cause consumer prices to go up. One answer is, input prices. Surely, you have noticed that filling up your car is more expensive when oil prices are high. The graph shows consumer and producer price indices. As you can see, while the producer price index is more volatile, the two series track each other really well. What is the major cost component of most industries? Labor cost.

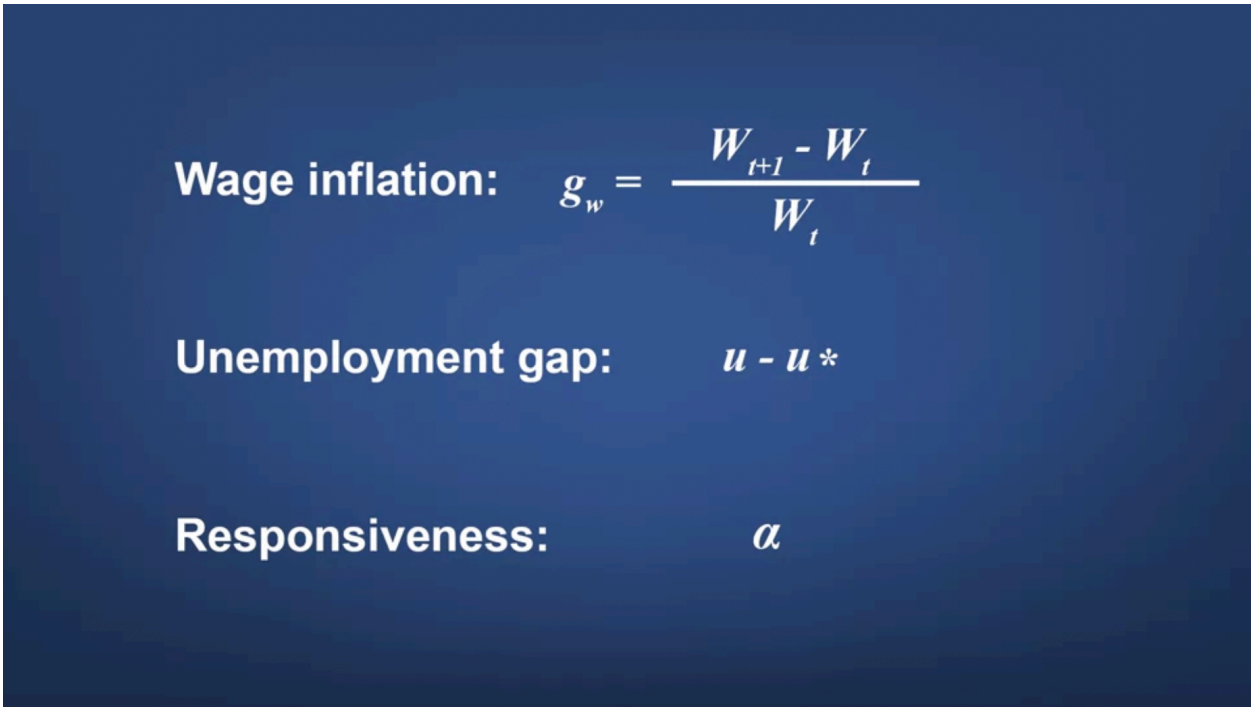


Let's add an employment cost index to this graph. You can see again that employment cost and consumer price inflation track each other really well. Moreover, consumer price inflation is often just between the producer price index and the employment cost index that includes wages and benefits, as it is the combination of the two. Now consider, when do wages increase most? When employees have the most bargaining power, that is, when unemployment is low, and there are less applicants per job. Conversely, when unemployment is high, employers have more choice, and they don't have to pay higher wages to attract job applicants.



This relationship was first noted by Arthur Phillips, who plotted unemployment against the wage

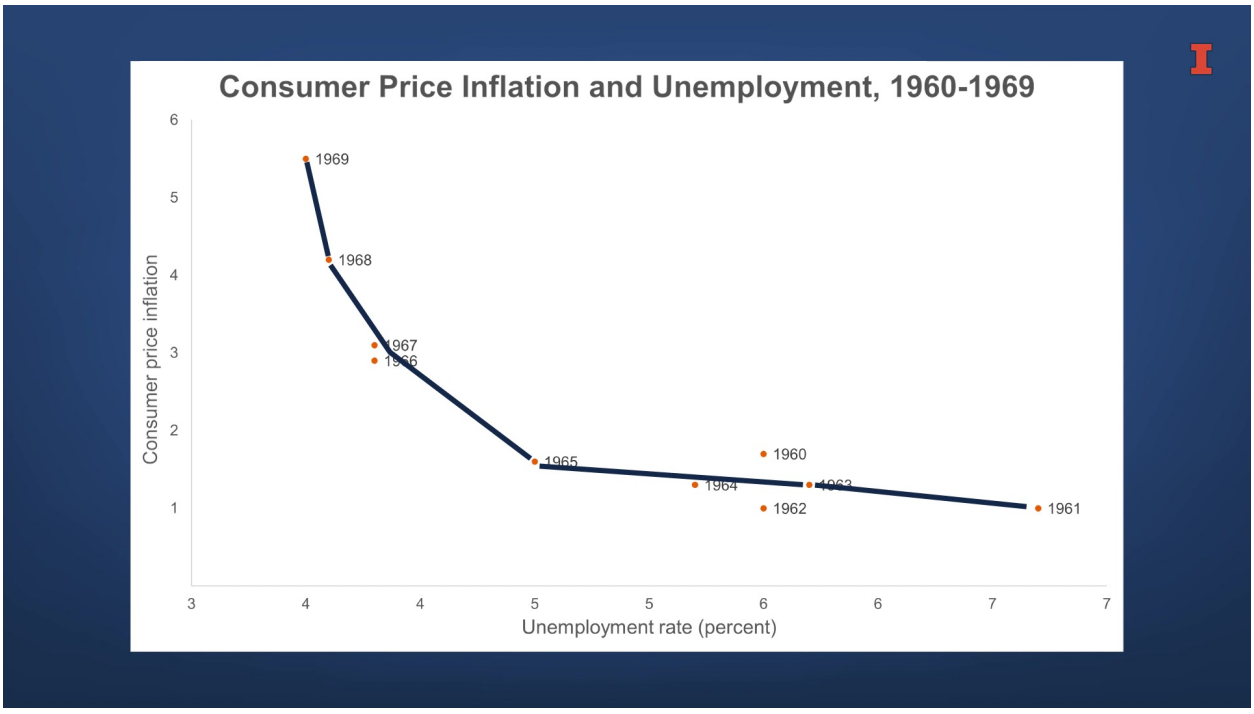
growth, and found an inverse relationship between unemployment and wage growth in the United Kingdom.



Let's consider this more formally. The rate of wage inflation g_w, is the change in wages between time t, and t plus 1, divided by wages in t. The first factor for wage inflation is the unemployment gap, that is the difference between unemployment, u, and the natural rate of unemployment, u-star. The natural rate of unemployment means, that there is only frictional unemployment, that is, job search always takes time. There's always some unemployment even in a time of full employment. The unemployment gap therefore measures cyclical unemployment. The second factor for wage inflation is how responsive wage inflation is to this gap. Let's call this responsiveness alpha.

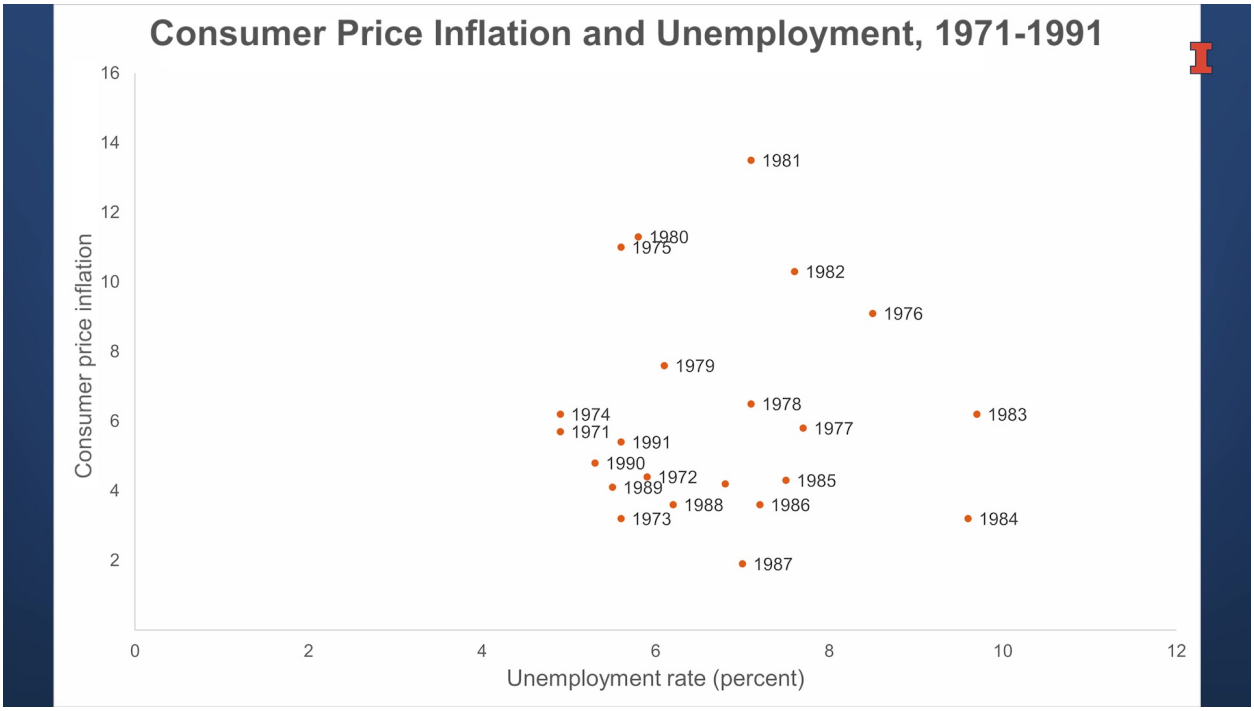
Simple Phillips curve: $g_w = -\alpha(u - u*)$

Putting these pieces together, we get wage inflation is the negative of the responsiveness of wage inflation to alpha times the unemployment gap. This equation is referred to as the simple Phillips curve. However, we have seen earlier that consumer prices and wages move together. Over time, the term Phillips curve has been used to describe the relationship between unemployment and inflation. Let's have a look at this relationship using data from the 1960s.

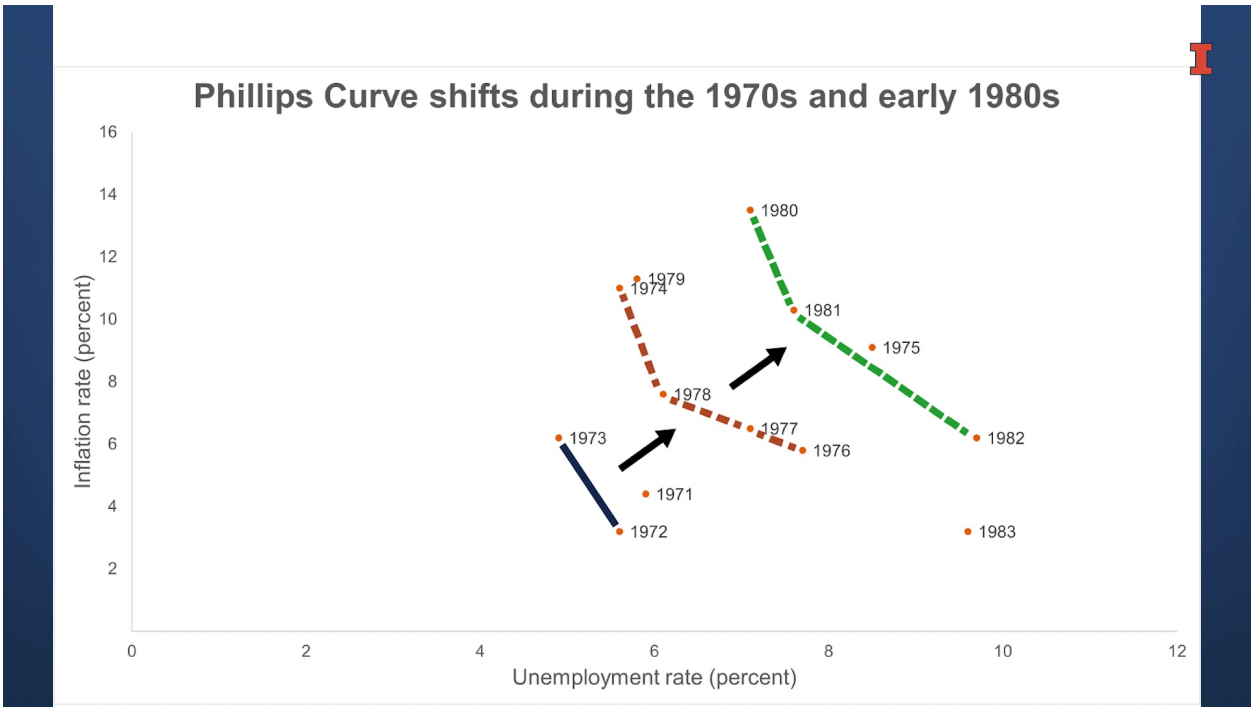


As you can see, the negative relationship between inflation and unemployment holds in the United States in the 1960s. This graph suggests a clear trade-off between unemployment and

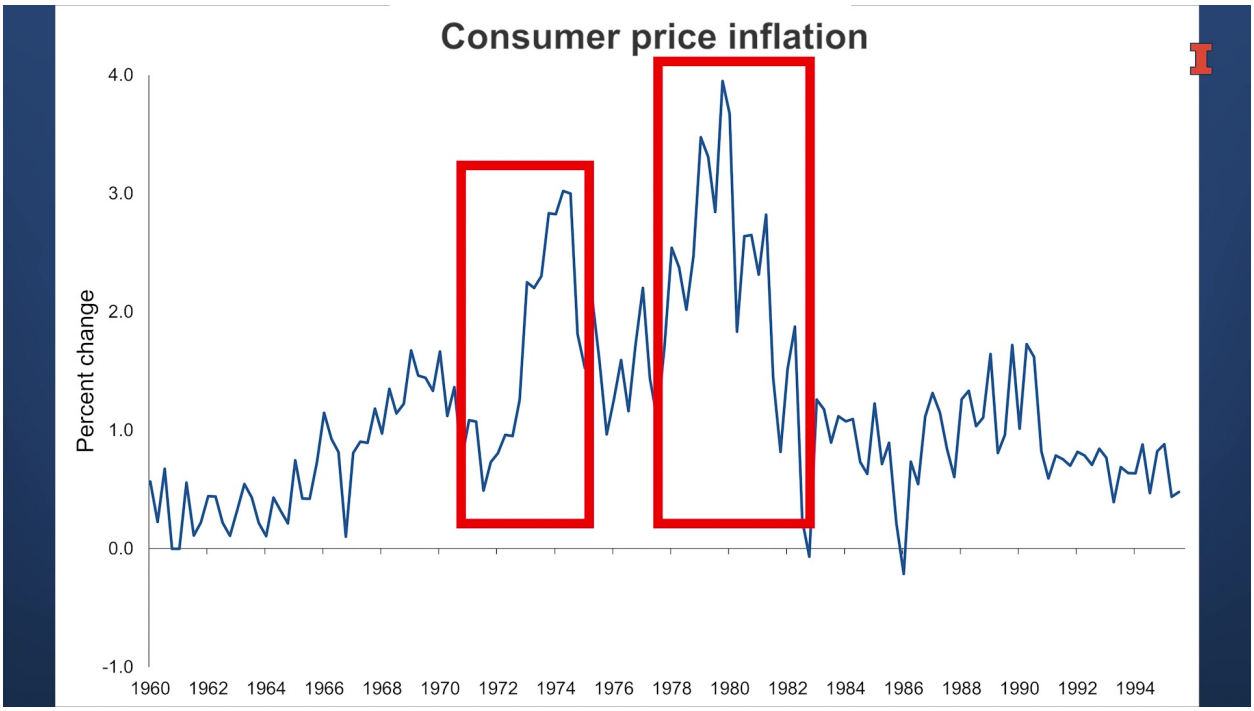
inflation, and that trade-off is central to monetary policy as stable prices and maximum employment are the Federal Reserve's mandate. In the 1960s and early 1970s, it was thought that the relationship between unemployment and inflation was stable, at least in the long run. Policymakers, therefore, carefully explored this trade-off and used it for policy decisions.



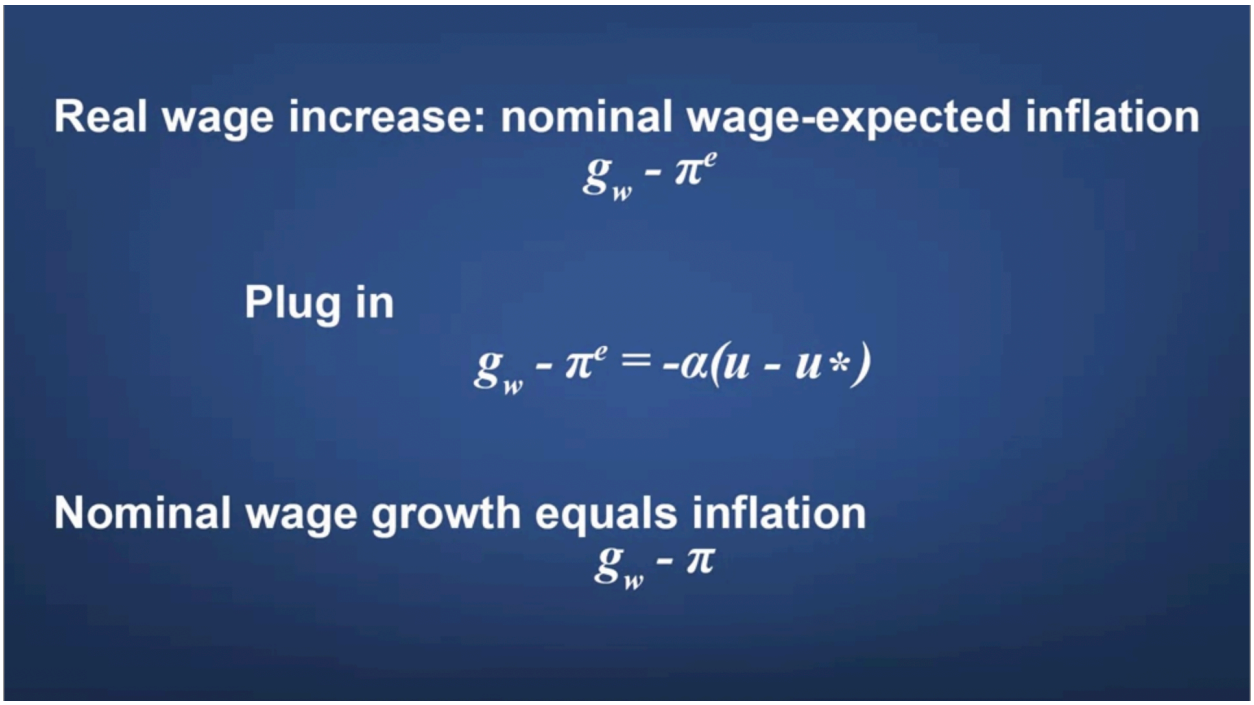
However, over the next two decades, a different pattern emerged. As the graph suggests, over the 1970s and 1980s, there does not appear to be a smooth relationship between inflation and unemployment in the long run. However, if you squint a little, you can still see a distinct pattern. It looks like there is not one, but three relationships.



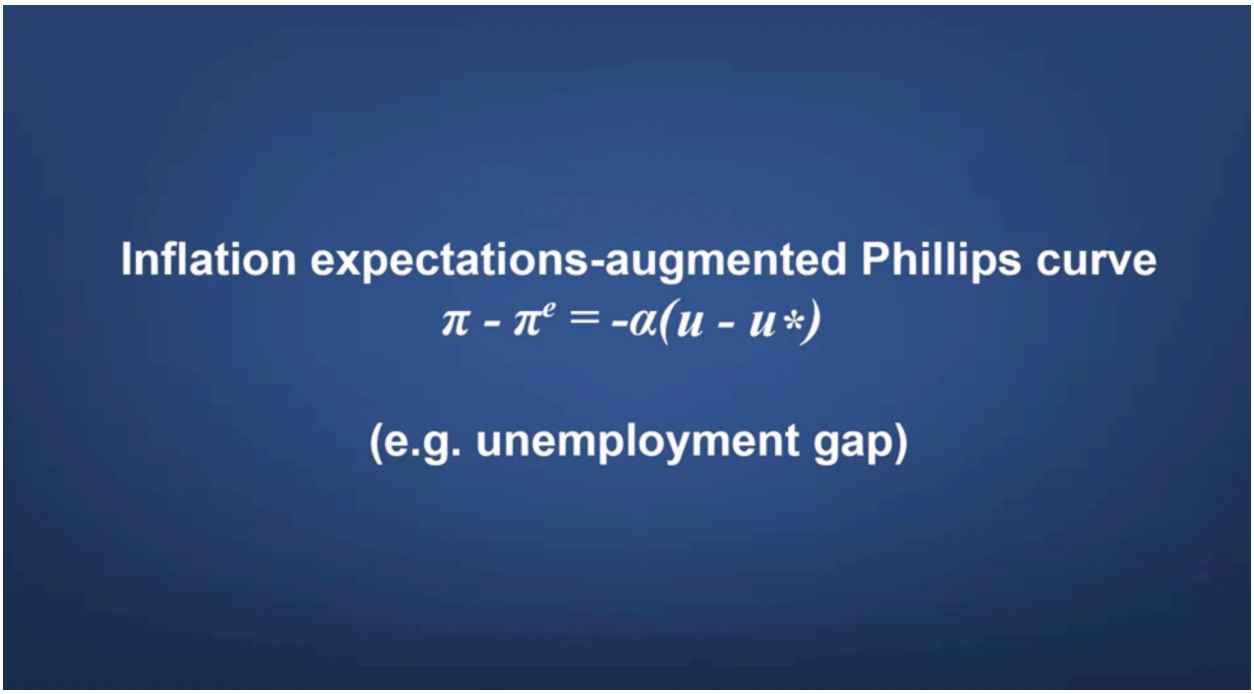
One for the early 1970s, one for the late 1970s, and one for the early 1980s. When you connect the dots, it looks like three Phillips curves, with the curve shifting outward over time. An outward shift is not a good thing. The further the Phillips curve shifts out, the more inflation is needed to reduce unemployment. While the 1970s and 1980s cast doubt on the long run relationship between inflation and unemployment, the data indicate that at least in the short run the relationship is present. We now examine what determines these short run Phillips curves in the 1970s and 1980s.



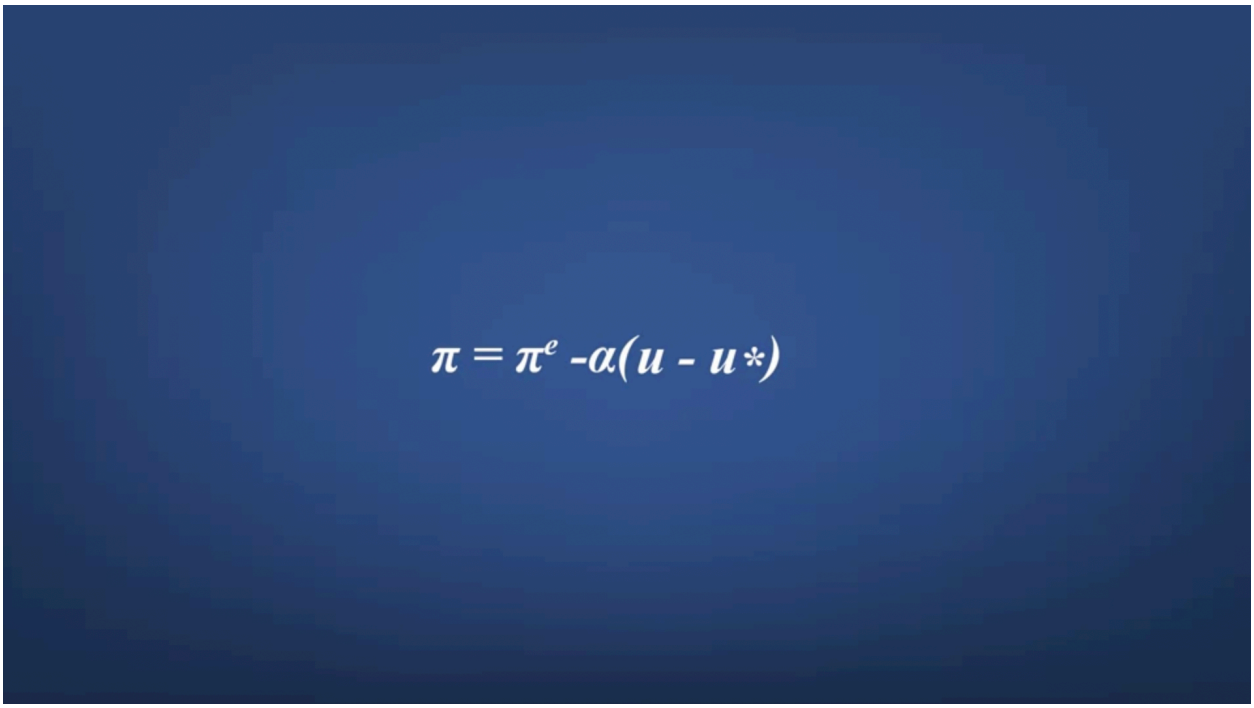
Let's look at consumer price inflation between 1960 and 1995. Clearly, during the early 1970s and early 1980s, increases in consumer price inflation were on average much higher than in the 1960s. Hence, one possible explanation for the outward shift of the Phillips curve could be an upward shift in inflation expectations from the early 1970s to the early 1990s. To illustrate how inflation expectation matter in this context, consider your employer announces a 5% across the board wage increase. This sounds like a decent increase. But now suppose consumer price inflation currently is 10% and is expected to remain at 10%, so your income in real terms, that is income adjusted for inflation, actually falls by 5%. In other words, workers don't care as much about nominal wage increases as they do about real wage increases as loss of raising the standard of living.



Let's account for inflation expectations in the Phillips curve. The expected real wage growth is the nominal wage increase, g-w, minus expected inflation, Pi-e. Plugging this in the simple Phillips curve gives that the expected real wage growth is equal to the negative of the responsiveness of wage inflation to the unemployment gap times the unemployment gap. If the real wage is constant, then nominal wage growth, g-w and consumer price inflation, Pi have to grow at the same pace.

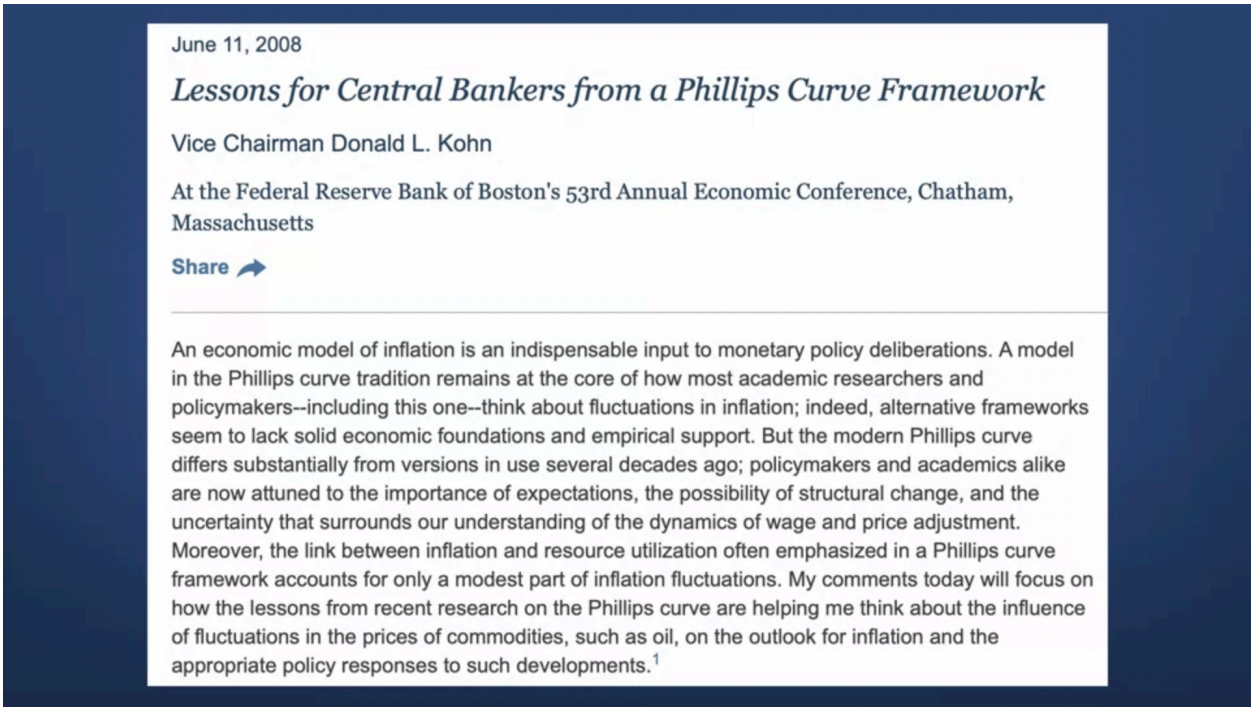


Replacing nominal wage growth with inflation gives us the inflation expectation-augmented Phillips curve that relates differences in inflation from inflation expectations to employment gaps.



Let's rearrange this equation. From this formula, we can see that for full employment, meaning an unemployment gap of zero, inflation has to be equal to inflation expectations. Going back to the 1970s and 1980s, when workers expected higher inflation, many demanded higher wages pushing inflation up to the level of inflation expectations. This increase in inflation expectations account for the outward shift of the short-run Phillips curve. This is why policymakers often

consider whether inflation expectations have changed. To be clear, other factors can also shift this Phillips curve. For instance, supply shocks, such as the oil shocks in the 1970s and 1980s. More advanced versions of the Phillips curve take also supply shocks into account. Again, the trade-off between inflation and unemployment is central for deciding on monetary policy.



June 11, 2008

Lessons for Central Bankers from a Phillips Curve Framework

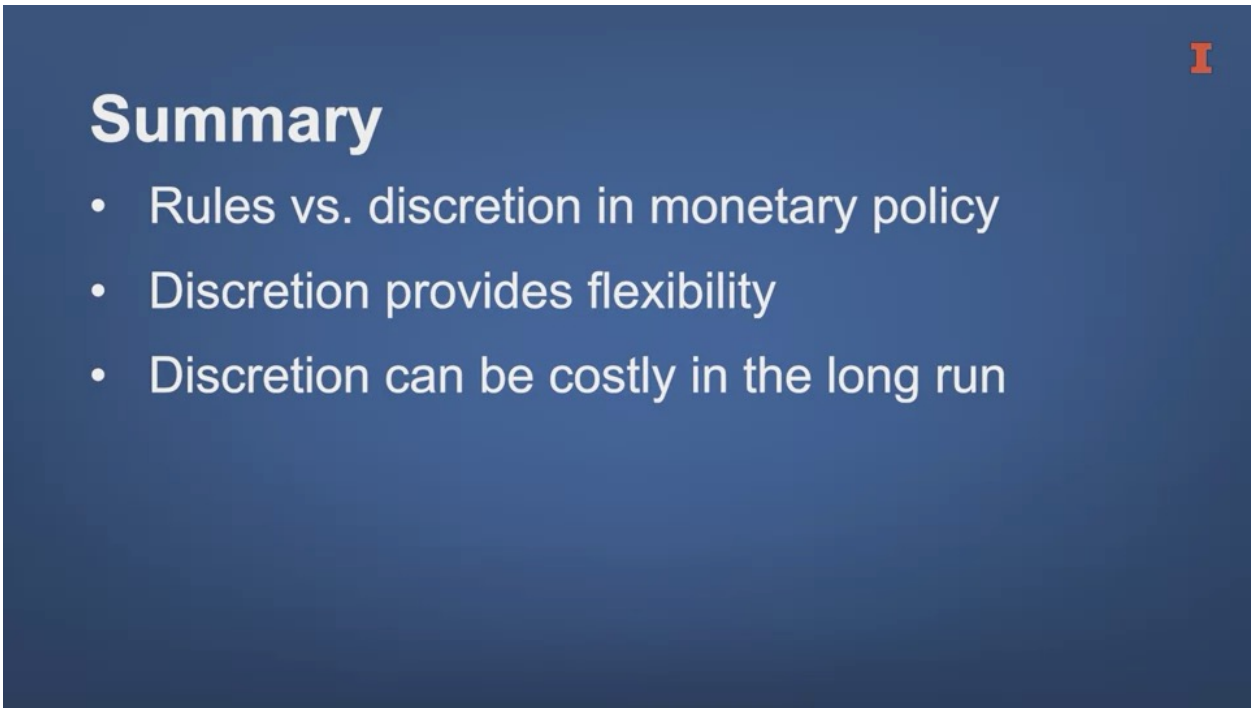
Vice Chairman Donald L. Kohn

At the Federal Reserve Bank of Boston's 53rd Annual Economic Conference, Chatham, Massachusetts

Share

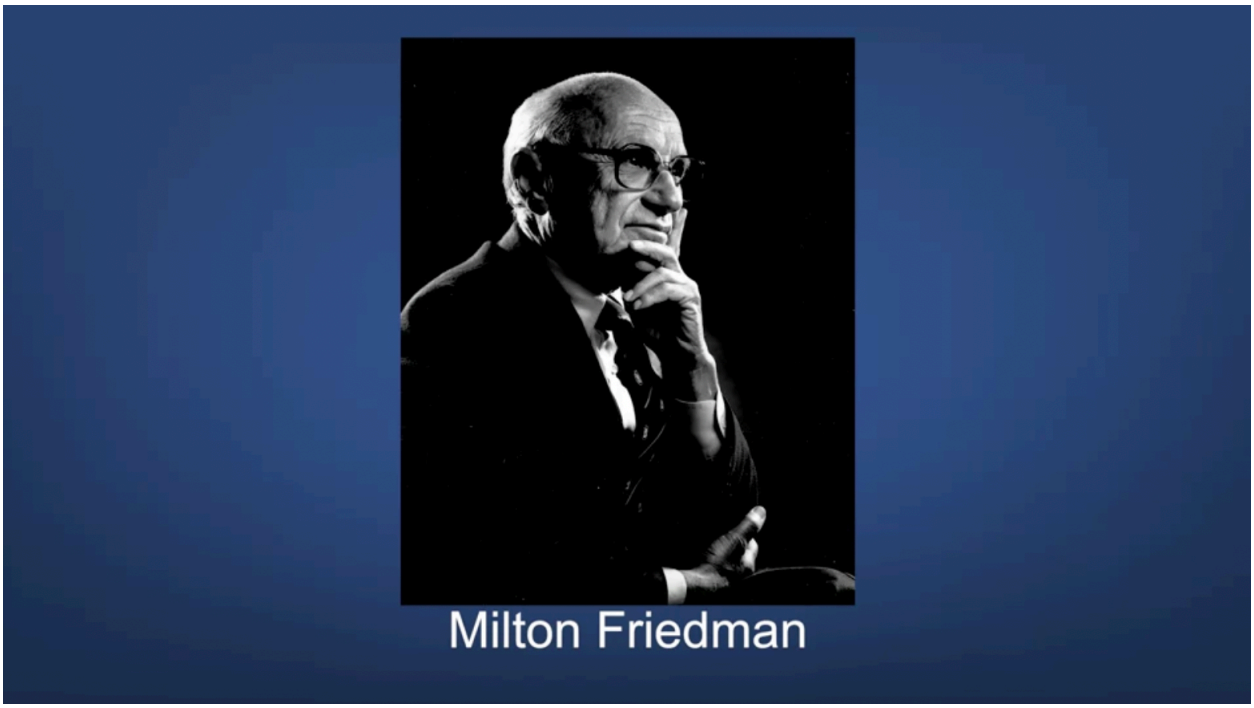
An economic model of inflation is an indispensable input to monetary policy deliberations. A model in the Phillips curve tradition remains at the core of how most academic researchers and policymakers--including this one--think about fluctuations in inflation; indeed, alternative frameworks seem to lack solid economic foundations and empirical support. But the modern Phillips curve differs substantially from versions in use several decades ago; policymakers and academics alike are now attuned to the importance of expectations, the possibility of structural change, and the uncertainty that surrounds our understanding of the dynamics of wage and price adjustment. Moreover, the link between inflation and resource utilization often emphasized in a Phillips curve framework accounts for only a modest part of inflation fluctuations. My comments today will focus on how the lessons from recent research on the Phillips curve are helping me think about the influence of fluctuations in the prices of commodities, such as oil, on the outlook for inflation and the appropriate policy responses to such developments.[1]

For instance, in 2008, the then vice chairman of the board of governors of the Federal Reserve System, Donald L. Kohn stated that an economic model of inflation is an indispensable input to monetary policy deliberations. A model in the Phillips curve tradition remains at the core of how most academic researchers and policymakers, including this one, think about fluctuations in inflation. Indeed, alternative frameworks seemed to lack solid economic foundations and empirical support.



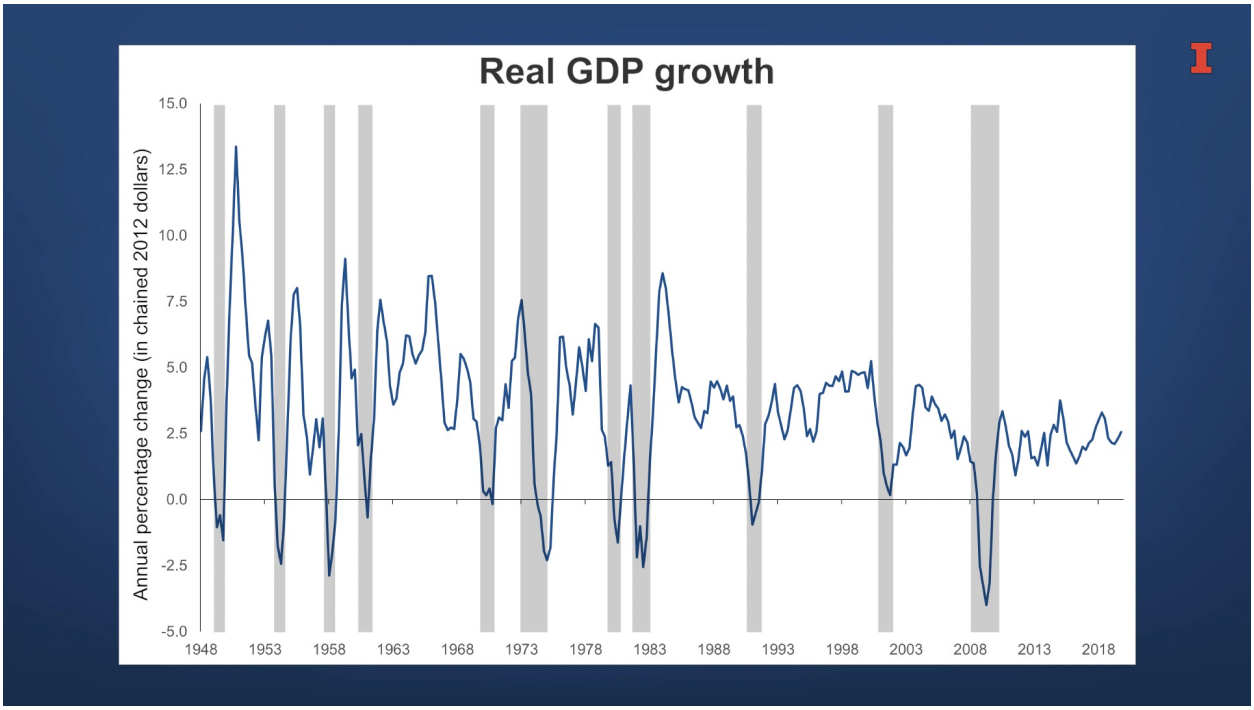
What have we discussed in this lesson? First, wages and inflation are moving together. Second, there is a trade-off between inflation and unemployment modeled in the Phillips curve. Third, changes in inflation expectations can shift the Phillips curve.

Lesson 3-1.3: Discretionary and Rule-Based Monetary Policy



Hello and welcome to this lecture on discretionary and rule based monetary policy. In this class we consider whether monetary policy should respond to economic fluctuation and similarly whether the central banks should have a discretionary or rules based response. We will look at a simple example that illustrates a key trade off of discretionary monetary policy. Should a central banks respond to cyclical fluctuation in unemployment and inflation. Monetarist in the tradition of Milton Friedman, who won the Nobel prize in 1976, are skeptical that central banks can counteract cyclical fluctuations. Instead, Friedman proposed what is known as the K-rule.

The central bank should increase the money supply by constant percentage rate every year, irrespective of business cycles. Friedman argued that by following a simple rule, central banks could contribute to promoting economic stability. Specifically with moderate cross of the money supply. Central banks could avoid either inflation or deflation of prices. Friedman himself suggests that money supply curves should be somewhere between 2% and 5%. Clearly, this rule ignores economic conditions. The central bank has no leeway and just follows the preprogrammed algorithm. The advantage of this rule is that financial markets and businesses can perfectly anticipate all monetary policy actions and base their decisions on it. In contrast to this strict rule, our activist policies that are designed to respond to economic fluctuations and smooth them out. Let's step back for a moment and ask ourselves what the costs of economic fluctuations are and whether this justifies interventions by central banks.



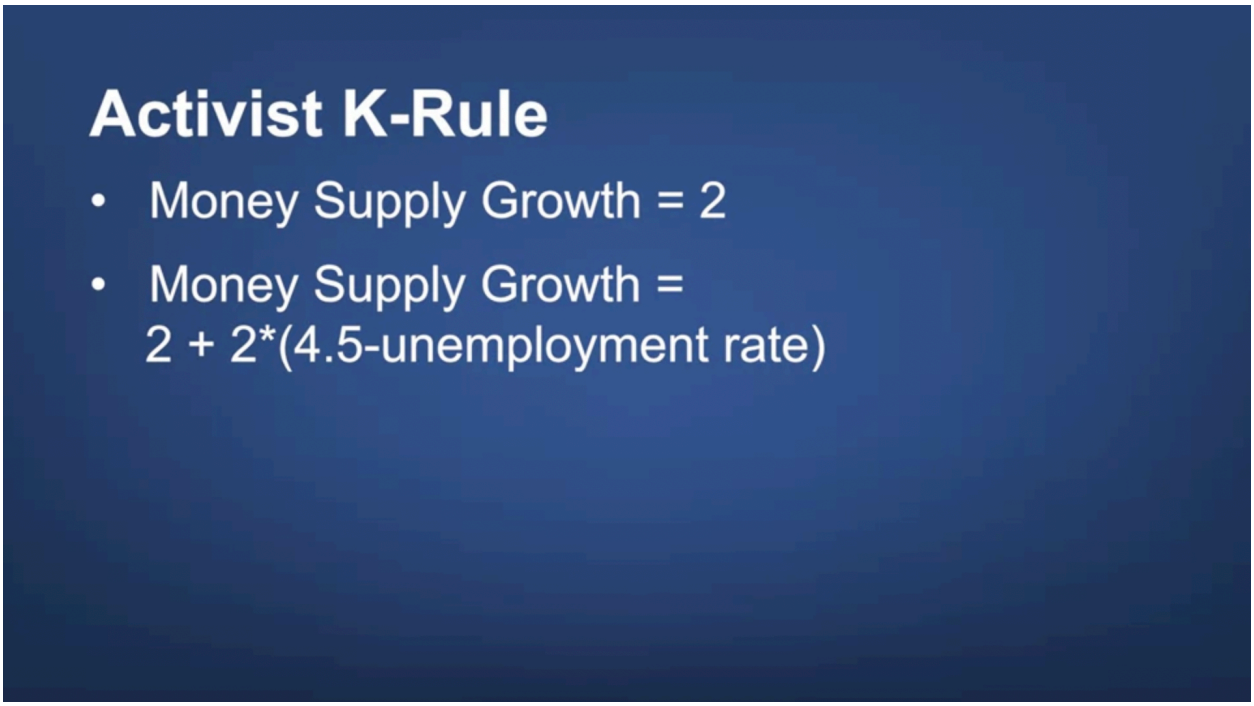
This graph shows you the annual growth rate of real GDP. Now let's focus on the recession's indicated by the shaded areas. You can see that with the exception of the financial crisis, the reduction in Real GDP is perhaps 2%. This doesn't sound like a lot. Indeed. Some economists have argued based on this observation that the costs of business cycles are small. However, just looking at GDP overlooks several issues.

Costs of recessions

- High cost of those losing their jobs
- Skill deterioration due to longer unemployment spells
- Lower consumption due to credit constraints

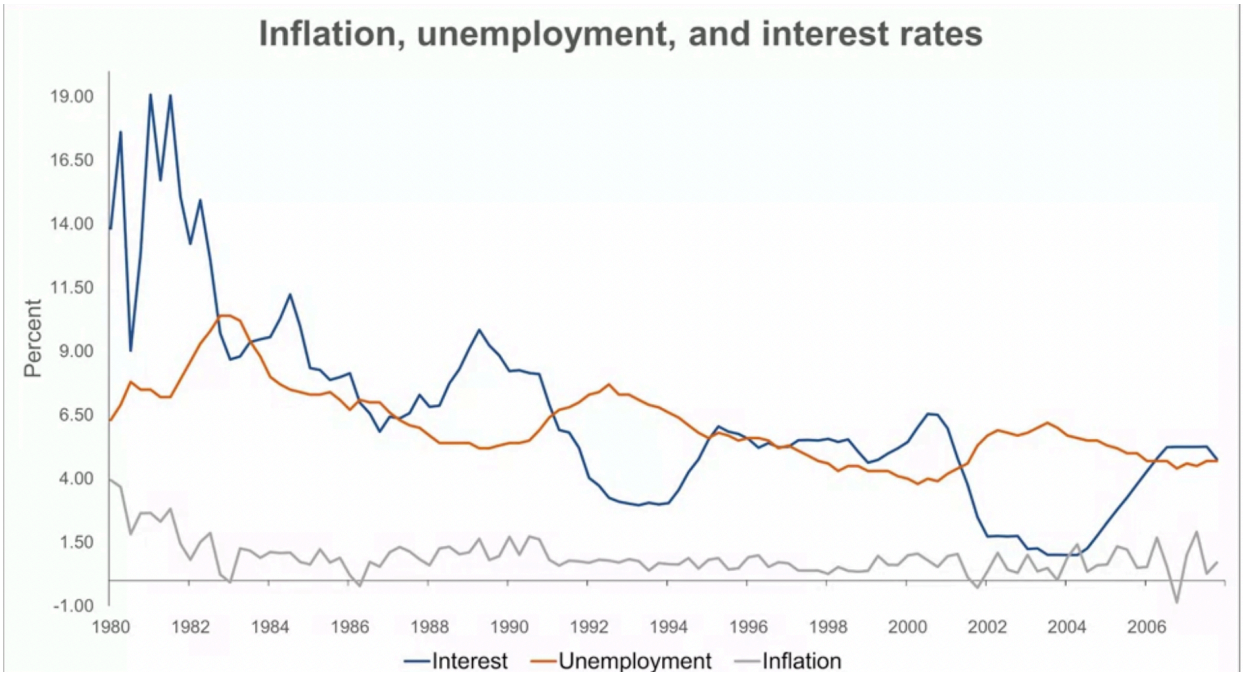
First, the cost of business cycles falls differentially on those who lose their job or enter the labor market during a recession. Research shows that if you got your first job during a recession, your

wage profile will be lower for your whole career. Second, unemployment duration goes up increasing the chances that workers skilled deteriorate while being unemployed. Third, unemployed workers have to reduce consumption as they cannot borrow against future wages. Taken together the cost of business cycle fluctuations are substantial. Once you consider an individual rather than the economy as a whole. These costs provide one rationale for activist monetary policy. A second version of for activist monetary policy, our times of extreme disturbances such as the 2008 financial crisis or the COVID 19 pandemic. Even Milton Friedman acknowledged that in these extreme circumstances central banks should intervene. However, not all activist policies are discretionary.

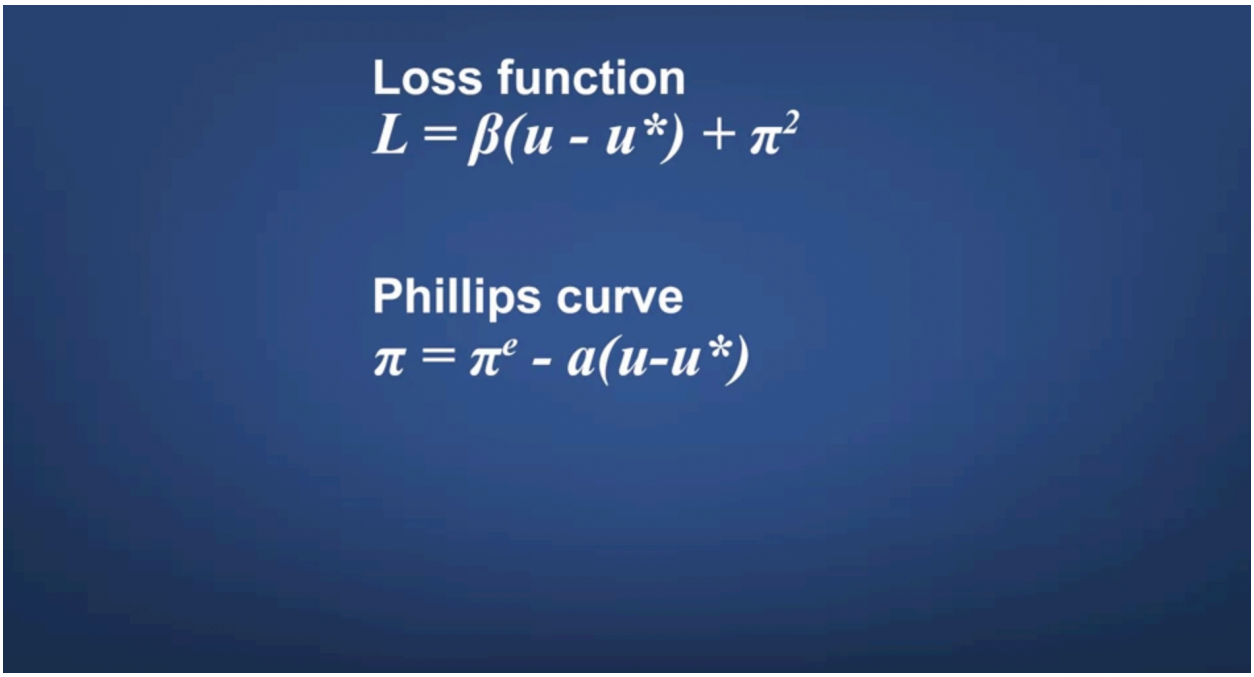


Let's consider an activist version of treatments K-rule. The central bank rule is to let money supply grew by 2%,, but also wants the money supply to respond to fluctuations in unemployment relative to the natural rate of unemployment of 4.5%. It decides that for every half percentage point that unemployment is above its natural rate, money supply should Increase by 1%. So the activist rule is money supply is equal to 2 plus 2 times the difference between the natural rate of unemployment and current unemployment. With 6% unemployment. this rule would call for a money supply growth of 5%. Conversely, if unemployment is only 4%,, then the central bank would grow the money supply by only 1%. This example illustrates that you can have rule-based monetary policy that is counter cyclical. Another activist countercyclical rule is the so called tailored rule that ties nominal interest rates to fluctuations in inflation and employment. We discussed this rule in detail in a separate lecture. You may ask yourself, why haven't central banks given countercyclical rules? There are two reasons for this. First, our knowledge of the economy is constantly changing and progressing. But for rules to be credible, they would need to be written in law and changing those cost time. While certainty about future monetary policy is good flexibility to change monetary policy, when circumstances change is

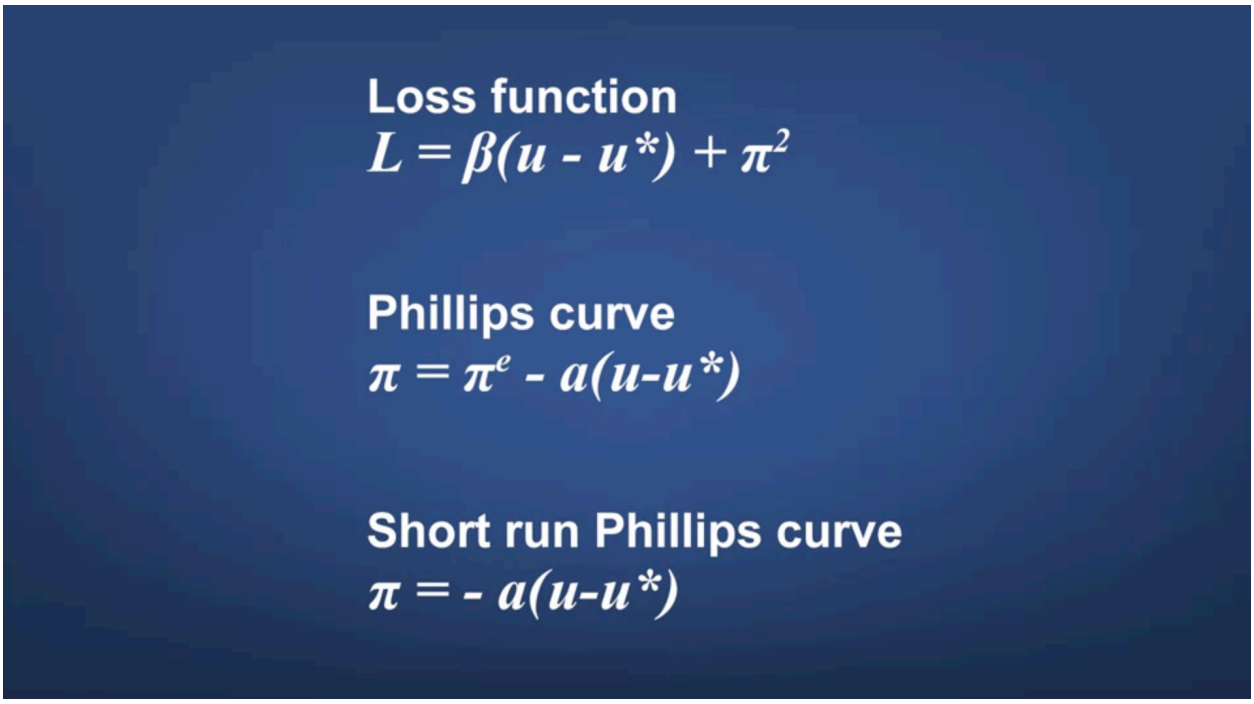
better. Second, suppose, the central bank would achieve a better outcome in terms of keeping output close to target by deviating from the rules, then why shouldn't it?



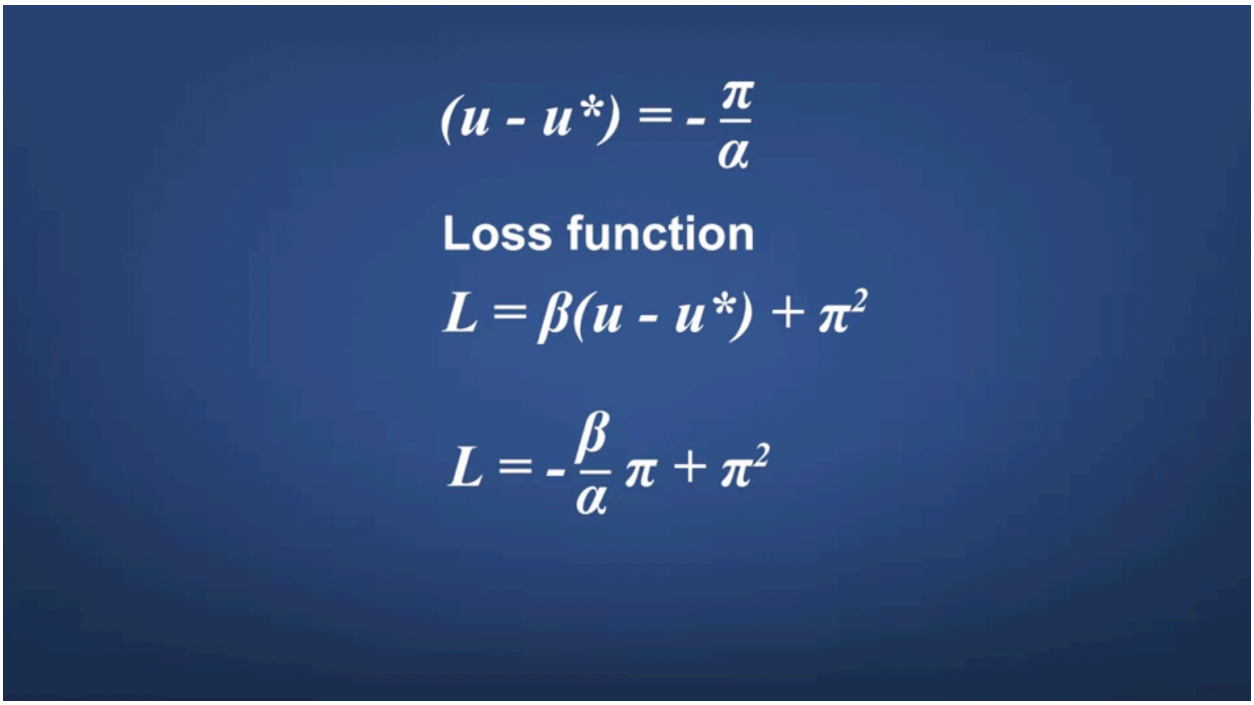
It seems then that there is a case for modest activist discretionary policy. Indeed, when you look at inflation unemployment and interest rates in the United States during the early 1990s and the early 2000s, you could conclude that this type of policy was quite successful. The graph shows you the time series of inflation, unemployment and interest rates. As you can see when the 1990 recession started, the Federal Reserve cut the interest rate and unemployment rates drop below previous session levels within four years. Inflation remained low throughout the 1990s. This pattern repeats itself after the bust of the.com stock market bubble in early 2000 and the 2001 recession. The low volatility in the macroeconomic variables, both attributed to policy makers and the activists discretionary policy. But what are the potential downsides to discretionary policy? The key issue is the idea of time inconsistency. That is, policymakers face a tradeoff between short term gains and long run costs.



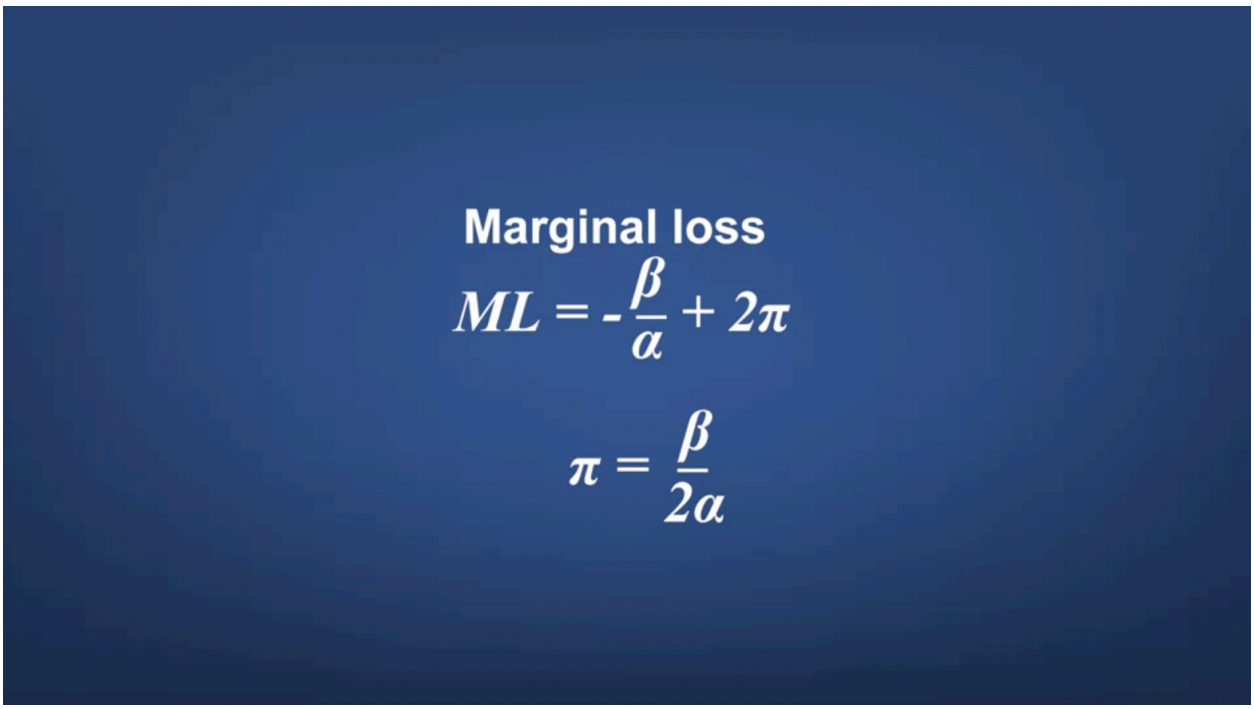
Let's look at a specific example to illustrate the point. Consider a central bank that cares about inflation and unemployment. It has a loss function L. That features the deviation of unemployment u from its natural rate, u star with some weight beta and inflation pi squared. So zero inflation and unemployment at the natural rate would mean zero losses. We call the Phillips curve that links inflation pie two inflation expectations e and the deviation of unemployment from its natural rate. The central bank announces an inflation rate target of zero. Assume the central bank is credible and hence in the short term inflation expectations are fixed at zero.



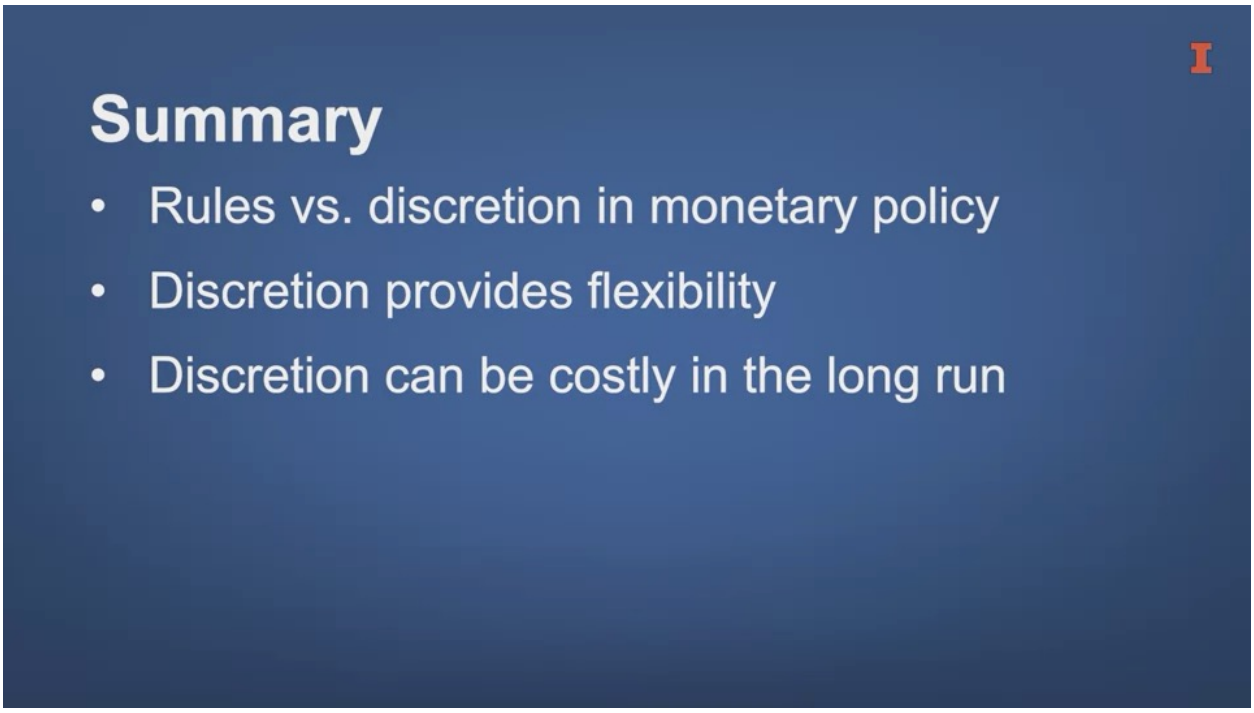
Now, the central bank faces a short run Phillips curve where inflation is only a function of the unemployment gap.



To see what the central banks optimal policy is in the short run, let's rearrange the Phillips curve in terms of the unemployment gap. The unemployment gap is equal to negative inflation divided by alpha. Now pluck this expression into the lost function of the central bank and we get beta divided by alpha, times inflation plus inflation squared to get the optimal policy we have to take the first derivative of this function. That is the marginal loss.

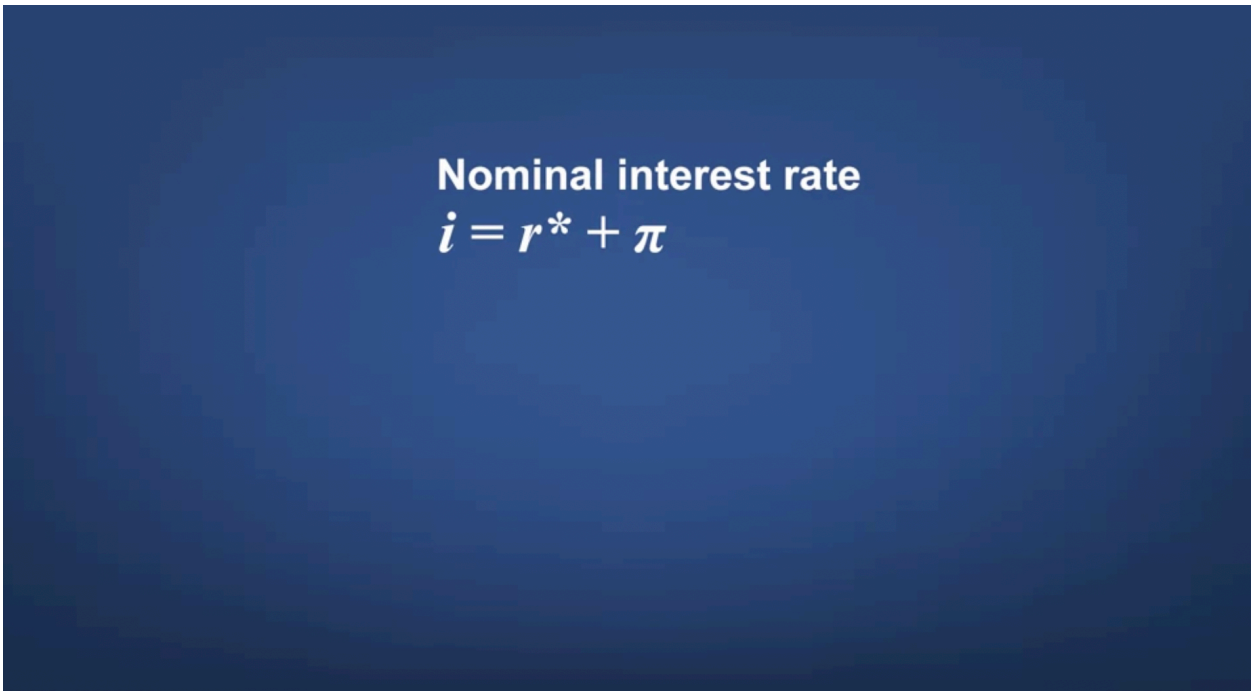


This gives us a marginal loss of minus speeder divided by alpha plus two times inflation. Setting the marginal loss to zero gives us that inflation should be beta divided by two times alpha. This means that the central banks optimal inflation rate in this situation should be larger than the previously announced inflation target of zero. While this policy is optimal for the central bank, it is also inconsistent with the previous announcement. Often inflation target of zero. However, once the central bank has produced inflation over the announced 0%, inflation expectations will not adjust, no matter what the central bank announces next time. Discretionary monetary policy hence can only be successful if the central bank is credible in its anti-announcements and does not deviate too much from its announcements exposed.



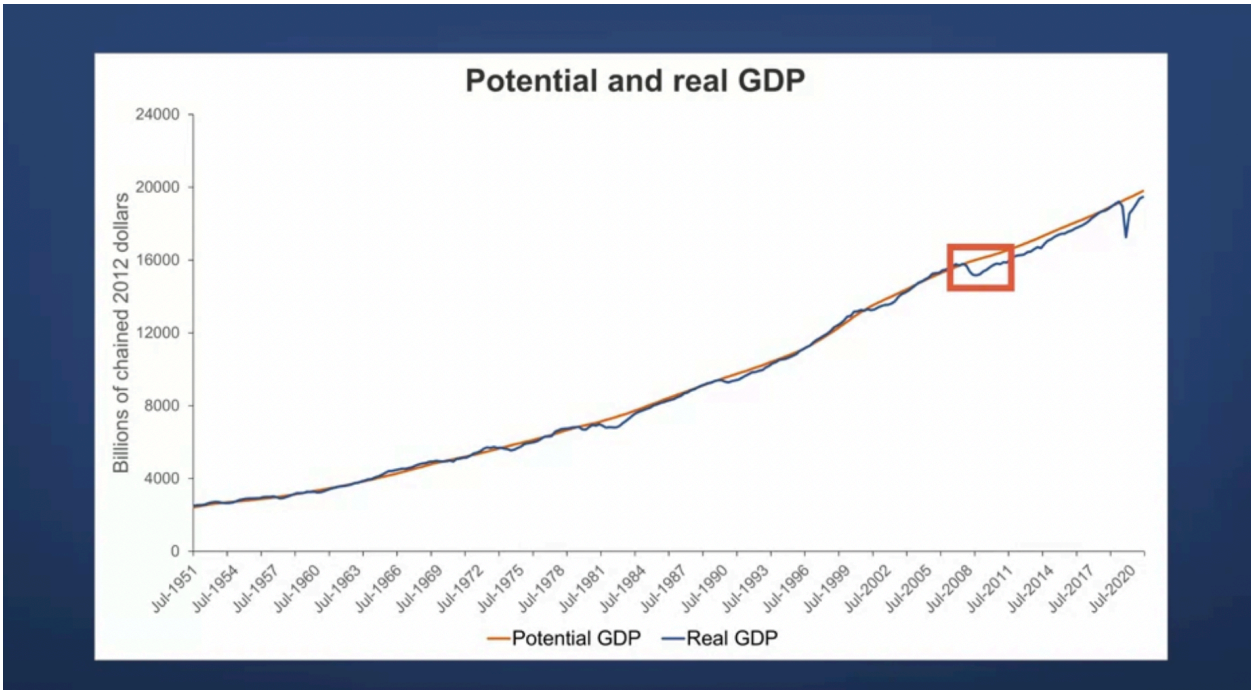
What have we learned in this lesson. First we distinguish rule based and discretionary monetary policy. Second, discretionary monetary policy is more flexible and can react better to changing circumstances. Third, the downside of discretionary policy is that policy makers can focus on short-term gains that would come with long run costs.

Lesson 3-1.4: The Taylor Rule

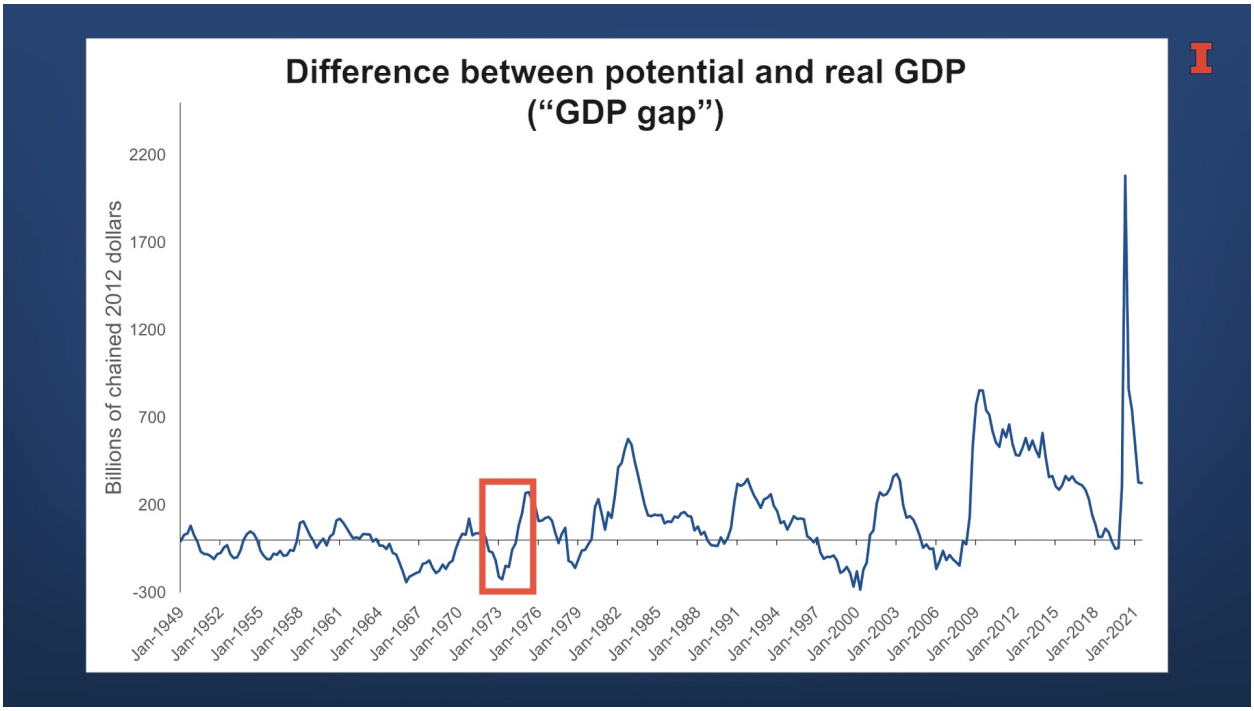


Hello and welcome to this lecture on the so-called Taylor rule. In this class, we will be discussing how monetary policy takes the trade-off between inflation and unemployment into account. In this context, we will examine a simple rule for interest rate setting, the Taylor rule. Let's start with the definition of the nominal interest rate. The nominal interest rate i has two components: the real interest rate, also referred to as r star and inflation Pi. Central bankers target nominal interest rates when setting the federal funds rate. They set the interest rate to fulfill their mandate. In the Federal Reserve's case, stable prices and maximum employment. But central bankers face a trade-off between unemployment and inflation. This trade-off has been formalized in the Phillips curve that we discussed in detail in a different lecture. Since Bohr's stable prices and maximum employment are mandates of the Federal Reserve, you may wonder how this trade-off is approached. For instance, should you put more weight on inflation or more weight on unemployment?

To understand the decision-making process, let us start by defining some useful terms and concepts. First, there's a negative relationship between unemployment and GDP. This relationship is called Okun's law. When the economy is producing fully utilizing its resources, then economists say that the economy is producing its potential GDP. Potential GDP grows over time due to technology, education, and demographic trends. When an economy is at its potential GDP, then this typically implies full employment. Central bankers therefore want to know whether the economy is producing close to potential GDP and therefore close to full employment or not. A commonly used measure is the GDP gap, which is the percentage point difference between real GDP and an estimate of potential GDP.

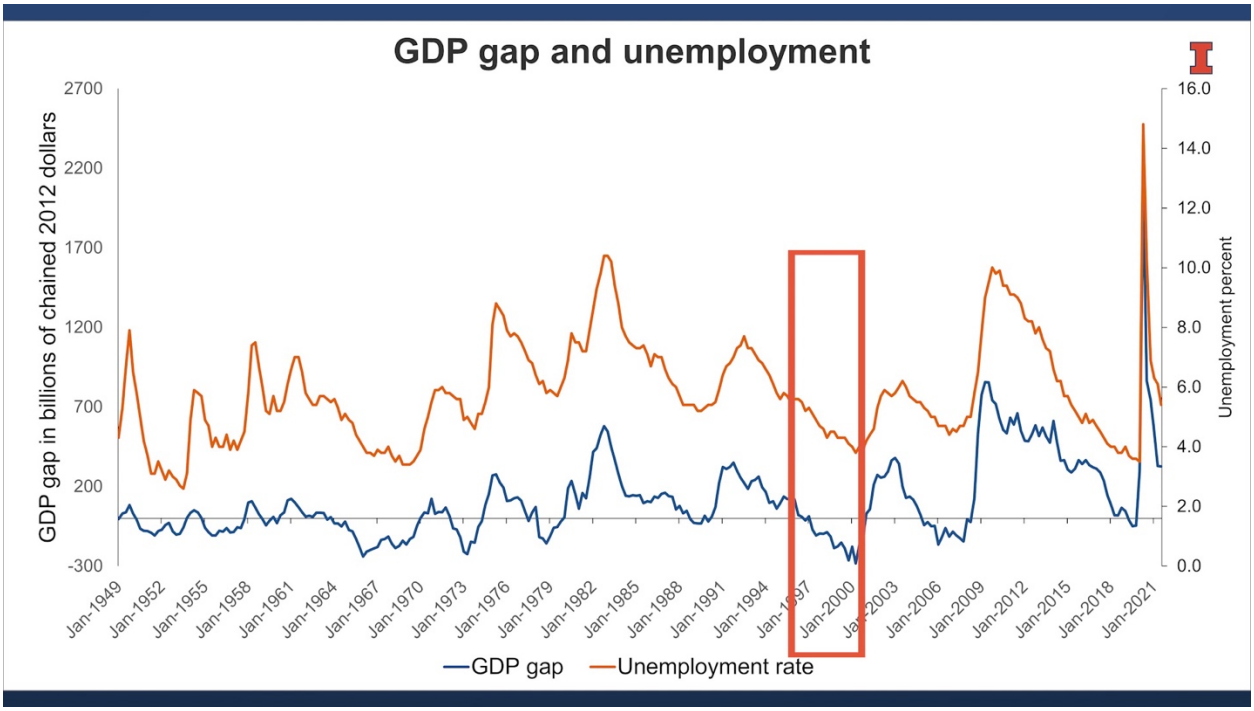


In the chart, you can see the Congressional Budget Office estimate for US potential real GDP up to 2030 and actual real GDP. While the two are tracking each other closely, there are notable deviations. For instance, after the 2008 financial crisis, when real GDP was much lower than potential real GDP. If you squint a little, you can also see times when real GDP is a bit higher than potential real GDP.

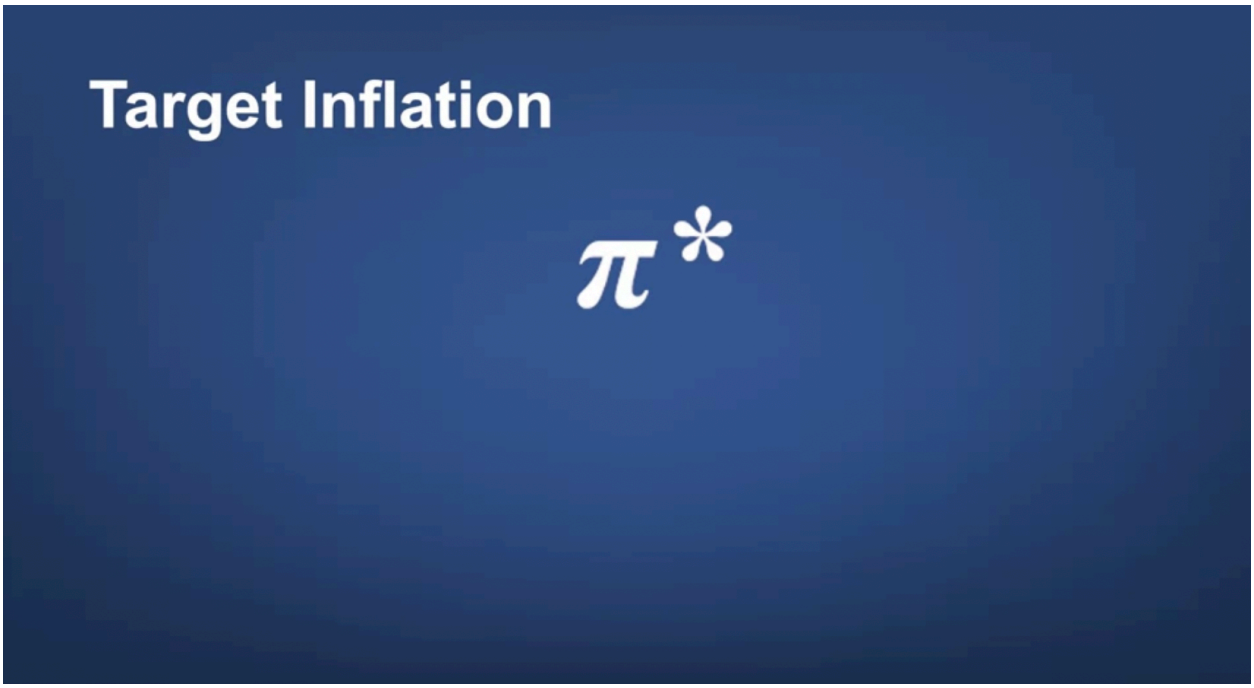


In this graph showing the percentage point output gap, you can see that there was a positive gap in 1973. These are times when resources are used more than they will be in the long run.

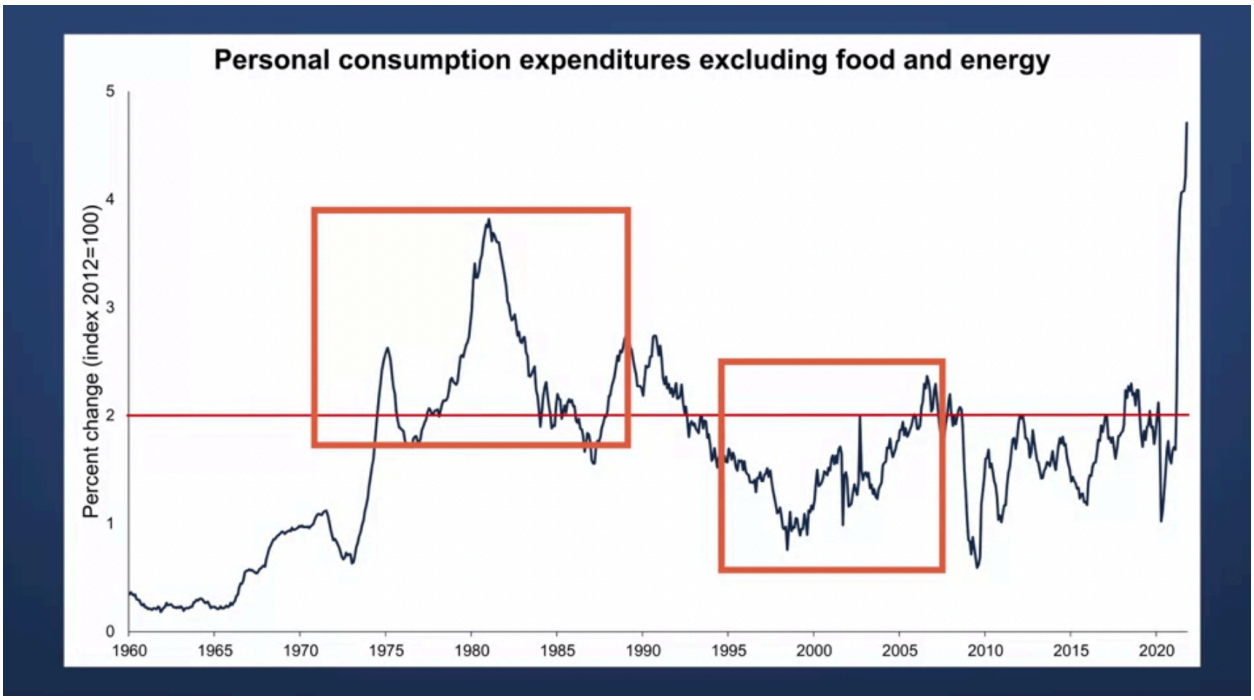
Examples are overtime, extra shifts, and so on. Positive gaps are uncommon and small. They indicate times of booms when the economy runs hard.



Going back to unemployment. In this graph, you can see that when the gap is positive, unemployment is already low and often continues to fall. Look for instance at 1973 or 2000 or 2006 and 2007. The key insight here is that using the GDP gap as an input for monetary policy makes a lot of sense when maximum employment is one of your goals. The second part of the Federal Reserve's mandate is stable prices. What do stable prices mean?

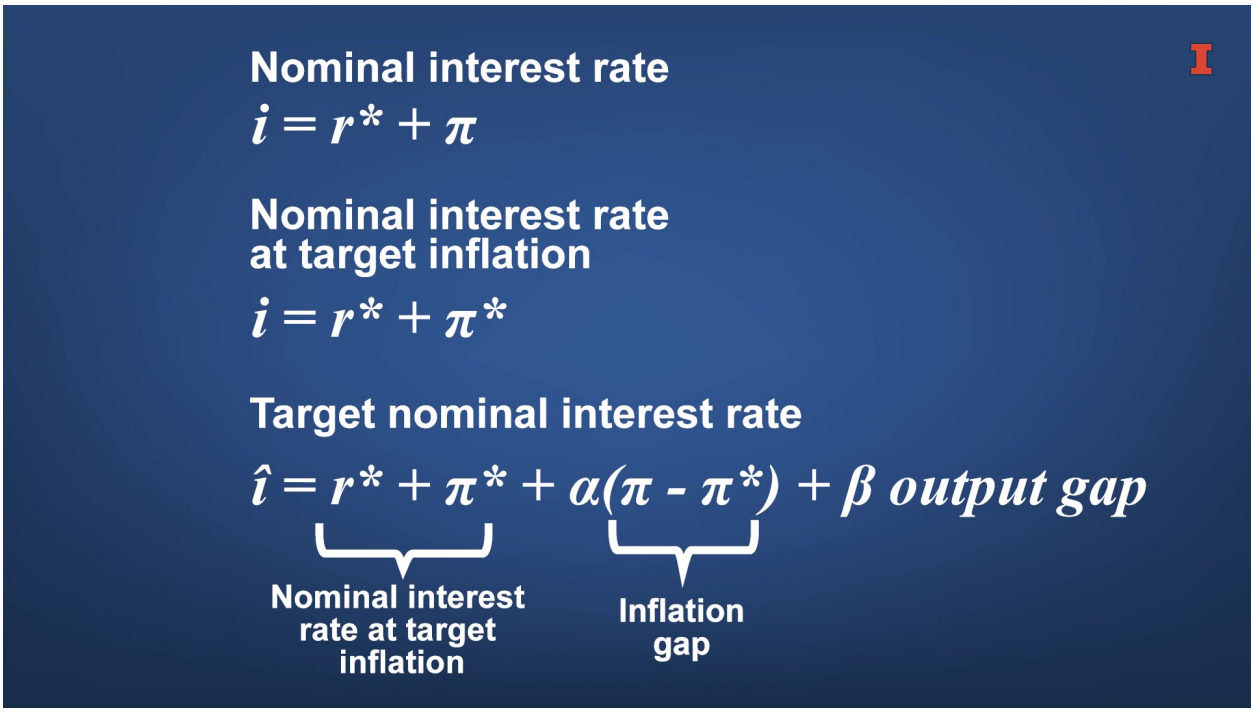


It means there is some target inflation rate Pi star. Academics such as John Taylor, whose rule we are exploring here, have used 2% for Pi star. The Federal Reserve seems to agree. Since 2012, the FOMC has announced it charged an annual rate of 2% consumer price inflation to be most consistent over the long run with the Federal Reserve's statutory mandate. Similarly, the European Central Bank works to achieve inflation below, but close to 2%.

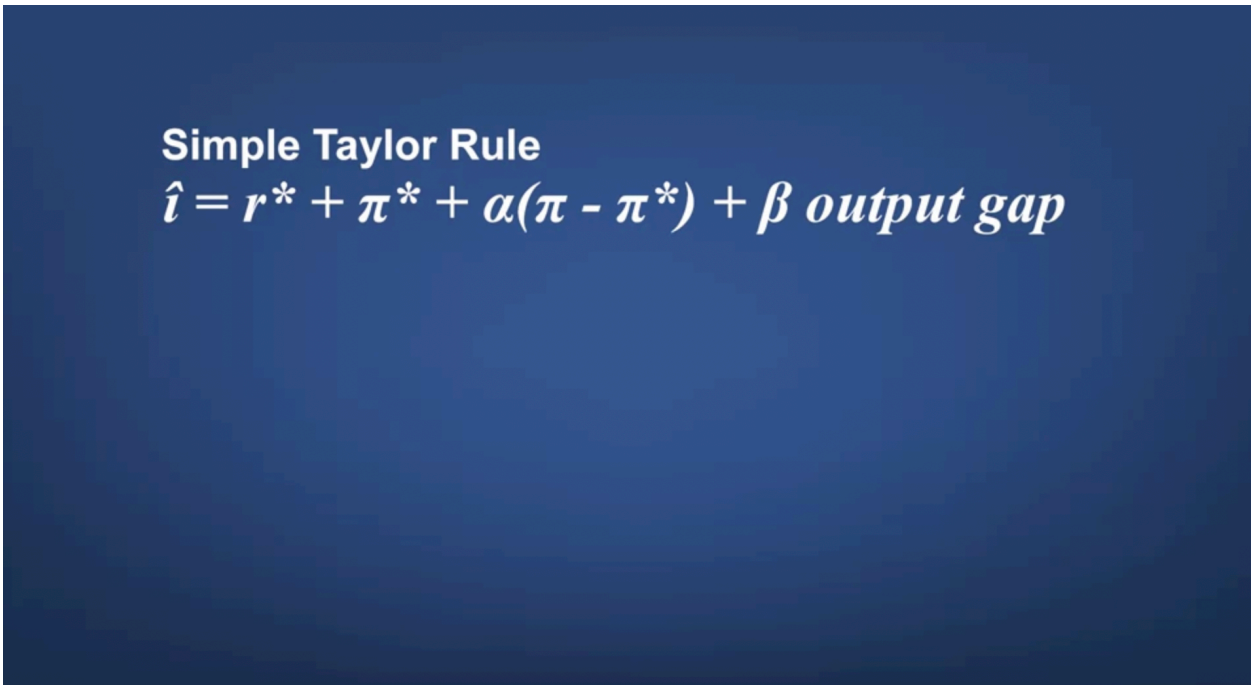


The graph shows you the annual growth rate of personal consumption expenditure inflation. As you can see, inflation was way above target in the 1970s and 1980s. However, since the mid-1990s, inflation has rarely been significantly larger than 2%. In fact, during the late 1990s and in

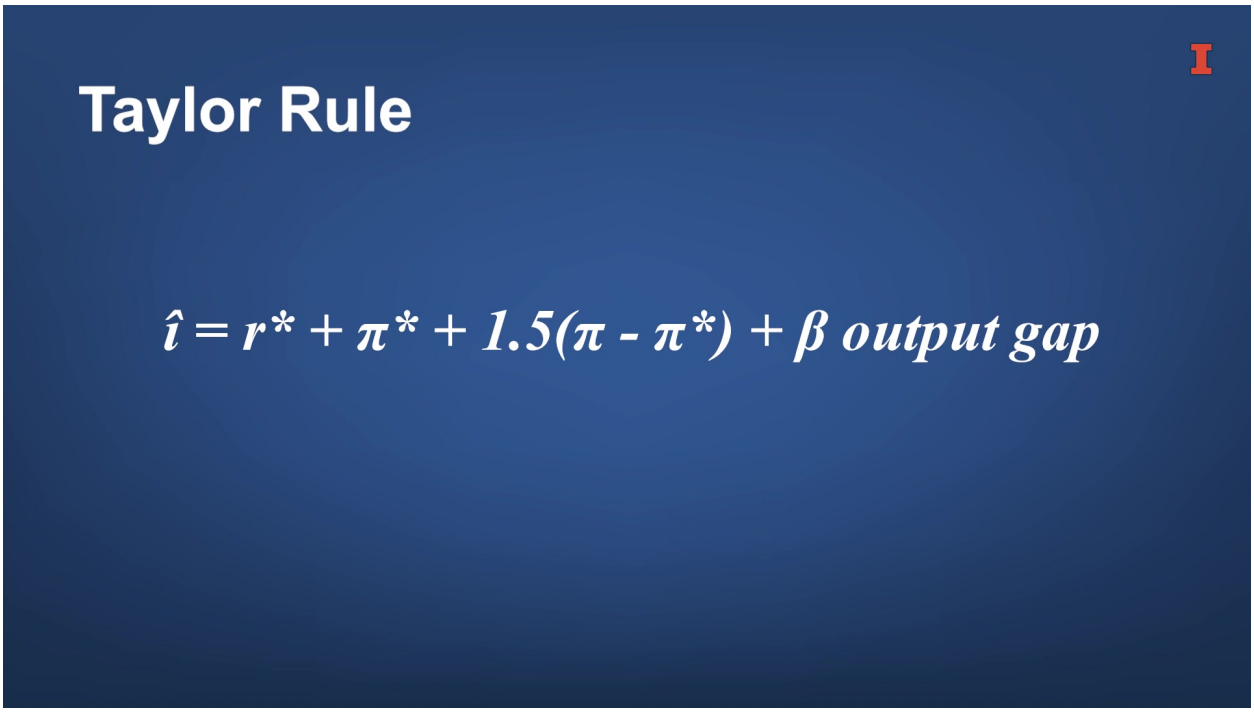
the aftermath of the 2008 financial crisis, inflation was considerably lower than 2%. Just as with the output gap, there is an inflation gap measuring how much inflation differs from the central bank's target inflation rate.



Now recall that the nominal interest rate is equal to the real interest rate r star and inflation Pi. Ideally, we would be at target inflation. The nominal interest rate at target inflation would be r star plus Pi star. But now we have to take deviations in inflation and output into account and weigh them to get a target nominal interest rate, i head for the Central Bank. Let's call the inflation rate alpha and the output rate beta.

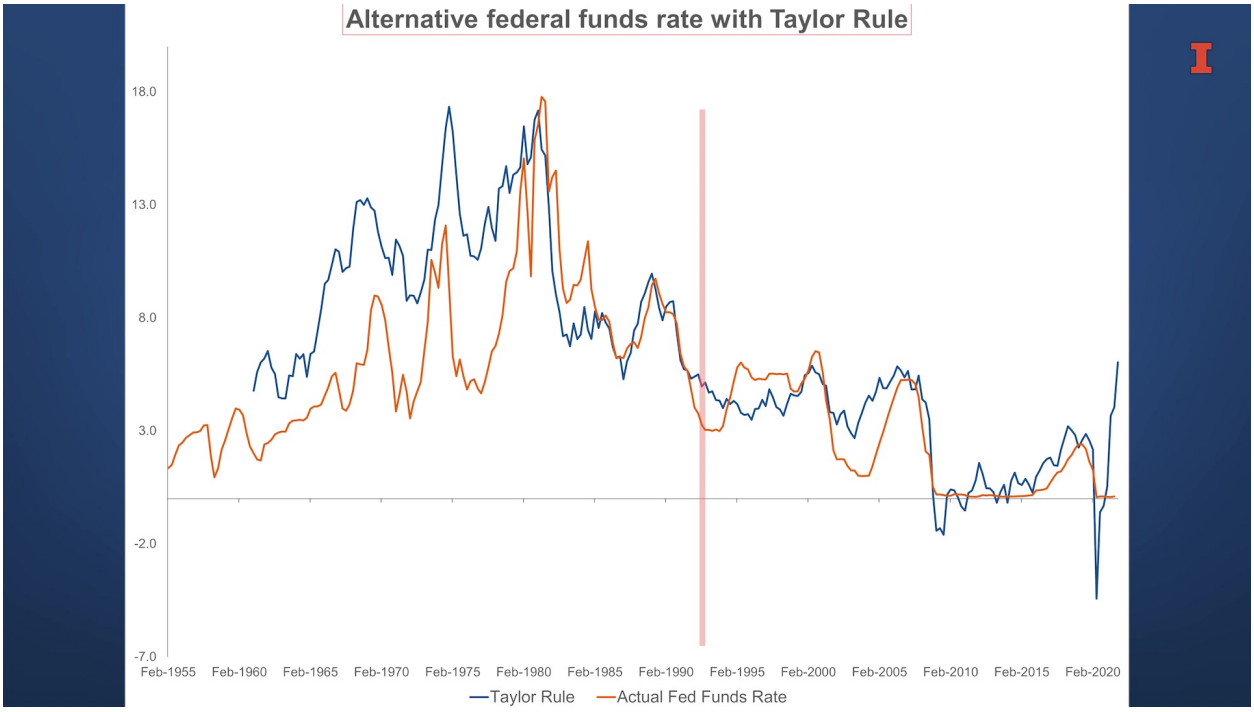


This equation is called the simple Taylor rule. It was proposed by John Taylor in an academic article in 1993. This rule is very parsimonious, but still captures all elements for the decision-making process of the Federal Reserve. Of course, we now have to find values for the inflation rate alpha, and the output gap rate beta. Economic researchers have conducted numerous studies, what these rates should be. Taylor's original recommendation was to set both 2.5.



But now the consensus for the inflation rate alpha is 1.5 while the output gap rate beta

estimates vary bet ween 0.5 and 1. Let's have a look how this rule performs when we set alpha to 1.5 and beta to 1.



The graph shows you the actual federal fund's rate and the target nominal interest rate implied by the simple Taylor rule. As you can see, the simple Taylor rule tracks the federal fund's rate remarkably well, even after 1993 when the original study was published. Of course, the Taylor rule is not perfect. For instance, it assumes that there is no constraint on the interest rate. Meaning that in the Taylor rule, the interest rate can go negative, for instance, in early 2009. Since the original study, several extensions were proposed, but the simple rules still captures the essence of the Federal Reserve's interest rate setting considerations well. In fact, the Federal Reserve has considered the simple Taylor rule as one monetary policy alternative in its internal forecast, the Tealbook.

Near-Term Prescriptions of Simple Policy Rules

	Constrained Policy		Unconstrained Policy	
	2011Q1	2011Q2	2011Q1	2011Q2
Taylor (1993) rule	**0.13**	**0.13**	**-0.90**	**-0.81**
Previous Tealbook	*0.13*	*0.13*	*-0.82*	*-0.71*
Taylor (1999) rule	**0.13**	**0.13**	**-4.09**	**-3.89**
Previous Tealbook	*0.13*	*0.13*	*-4.21*	*-4.00*
Estimated outcome-based rule	**0.13**	**0.13**	**-0.42**	**-1.05**
Previous Tealbook Outlook	*0.13*	*0.13*	*-0.51*	*-1.17*
Estimated forecast-based rule	**0.13**	**0.13**	**-0.42**	**-0.98**
Previous Tealbook Outlook	*0.13*	*0.13*	*-0.47*	*-1.05*
First-difference rule	**0.16**	**0.26**	**0.16**	**0.26**
Previous Tealbook Outlook	*0.19*	*0.43*	*0.19*	*0.43*

Memo	2011Q1	2011Q2
Staff assumption	0.13	0.13
Fed funds futures	0.15	0.13
Median expectation of primary dealers	0.13	0.13
Blue Chip forecast (December 1, 2010)	0.20	0.20

Note: In calculating the near-term prescriptions of these simple policy rules, policymakers' long-run inflation objective is assumed to be 2 percent. Explanatory Note B provides further background information. The first-difference rule, the estimated outcome-based rule and the estimated forecast-based rule include the lagged policy rate as a right-hand-side variable. Since this Tealbook is published late in the quarter, the lines denoted "Previous Tealbook Outlook" report rule prescriptions based on the previous Tealbook's staff outlook, but jumping off from the average value for the policy rate thus far this quarter.

This table from the December 2010 Tealbook, shows you that the simple Taylor rule and the adjusted Taylor rule, were considered for setting future interest rates. The constraint policy refers to interest rates not going below zero, where the unconstrained policy shows that the simple Taylor rule calls for negative interest rates after the financial crisis.

Summary

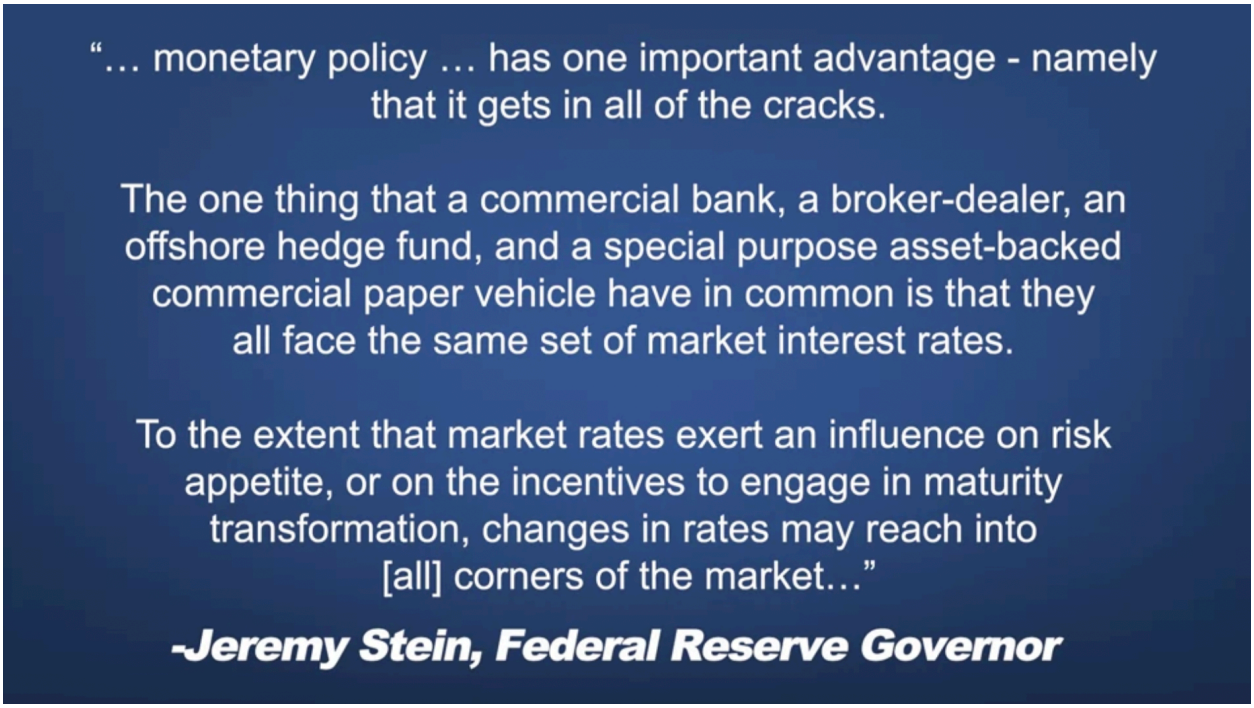
- Interest rate: Inflation vs. output gap
- Optimal rate can be determined with simple formula
- Most common formula: Taylor Rule

What have we learned in this lesson? First, central bankers consider deviations from potential output and target inflation when setting interest rates. Second, interest rates decisions can be

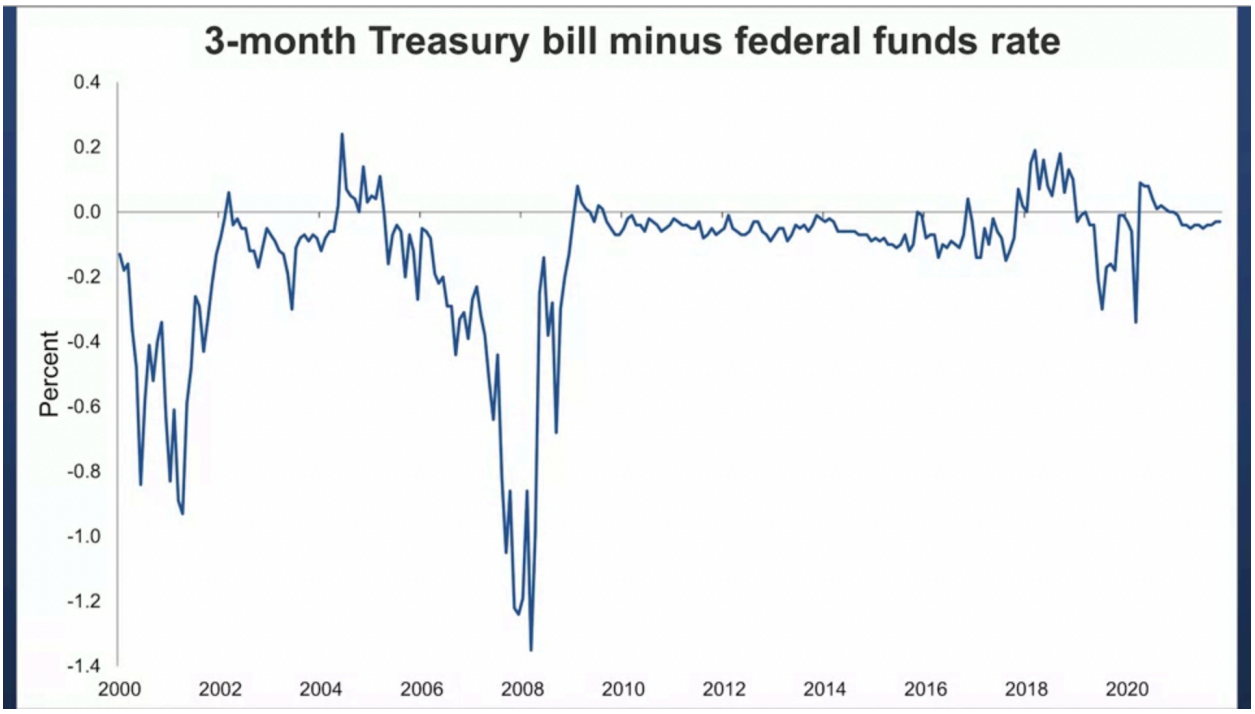
described in a simple formula that weigh deviations from potential output and target inflation. Third, the most common formula summarizing interest rates decisions is the Taylor rule.

Lesson 3-2: Transmission of Monetary Policy

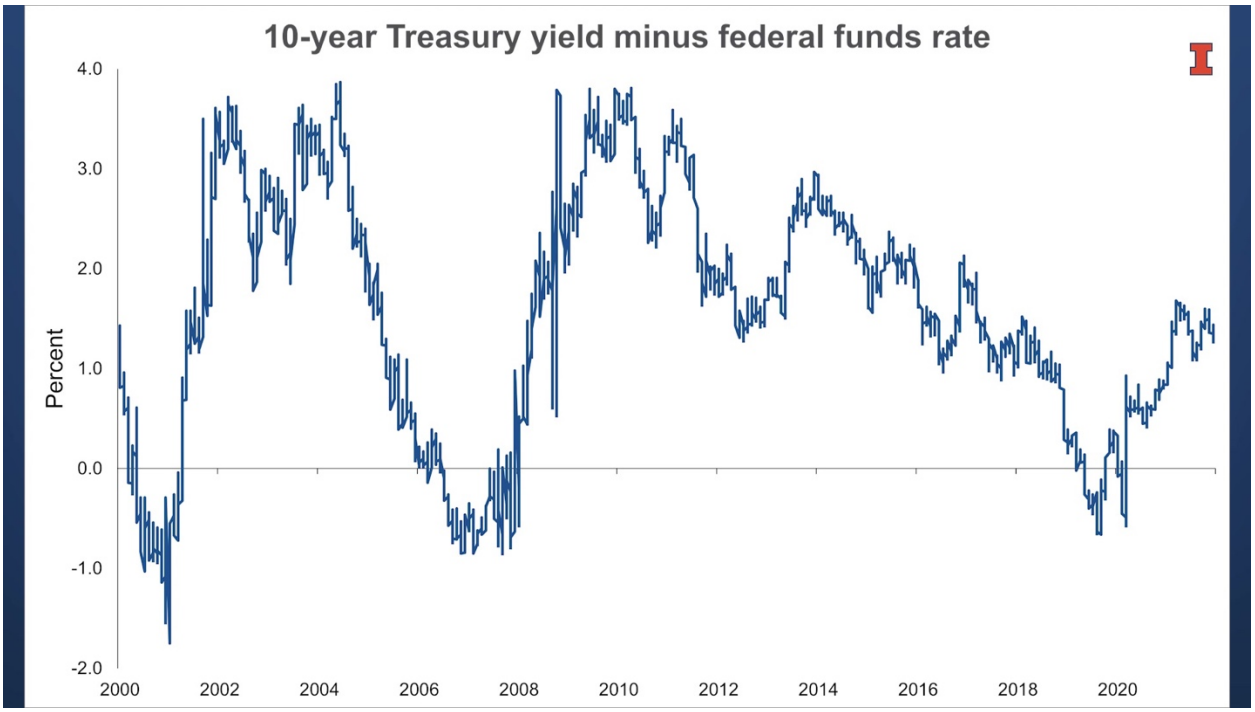
Lesson 3-2.1: How Do Changes in Monetary Policy Affect the Economy?



Hello and welcome to this lecture on how monetary policy affects the economy. In this class, we're going to take a 30,000 feet perspective and discuss how monetary policy affects the economy in general. We will talk about how firms and households are affected, and we'll look at how macroeconomic variables respond to increases in the federal funds rate. The Federal Open Market Committee, FOMC, adjusts monetary policy in response to changes in economic conditions. The most common response is raising or lowering the federal funds rate. A change in the federal funds rate will lead to changes in other interest rates and in financial conditions in the economy. In turn, loss changes will then affect the spending decisions of households and businesses, affecting economic growth, employment, and inflation. As the then Federal Reserve Governor, Jeremy Stein, put it in a speech in 2013, "Monetary policy has one important advantage - namely that it gets in all the cracks. The one thing that a commercial bank, a broker dealer, an offshore hedge fund, and a special purpose asset-backed commercial paper vehicle have in common is that they all face the same set of market interest rates. To the extent that the market rates exert an influence on risk appetite, or on the incentives to engage in maturity transformation, changes in rates may reach in all corners of the market." The effects of a change in the federal funds rate are most obvious for the short-term interest rates. The federal funds rate is an overnight interest rate. Let's look at how different the yield, that is, the rate of return on three-month US treasury bills, is from the federal funds rate.

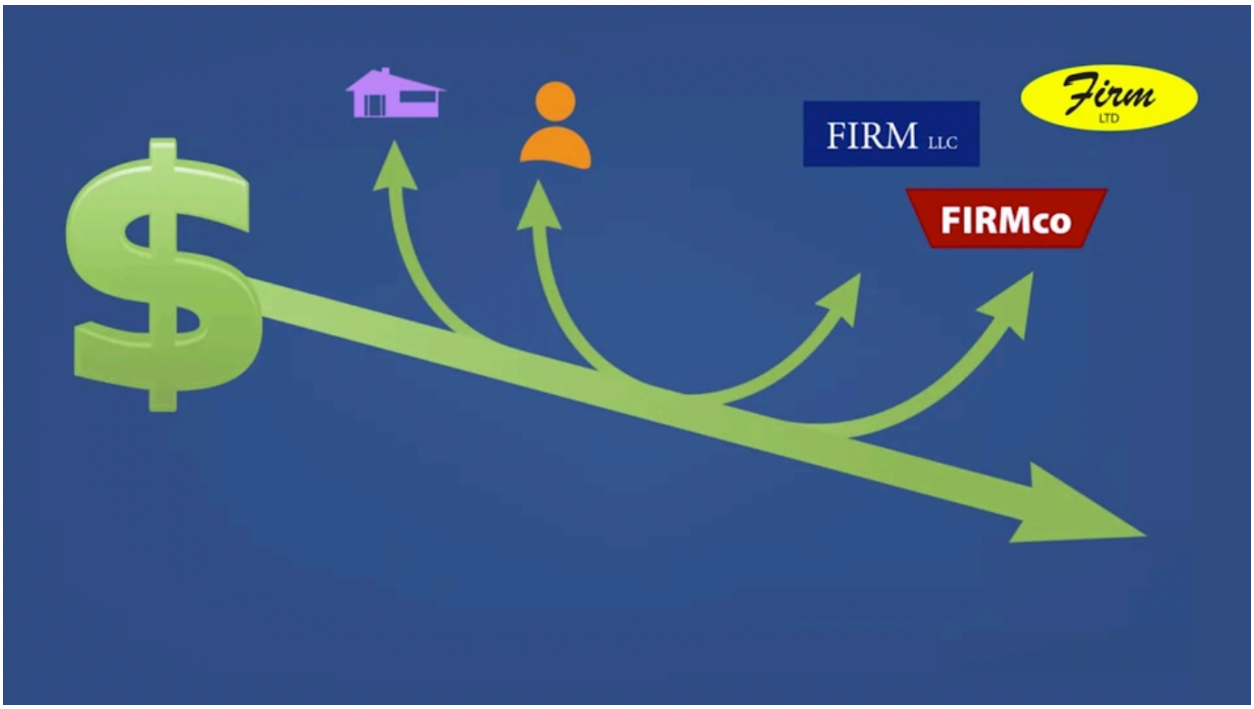


The graph shows that the difference between the two is close to zero. This means that the yield on the three-month US treasury bill moves almost one-to-one with the federal funds rate. Changes in short-term market interest rates are transmitted to medium and longer-term interest rates.



This graph shows you the difference between the yield on a 10-year treasury note and

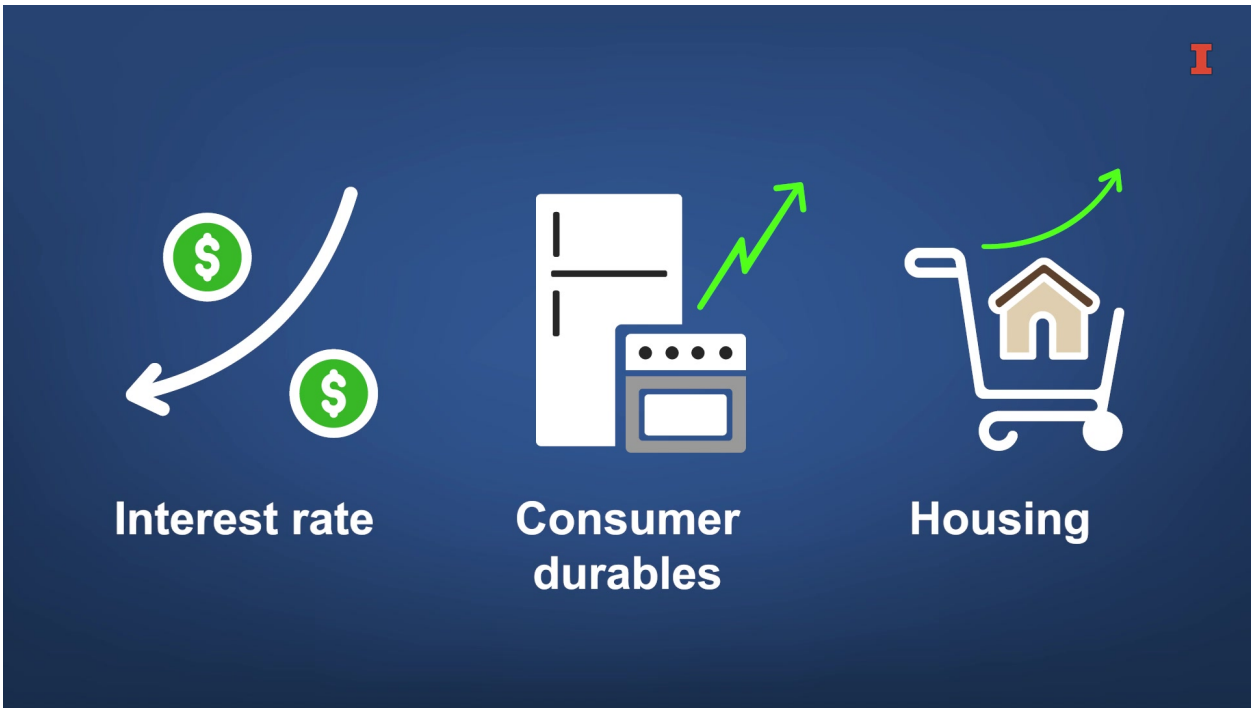
the federal funds rate. You can see that there is not a one-to-one relationship. More generally, the effect of a federal funds rate change on shorter-term interest rates will be larger than the effect on longer-term rates as longer-term rates incorporate expectations over longer horizons. This also means that medium and longer-term interest rates respond to how people expect the federal funds rate to change in the future. For example, if borrowers and lender think that the federal funds rate is going to increase substantially over the next several years, then medium-term interest rates today will be higher than short-term interest rates. This is one reason why forward-looking statements about future federal funds rate changes of the FOMC are heavily scrutinized by financial market participants.



Let's assume that the long-term interest rates are declining because of FOMC easing of monetary policy. This will make it cheaper for firms to take out loans and invest. Similarly, consumer loans and mortgages will become cheaper, stimulating consumption.

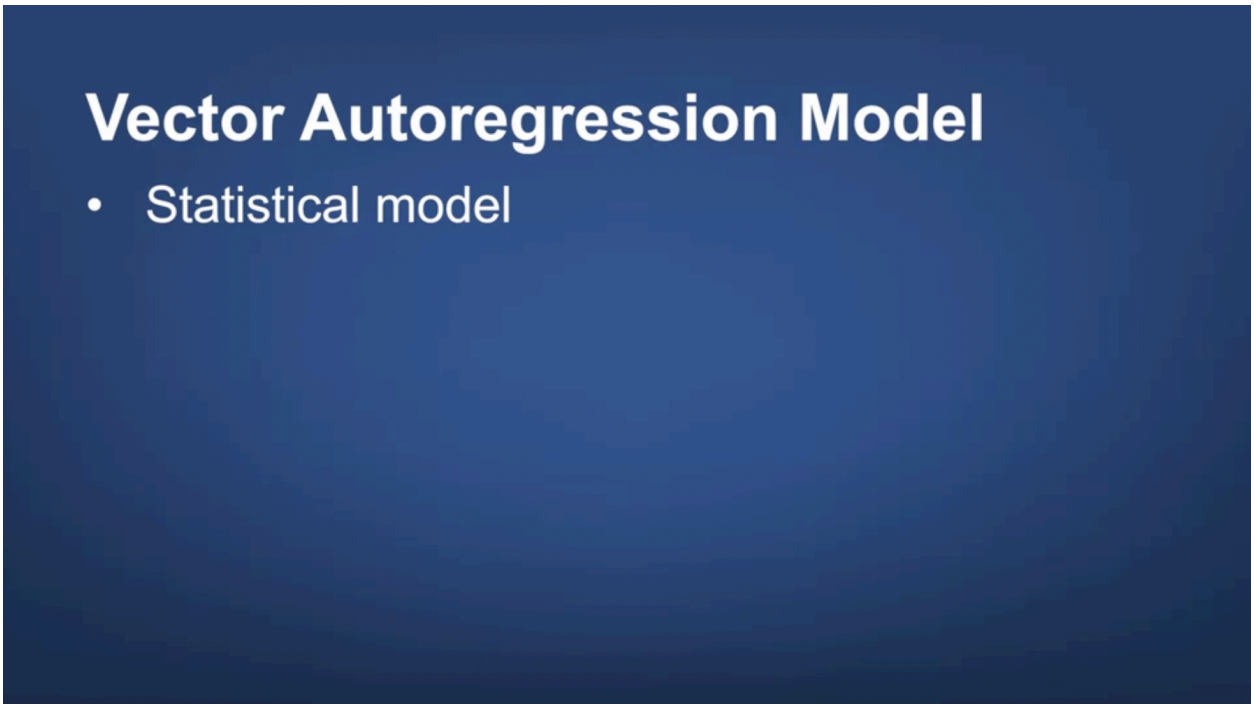
Lower long-term interest rates will also make yields on US dollar assets less attractive to international investors. These investors may then invest less in dollar-denominated assets, lowering the value of the dollar. A dollar depreciation tends to boost US exports as US goods become cheaper abroad. At the same time, imported goods become more expensive, giving you, as consumers and firms, an incentive to purchase domestically-produced goods. Longer-term interest rate changes also affect stock prices. Usually, we think about the market value of a firm as the discounted value of all future dividends.

When long-term interest rates decrease, the discount rate for future dividends becomes more favorable, and the market value of a firm, and therefore, the stock price increases. This increase in stock prices increases personal wealth, which in turn increases consumption.

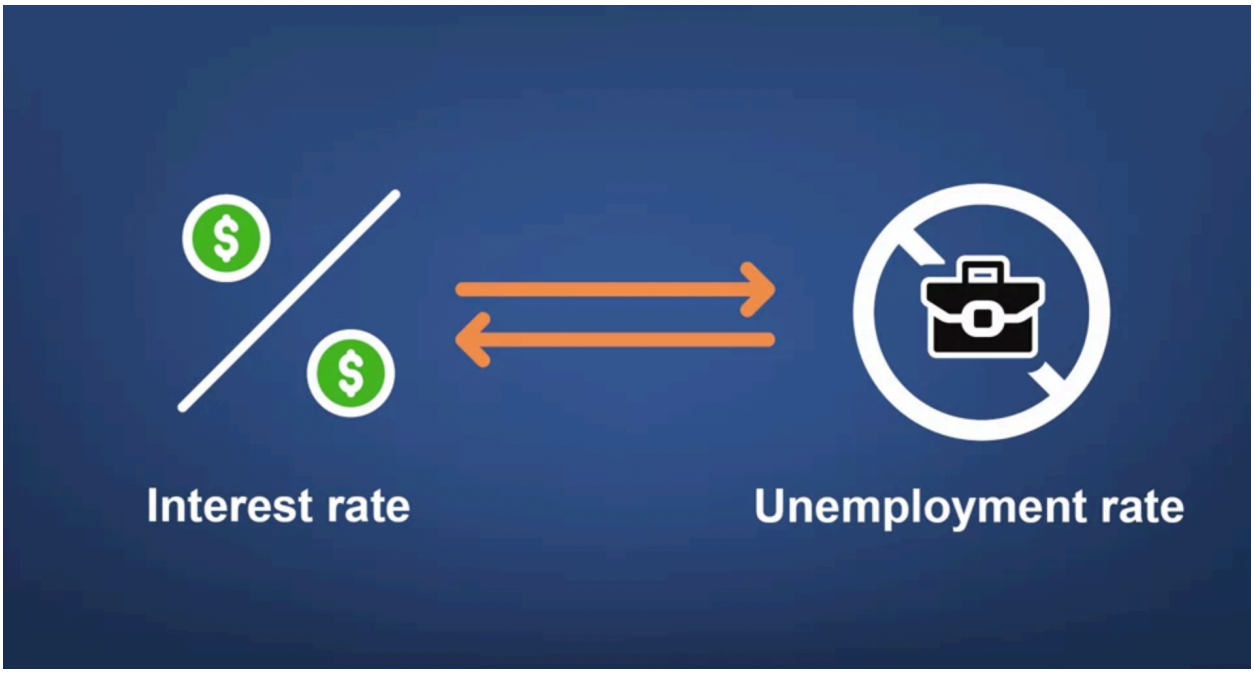


Let's put all these pieces together. Changes in longer-term interest rates, stock prices, and the dollar will affect a wide range of spending decisions of households and

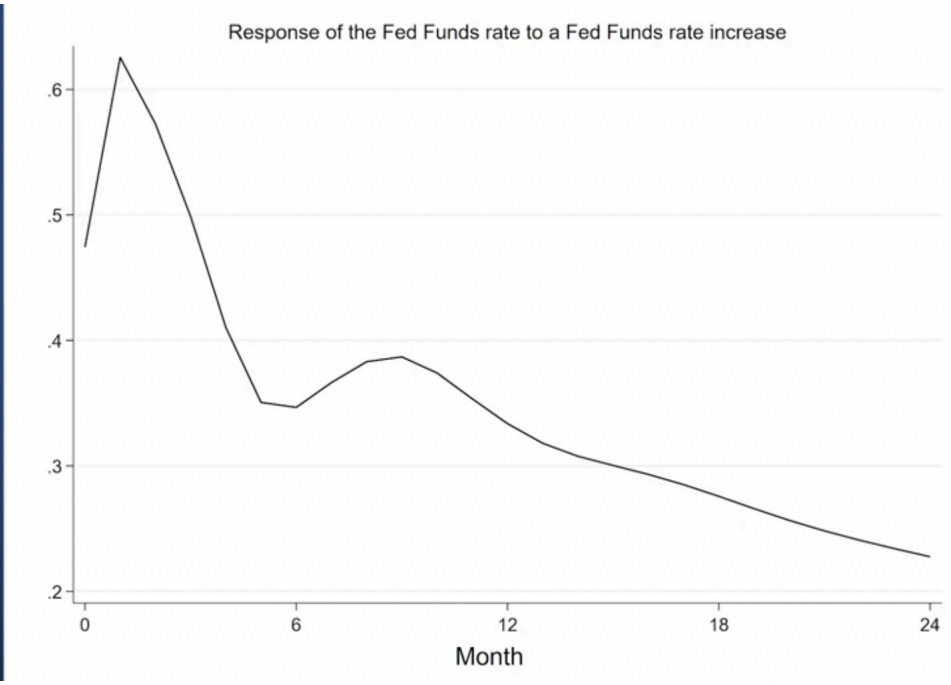
businesses. Lower long-term interest rates typically lead to more spending on durable goods, such as appliances. Lower long-term interest rates also result in lower mortgage rates, which makes buying a house or renovating a house more affordable. Owners of stocks may spend more on their stock portfolio, and therefore, their wealth increases in value. For businesses, the cost of investments decline because of reduced financing costs. Let's analyze some data to explore these effects. We want to know what happens to industrial production, money supply, the unemployment rate, and consumer prices after an increase in the federal funds rate. For this purpose, we are estimating a vector autoregression model.



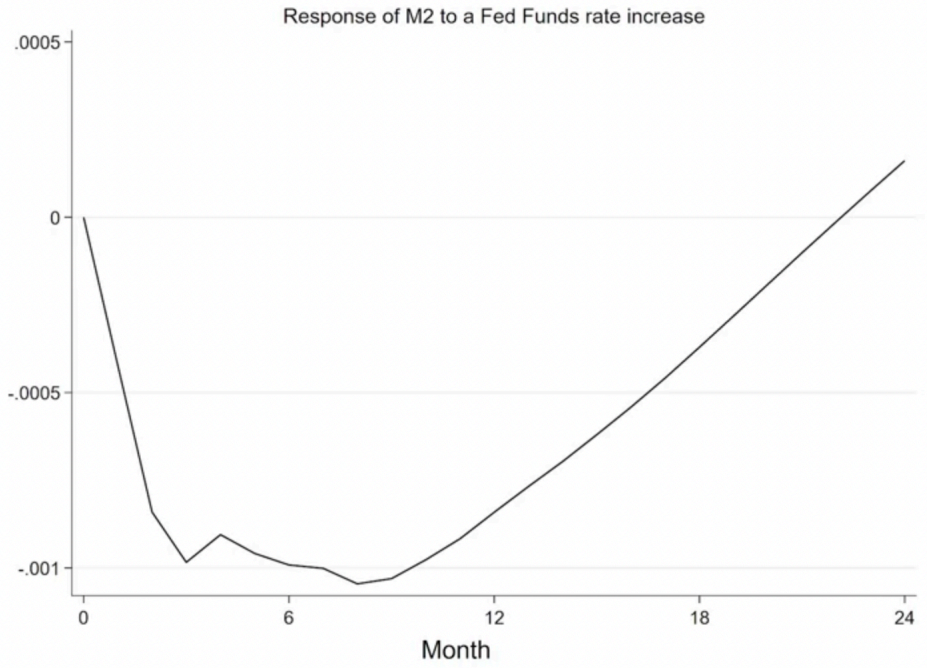
A vector autoregression is a statistical model that captures the relationship between multiple quantities as they change over time. This type of analysis was advocated by the Nobel Prize-winning economist, Chris Sims. Let me skip over the details on how a vector autoregression is implemented and just give you the intuition with a simple example.



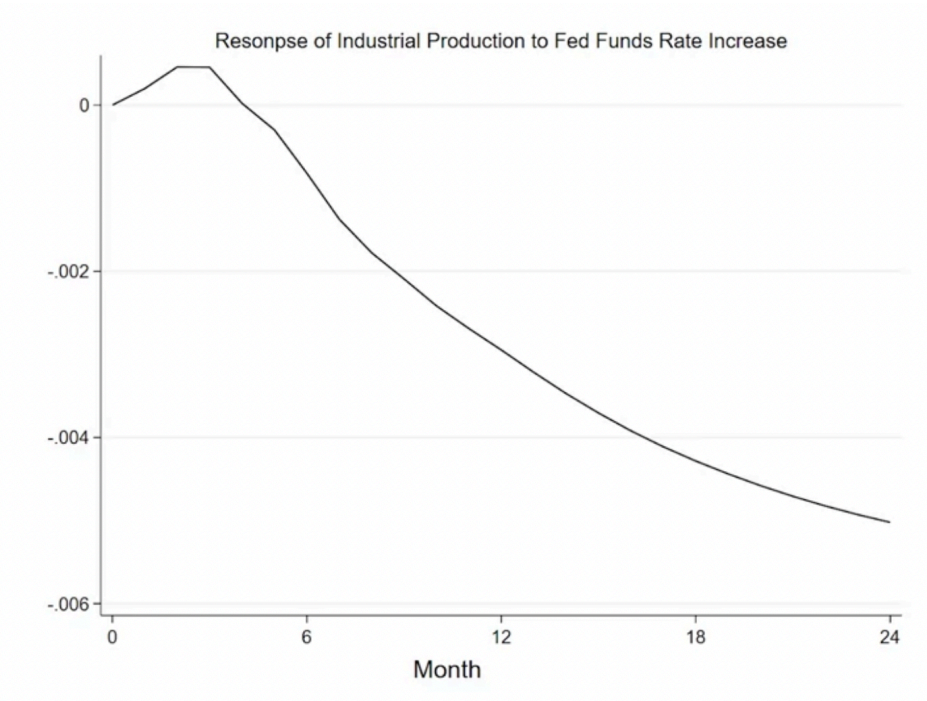
You want to know how the unemployment rate responds to changes in the federal funds rate. The problem is that the Federal Reserve's mandate includes maximum employment, so the FOMC looks at the unemployment rate when making the interest rate decision. Conversely, unemployment depends on firm's investment decisions, which in turn depend on the interest rate, so you don't really know what causes what. A vector autoregression accounts for these interrelationships. Simple assumptions allow you to identify the effect of the federal funds rate increase on unemployment. In this example, all you need to assume is that the current federal funds rate response to current unemployment but changes in the federal funds rate today will only affect unemployment tomorrow and not today. This is a pretty plausible assumption. Now, let us look at what happens to industrial production, money supply, the unemployment rate, and consumer prices after an increase in the federal funds rate using monthly data.



This graph shows you what happens to the federal funds rate over a two-year horizon after a one-time surprise increase of about 50 basis points. You will notice that the interest rate is likely to further increase in the short run but then the effect of the interest rates surprise wears off. Keep this graph in mind because it reflects the change in interest rates that will affect all other variables. The Federal Reserve implements federal funds rate increases with open-market operations. Specifically, the Fed will be selling securities and receiving cash in form of reserves in return.

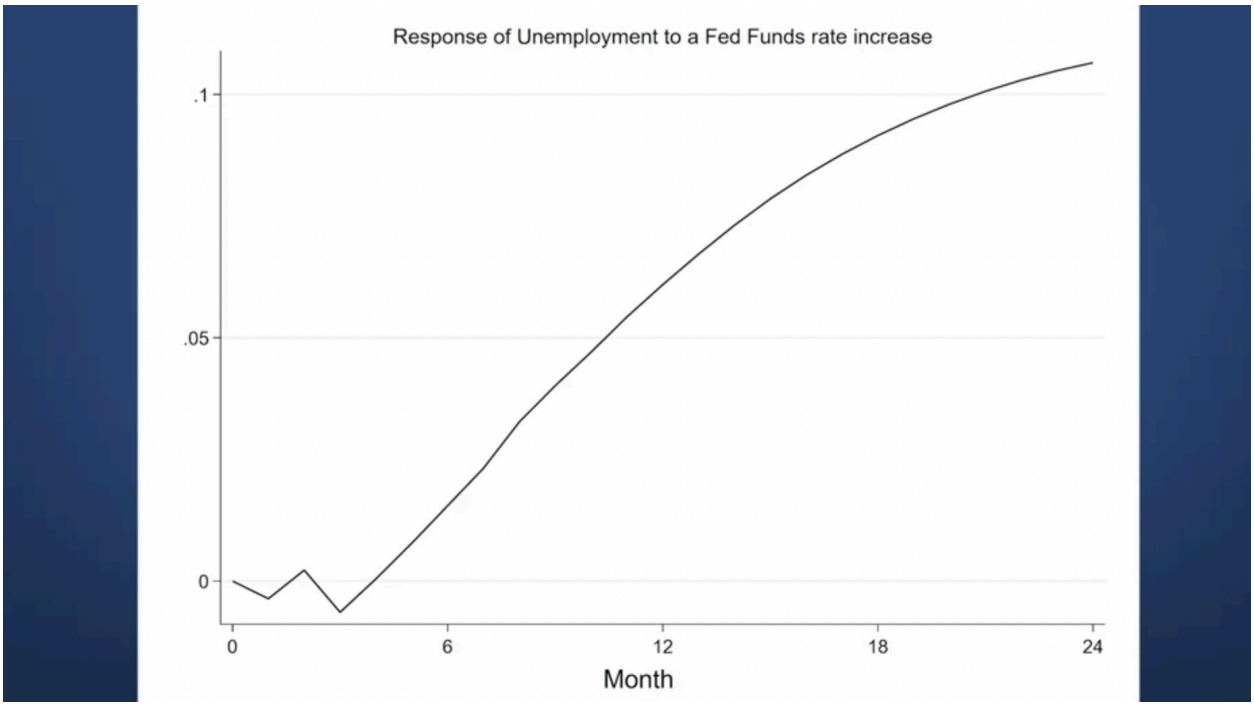


Reserves are part of the money supply here measured with M2. As you can see, the money supply shrinks right with the increase in the federal funds rate and it takes about two years for the effect to vanish. With less reserves, banks have less funds to lend reducing credit supply. Now, let's look at how these changes affect industrial production.



In the graph, you see that it takes about six months for industrial production to go down. This is an important point: monetary policy affects the economy with a lag. There are at

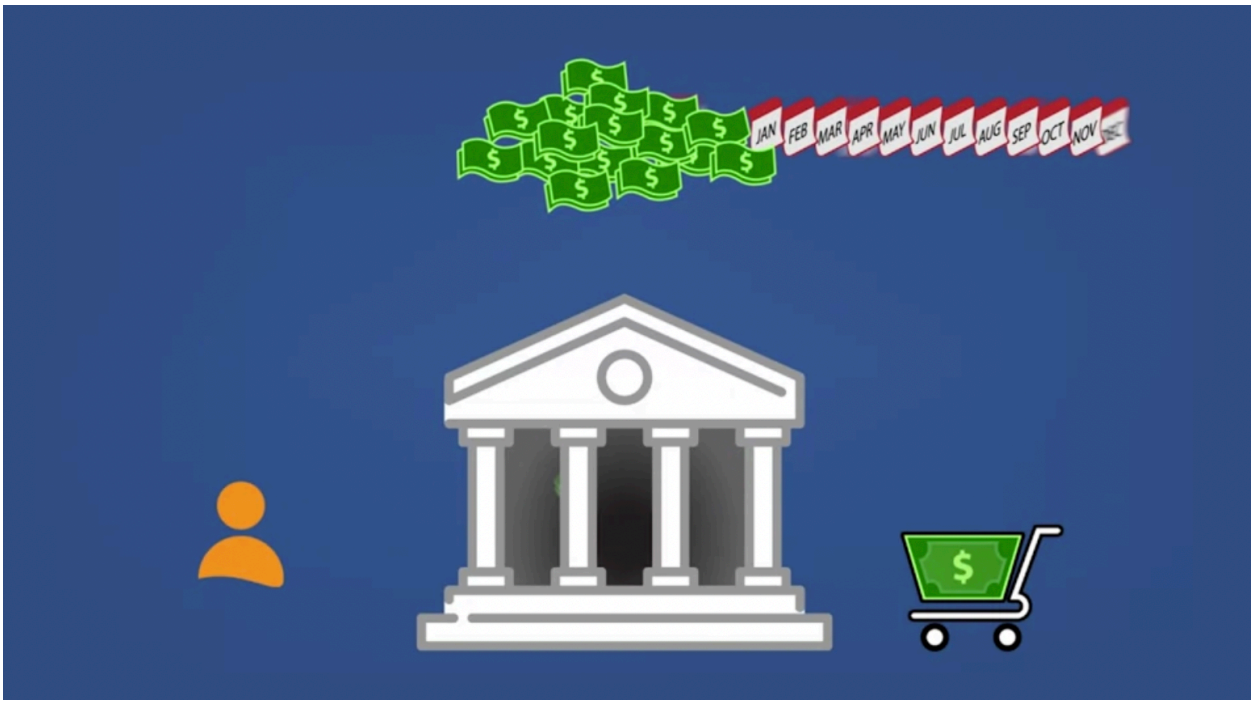
least two reasons for that. First, firms may have already received funding for investment plans and they're still implementing them. Second, it may take some time until changes in the interest rate affect consumer spending.



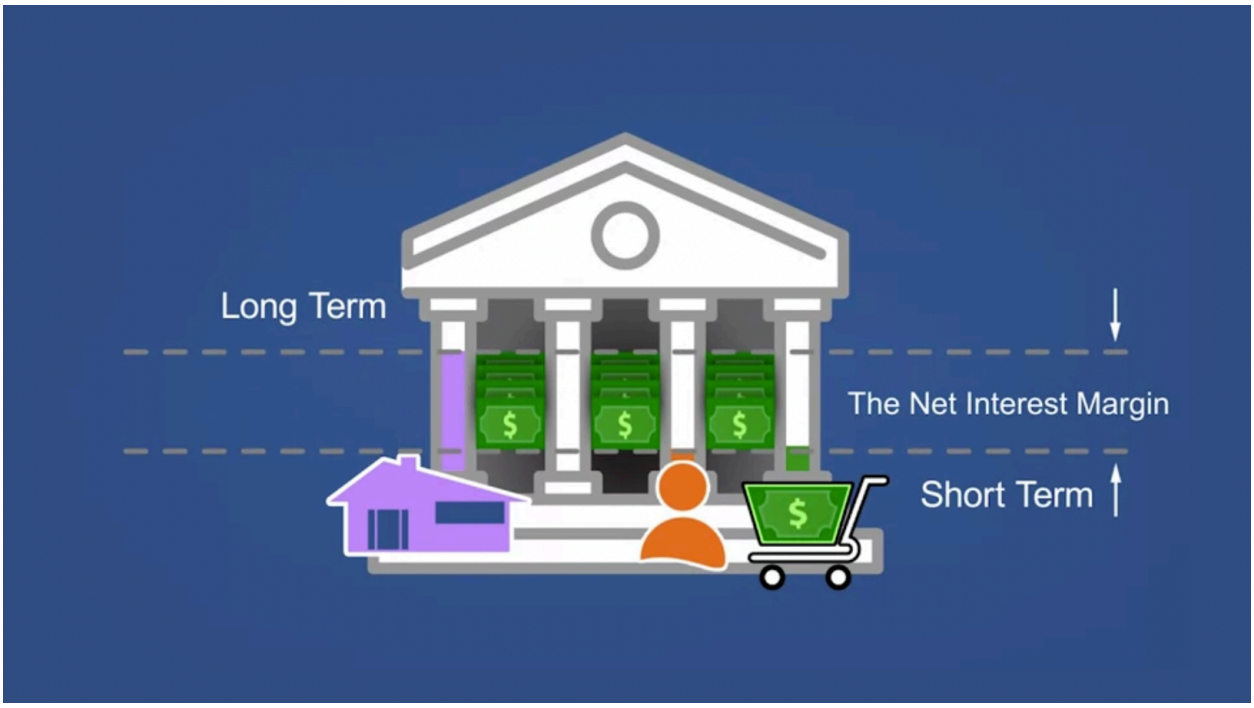
Unemployment is the mirror image of industrial production. It takes a couple of months, but with industrial production declining, unemployment starts to rise. If the FOMC increases the federal funds rate because it is concerned about the economy running too hard, then over the medium run, unemployment will increase somewhat. Conversely, a reduction in the federal funds rate will stimulate the economy and reduce unemployment. This leaves us with inflation. In this simple analysis, inflation actually goes up after an increase in the federal funds rate. This has long puzzled researchers. More advanced analysis revealed that this increase in consumer prices is driven by measurement issues. For instance, if you use the GDP deflator that captures the level of prices of all new domestically produced final goods and services, including those used by industry as a measure of inflation instead of personal consumer expenditure inflation, you find a negative response to a federal funds rate increase. There is evidence that inflation goes down when the federal funds rate was raised.

What have we learned in this lesson? First, on the aggregate level, monetary policy affects all interest rates, the exchange rates, stock prices, and eventually, consumption and investment. Second, empirical analysis shows that after surprise increase in the federal funds rate, money supply falls, industrial production goes down, unemployment increases, and prices decline.

Lesson 3-2.2: The Bank Lending Channel

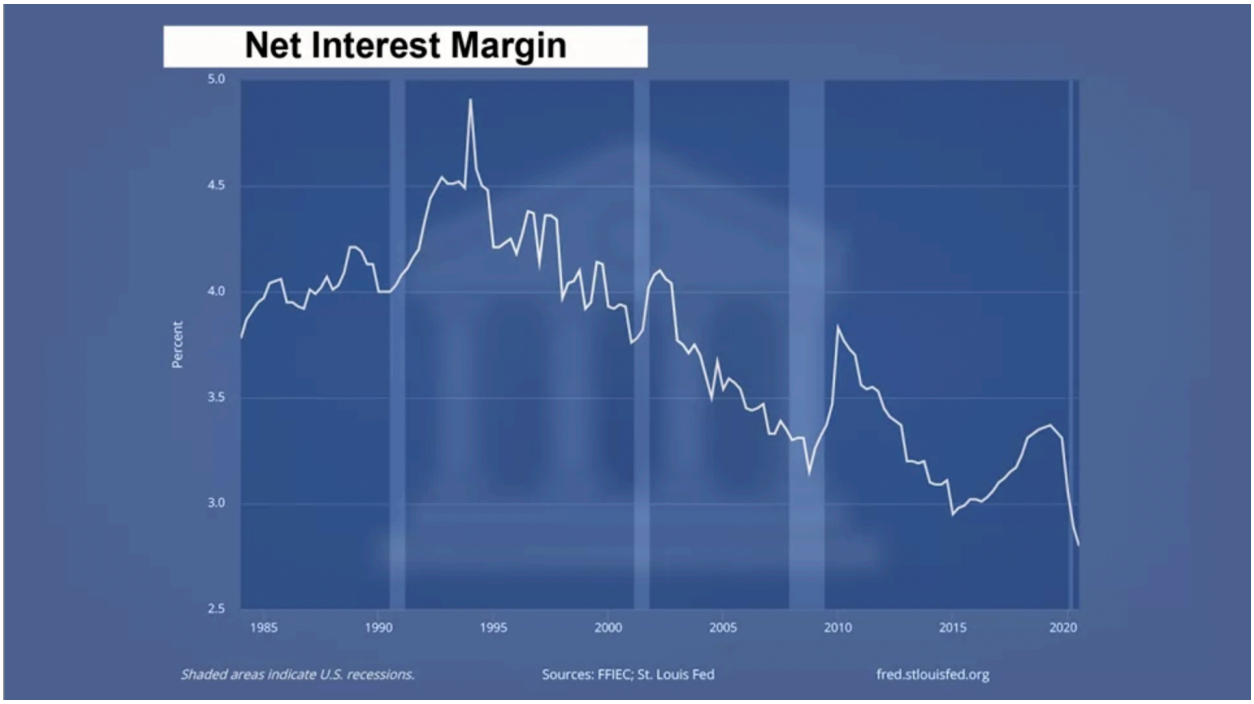


Hello, and welcome to this lecture on the bank lending channel of monetary policy. In this class, we examine how monetary policy affects credit supply from banks. We will discuss three mechanisms: net interest rate margin, reserves, and deposits. Consider the business model of a bank. A bank borrows short-term from depositors and money market funds, and uses these funds to originate longer-term loans.

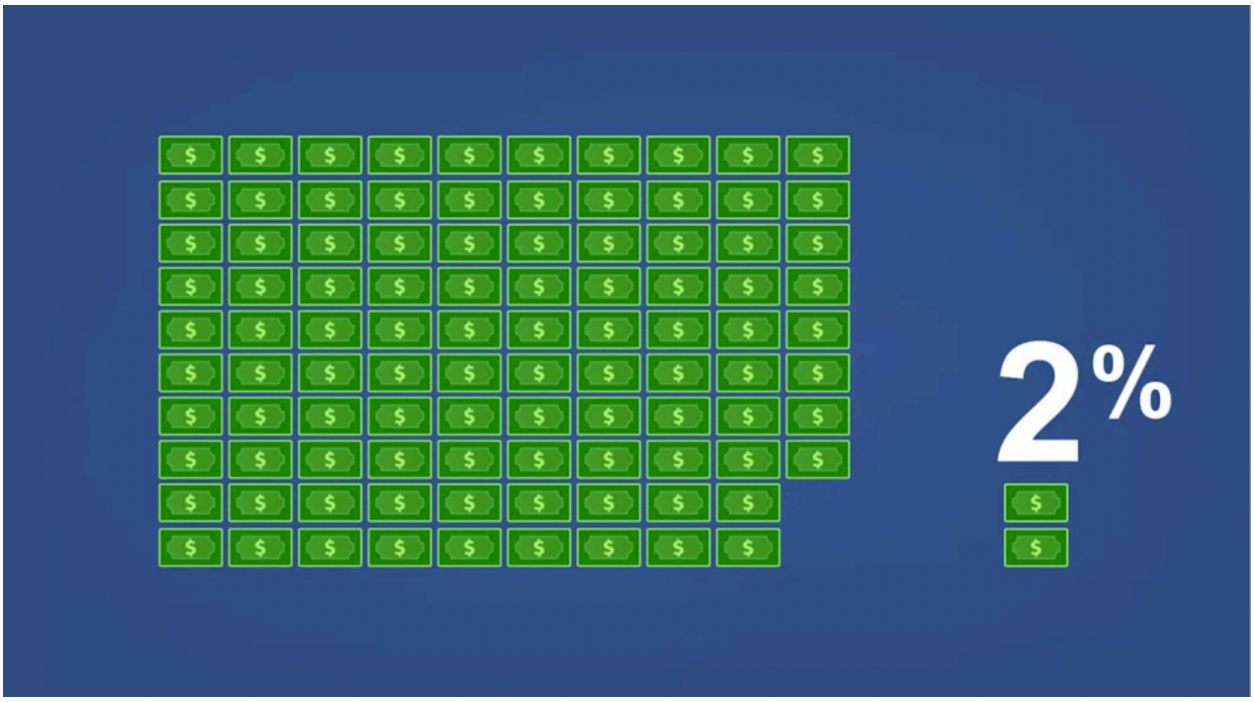


Since short-term interest rates are usually lower than long-term interest rates, the bank makes

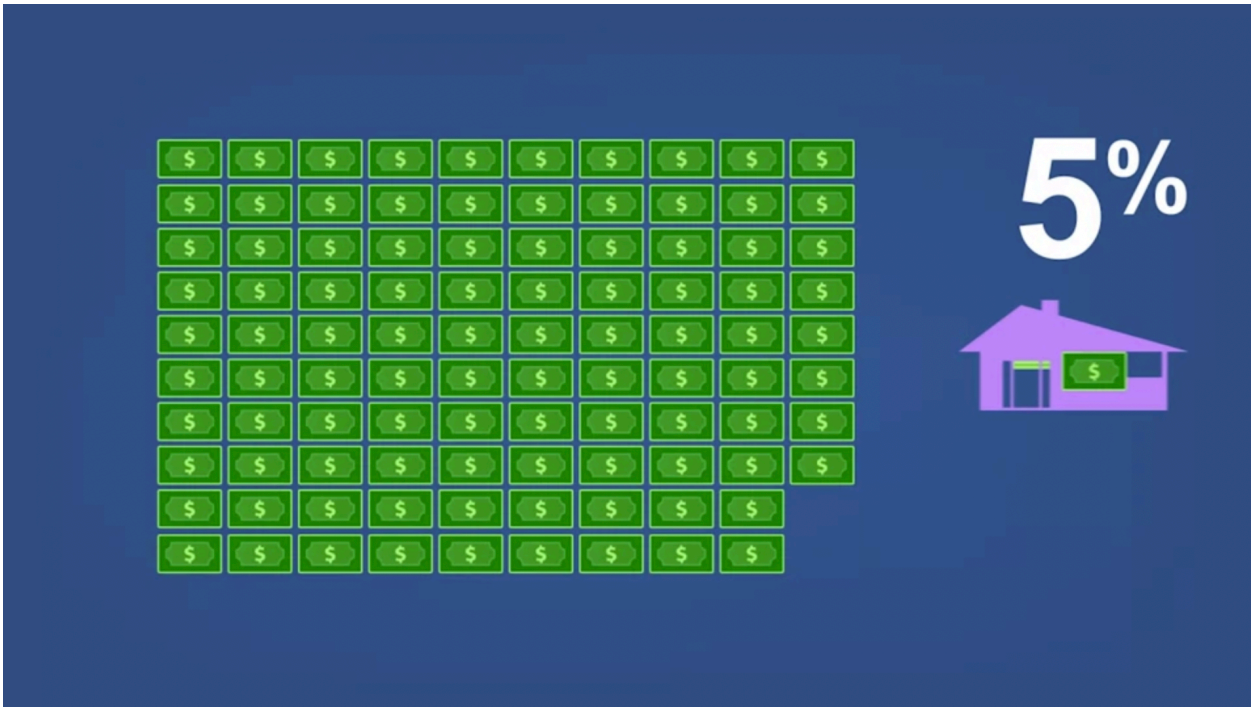
money by exploiting this difference between short-term and long-term interest rates. The difference between net interest income of banks from loans and mortgages and interest expenses paid by the banks to depositors is called the net interest margin. The net interest margin measures the profitability of a bank. The larger the net interest margin, the higher the profits.



This graph shows you the net interest margins of banks in the United States since the 1980s. As you can see, the net interest margin of banks has decreased over time. At the same time, you can see that the net interest margin significantly increases around 2010 when the Federal Reserve cut the federal funds rate to zero for the first time. Let's see how monetary policy affects the net interest margin in a simple example. Consider a bank that is entirely funded by deposits worth $100.

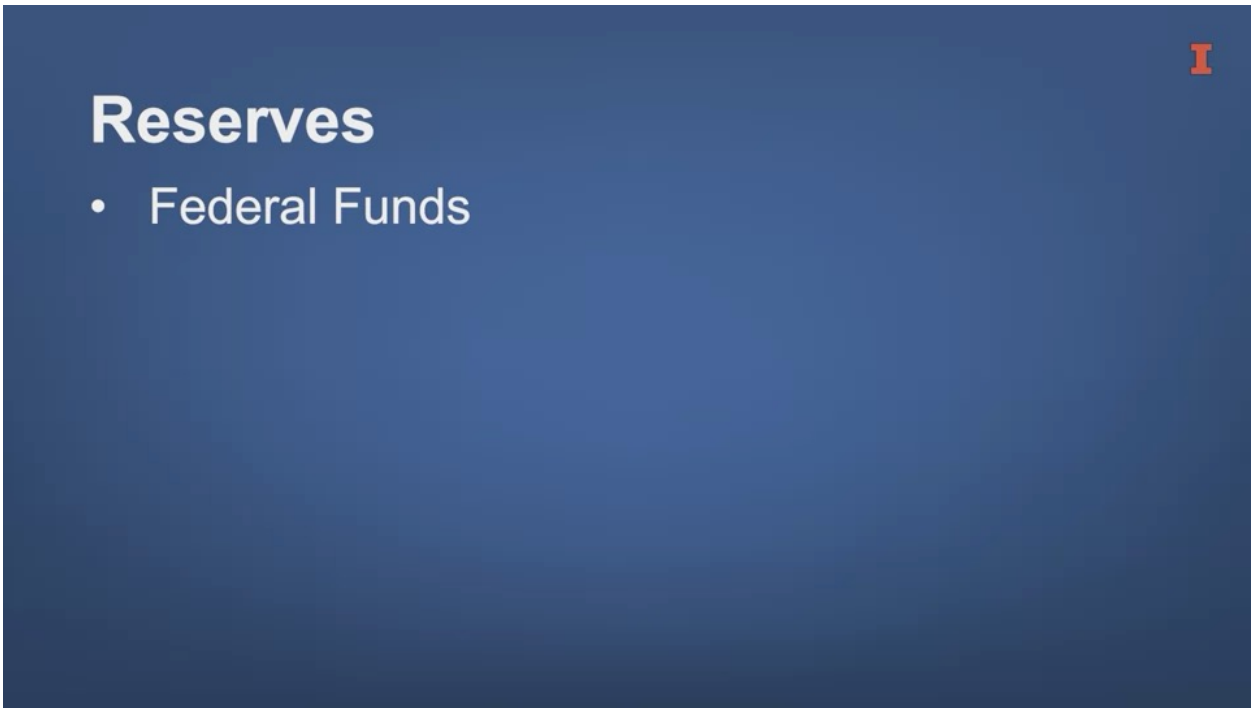


The interest rate on deposits is 2%, so total interest expenses are $2. The bank has issued one $100 fixed rate mortgage that pays 5% interest.



The interest income is $5, less $2 interest expenses gives you a net interest margin of $3 or 3%. Now assume that the Federal Reserve increases the federal funds rate from 2% to 3%. Since the market for federal funds is an overnight lending market, all other overnight and short-term interest rates will increase. Deposits are redeemable on demand, and as such, are very similar to overnight loans. If a bank does not want to lose deposits, the bank will have to

increase the deposit rate accordingly. The bank has to pay 3% for its deposits, but the interest rate on the fixed rate mortgage has not changed. The net interest margin therefore falls from 3% to 2%. A falling net interest margin means lower profits. Lower profits, in turn mean less capital for new loans. In other words, monetary policy directly affects bank profits and therefore credit supply of banks. Of course, how strongly monetary policy impacts profits depends on the share of fixed rate loans a bank has on its balance sheet. Some loans, such as loans to firms are typically floating interest rate loans, and hence, the net interest margin on these loans is not affected by monetary policy.



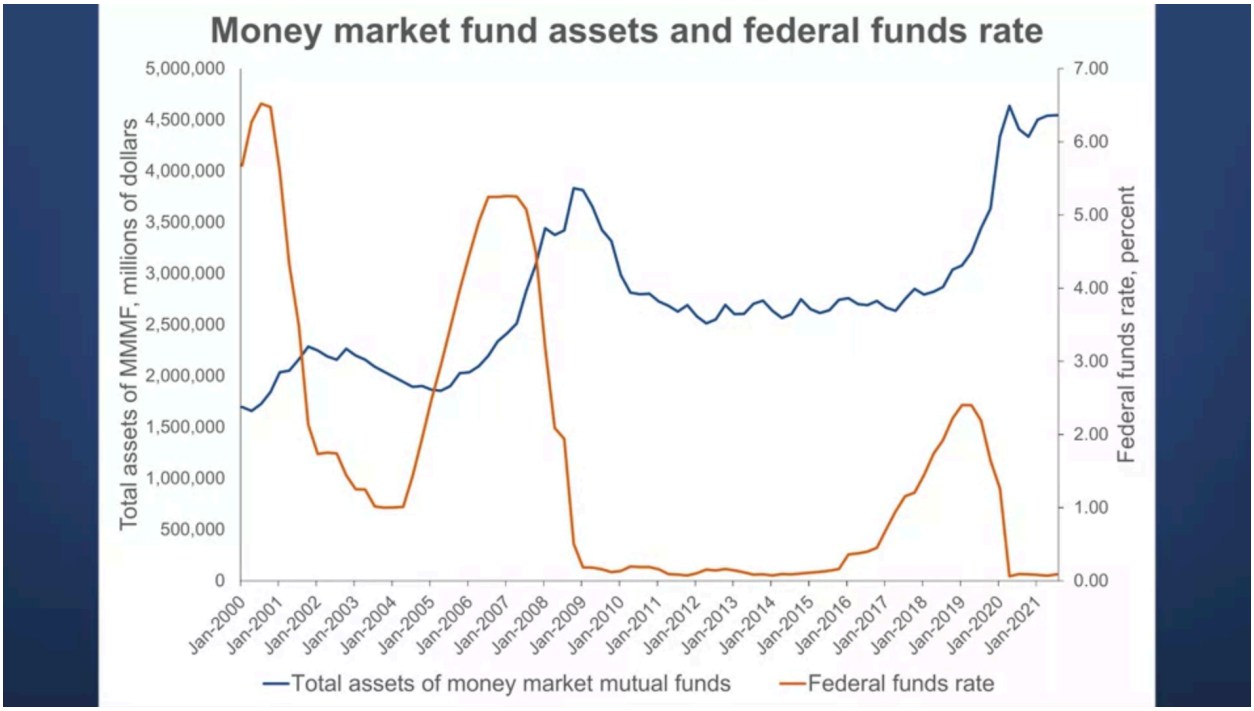
The second way monetary policy affects banks is through reserves held by banks in their federal reserve accounts. Those are called federal funds. When the Federal Reserve raises the federal funds rate, it typically does so by conducting open market operations. That is, the Federal Reserve sells securities to banks. The banks pay for the purchases of securities with reserves. With less reserves available in the federal fund market, credit supply in the short-term funding market goes down.

Banks use the federal funds market for short-term liquidity needs, for instance, when issuing loans. Of course, banks can also borrow in other markets, but often, that funding is more expensive or requires collateral, like for instance, the repo market. When there's less funding available to banks or the remaining available funding is more expensive, then banks would use the credit supply. Hence, monetary policy reduces the credit supply of banks by reducing reserves. Another way banks are affected by monetary policy is through deposits. Recall the simple example I gave for the net interest margin. In that example, the banks match the increases in the federal funds rate. However, as most of you know from your checking and savings accounts, banks are usually not fast when it comes to increases in interest rates on checking and savings accounts. Most depositors tend to not look for investment alternatives because it takes time. It takes even more time to switch banks because you have to change all your bank information everywhere. Even so depositors have alternatives, most find it too costly or too tedious to take advantage of these alternatives. This is why retail deposits are referred to as sticky and not sensitive to interest rates.

Money Market Mutual Funds

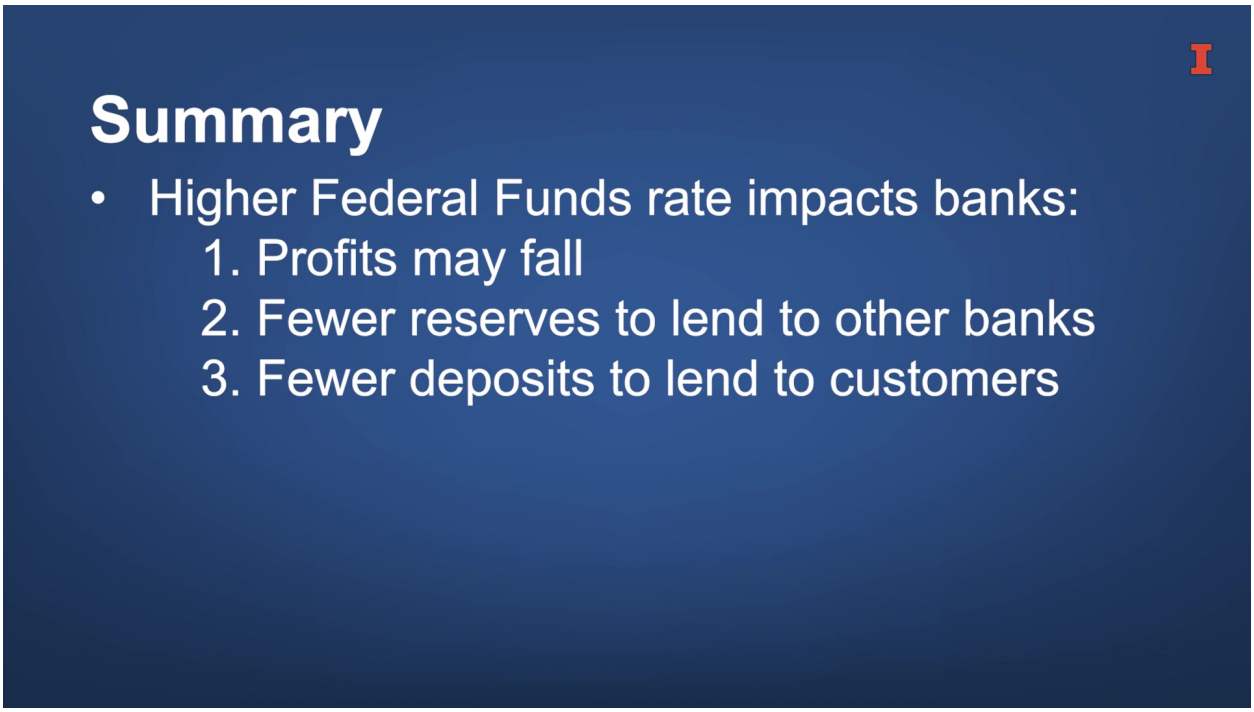
- Deposit alternative

However, some depositors, especially those with sizable deposits, do switch. They tend to withdraw their deposits from banks when the difference between the deposit rate and interest rates on alternative investments increases.



The closest substitute to deposits are money market mutual funds. The graph shows total assets of money market mutual funds and the federal funds rate. As you can see, when the Federal Reserve increases, the federal funds rate, for instance, between 2004 and 2006 or 2016 and 2019, assets of money market mutual funds grew much faster. The reduction in

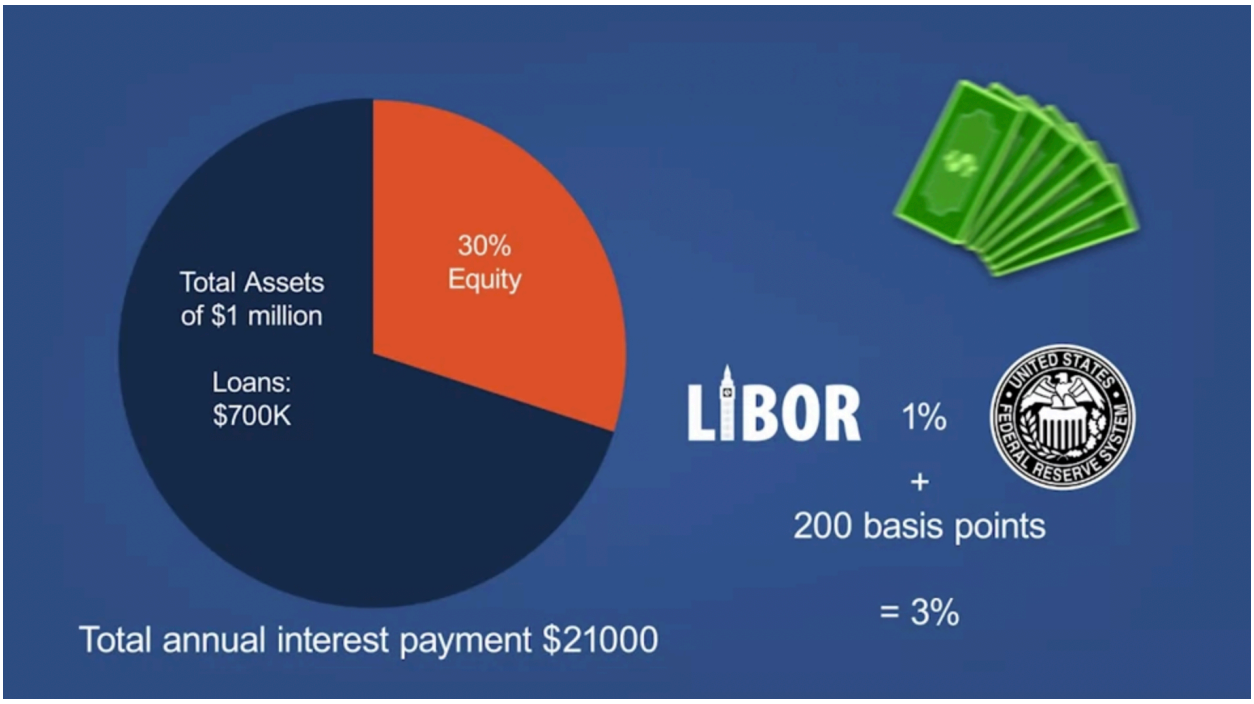
deposits also means that banks have less funding and hence have to reduce the credit supply. You may wonder why this behavior is optimal for banks. Banks face a choice between losing some deposits and forgoing some opportunities to originate loans and increasing interest rates on all deposits. For differently, would you rather lose 5% of deposits and originate 5% less loans or increase the interest rates on all deposits by one percentage points and keep your current pace of lending? Recent research suggests that banks are strategic about where they increased deposit rates. Within the United States, deposit rates tend to increase faster in places where there are small bank competition. This suggests that the easier it is to switch banks, the more banks have to respond to changes in interest rates to retain their deposits. The flip side of this finding is, that in places or countries with highly concentrated banking system, this deposit channel of monetary policy is less important.



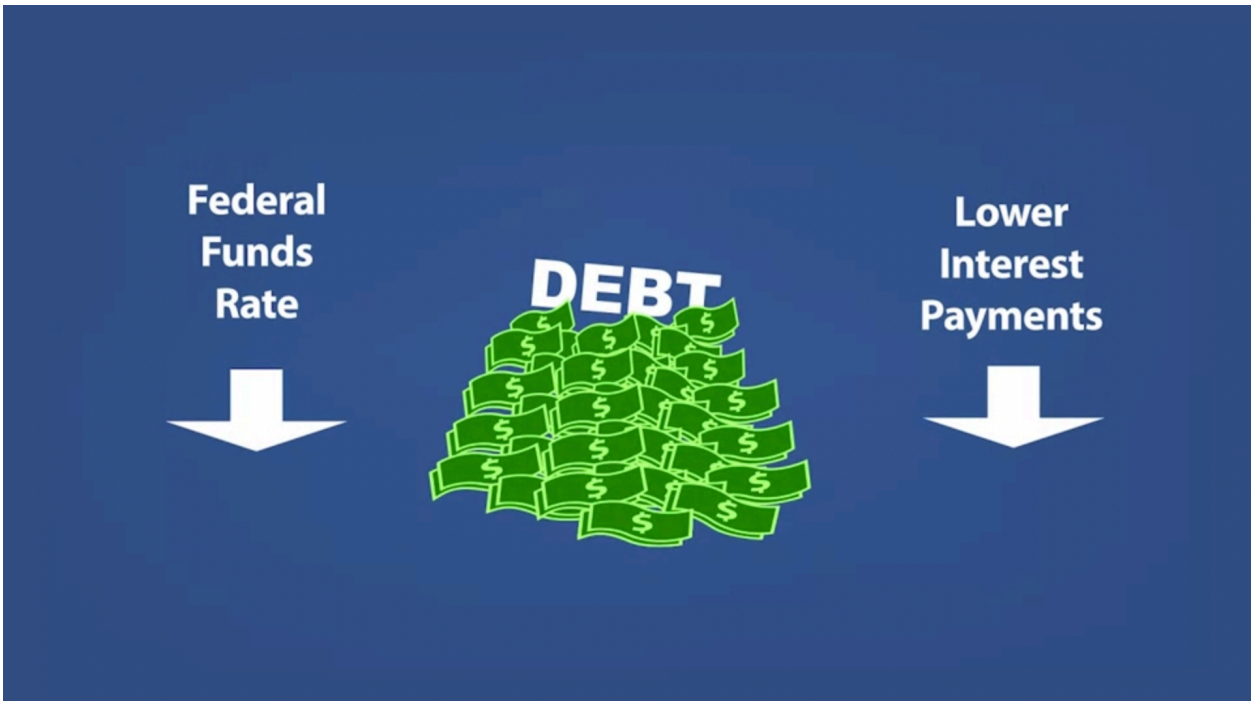
What have we learned in this lesson? Monetary policy affects banks through three channels. First, increases in the federal funds rate compresses the net interest margin, reducing profits. Second, increases in the federal funds rate reduce reserves available in the banking system. Third, increases in the federal funds rate lead to an outflow of deposits reducing bank funds. All three channels imply that increases in the federal funds rate reduce the overall supply of credit by banks.

Lesson 3-2.3: The Balance Sheet and Refinancing Channels of Monetary Policy

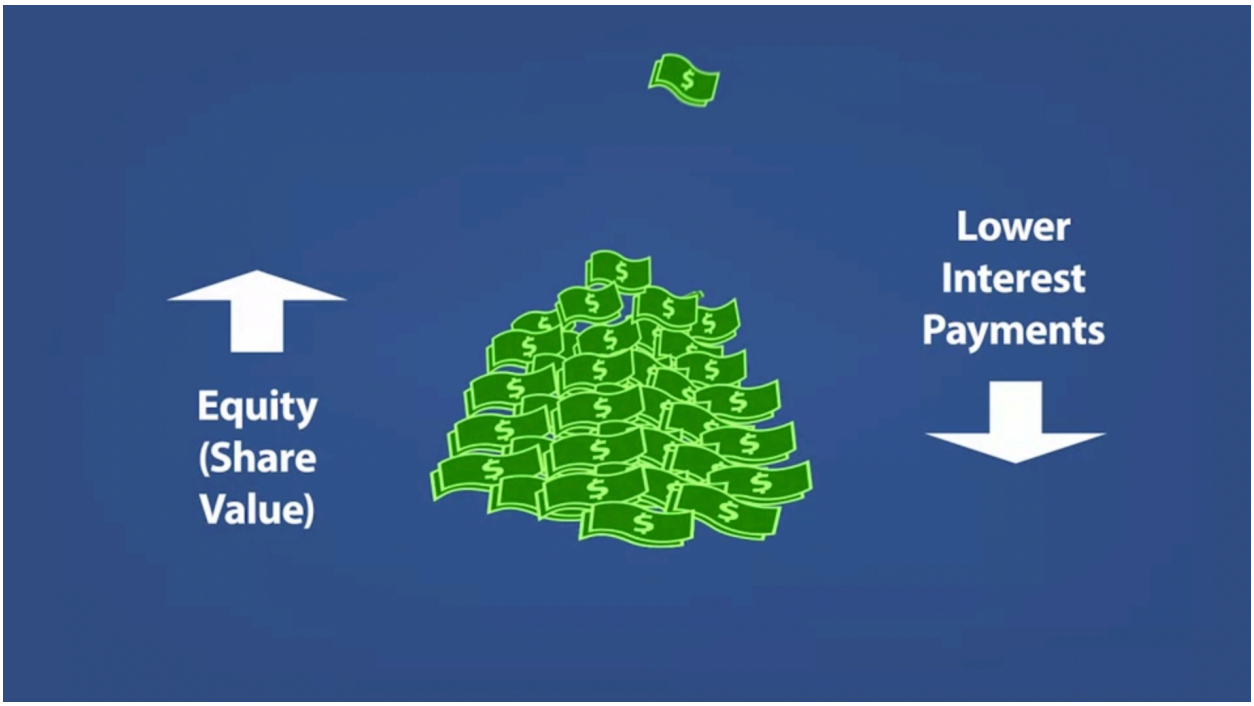
Hello and welcome to this lecture on the balance sheet and refinancing channels of monetary policy. In this class, we're taking a closer look at what changes in monetary policy mean for firms. We will then also talk about how changes in monetary policy affect consumers, especially those who have the option to refinance their mortgage. Let's start by looking at firms. Almost all firms take out some form of debt. Only the largest corporations have access to the bond market. Most firms take our bank loans. Commercial loans have a floating interest rate, such as the London Inter-Bank Offered Rate, LIBOR plus a spread, or the prime rate, the interest rate offered to the best borrowers. That means that the interest rate that the firm pays most with short-term interest rates.



Assume that a firm has total assets of one million and 30% equity, that means the firm has taken out loans worth 700,000. The interest rate on these loans is LIBOR plus 200 basis points. The LIBOR, like the federal funds rate, is an overnight unsecured interest rate and the two move almost one-to-one together. The LIBOR and the federal funds rate are currently 2%, so the loan interest rate is 4%. Then the total annual interest payment is $28,000. Now, the FOMC decided to cut the federal funds rate to 1%. The LIBOR will follow this move, so the interest rate on the firm's loans is 3%, reducing interest rate payments to $21,000. This reduction in the federal funds rate, hence freed up $7,000 that the firm can now use to invest. More generally, a reduction in the federal funds rate will increase profits of leverage firms by lowering the so-called external finance premium.

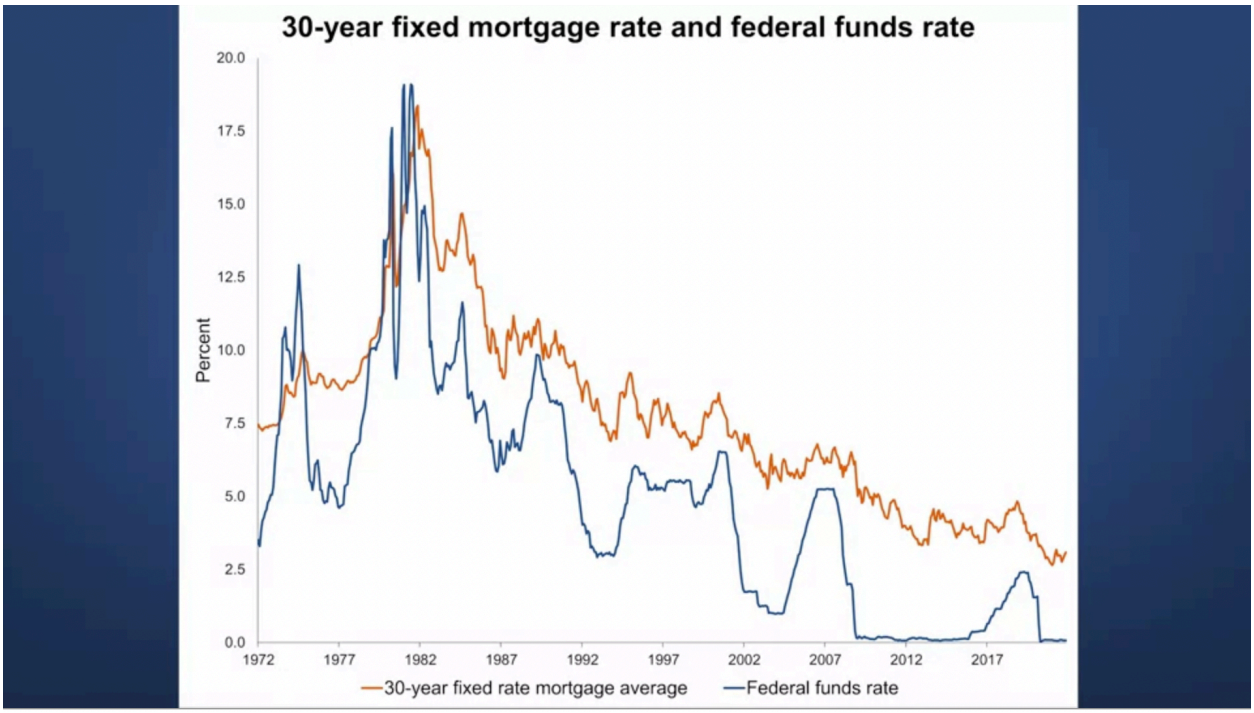


This channel was highlighted in research by the former Federal Reserve Chairman Ben Bernanke. Another implication of higher profits is that the firm's balance sheet will improve.

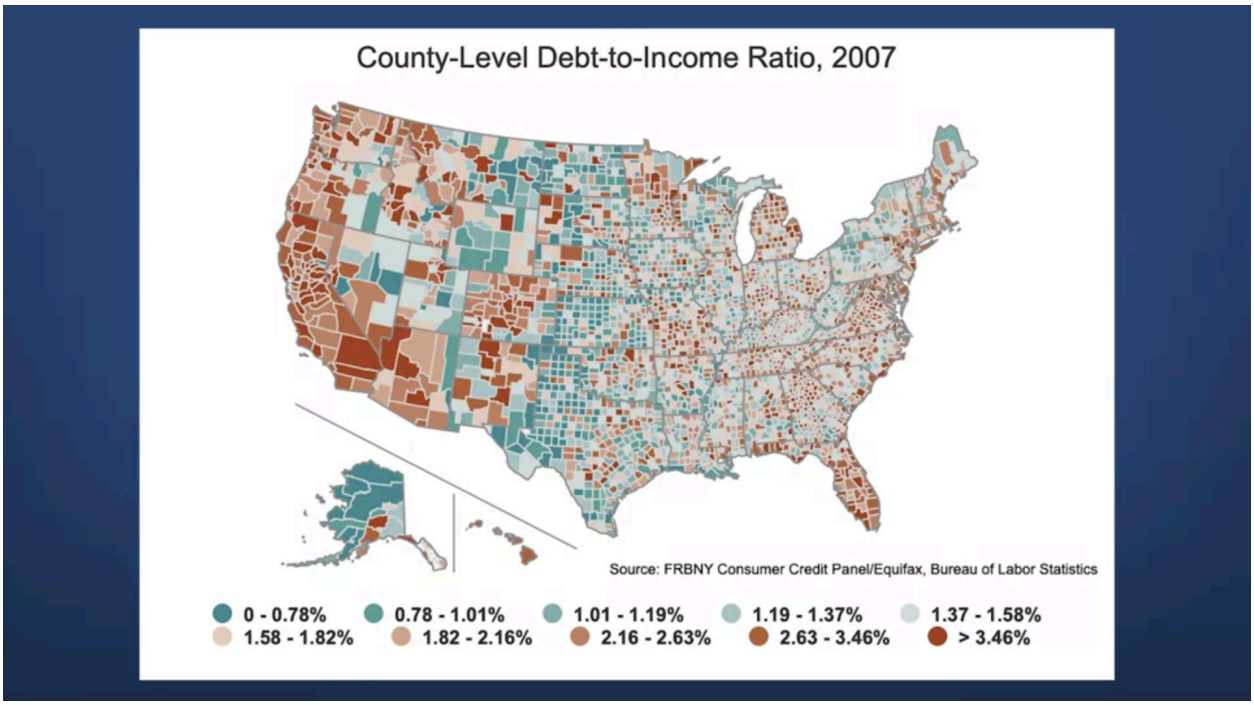


With higher profits, the firm is in a better financial position. This may further reduce borrowing costs. But what evidence is there that the interest rate cost differences matter?

Research suggests that there are differences in the behavior of small and large firms after increases in the federal funds rate. Such an increase reduces output and therefore profits. Larger firms who have access to the commercial paper market and other sources of short-term credit increase the short-term borrowing when profits decline. At the same time, the inventories of large firms grow. This suggests that large firms tend to maintain their levels of production and employment when interest costs increase and revenues decline. In contrast, small firms who do not have access to short-term credit respond to a decline in profits due to interest rate increases by reducing inventory and cutting work hours and productions. In sum, changes in monetary policy seemed to affect especially smaller firms that tend to be more financially constrained. In the aggregate, the effect is still sizable because smaller firms still employ more than one half or 0.5 of all workers in the United States. Now let's have a look at consumers. The largest line item on a household's balance sheet is usually the mortgage.

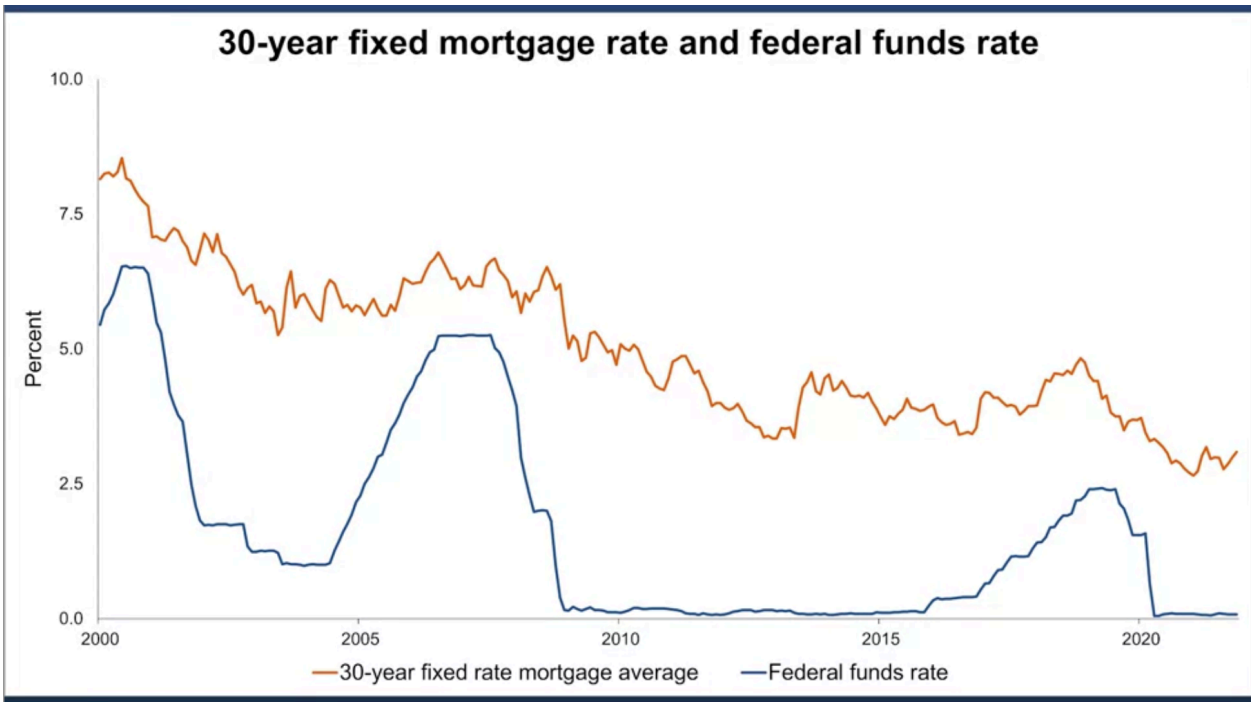


The craft shows you the interest rate on a 30-year fixed rate mortgage and the federal funds rate. As you can see, the two move together. Mortgage rates will respond to changes in monetary policy. How big of an effect can you expect from mortgage rate changes?



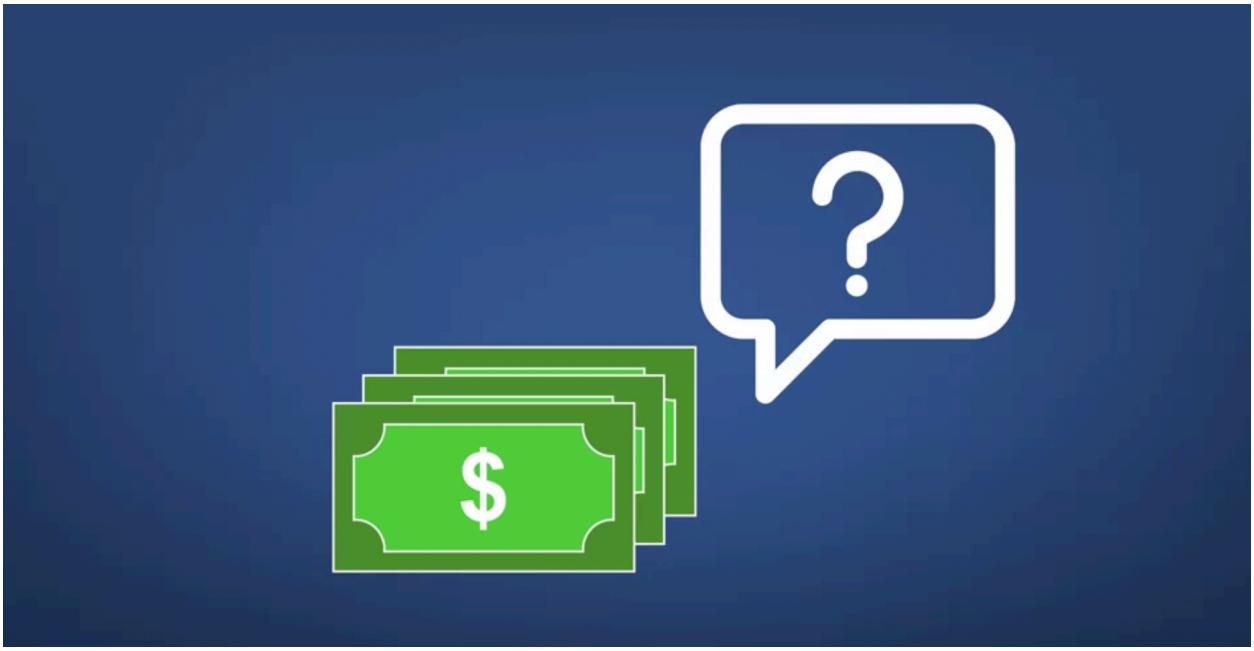
The answer depends on how indebted households are. The map shows you the median debt to income ratios for all counties in the United States in 2007 right before the

financial crisis. As you can see, there's quite a number of counties in which debt is more than three times the annual income. With such high leverage changes in the interest rates can have sizable effect on interest expenditure and therefore on household consumption choices. While some mortgages in the United States have adjustable interest rates, most mortgages are fixed rate. When the FMC decides to lower the federal funds rate, mortgage rates tend to follow. In response, consumers may decide to refinance their current mortgage that has a higher interest rate than the current mortgage rate. That is, they take out a new lower interest rate mortgage to pay off the old higher interest rate mortgage. These interest rates savings due to refinancing can be substantial.

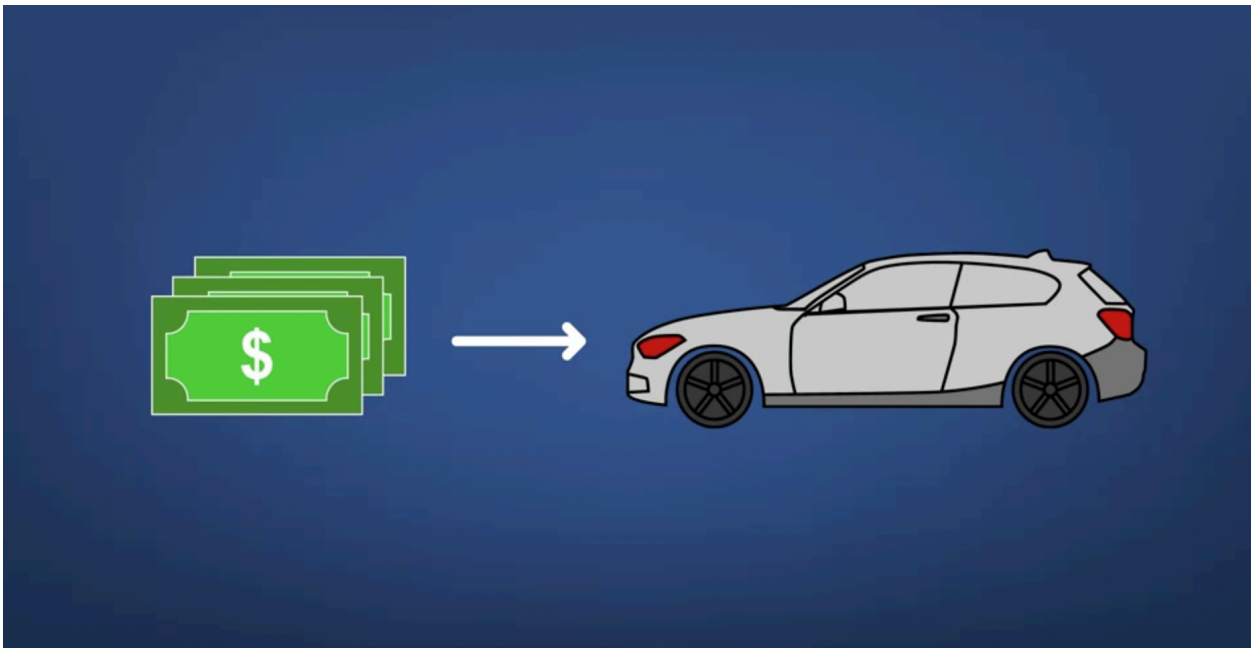


Let's go back to the graph with the mortgage interest rates, but focus on the 21st century. In 2006, the mortgage interest rate was about 6.5%, but in December 2011, it had fallen below 4%. A household that had not paid any principle could have saved almost 40% on mortgage interest expenses by refinancing mortgage. A lot of people did.

A recent study by Demachio and co-authors examining this time period, found that the average household that got a lower mortgage interest rate saved almost $1,000 per month in mortgage payments.



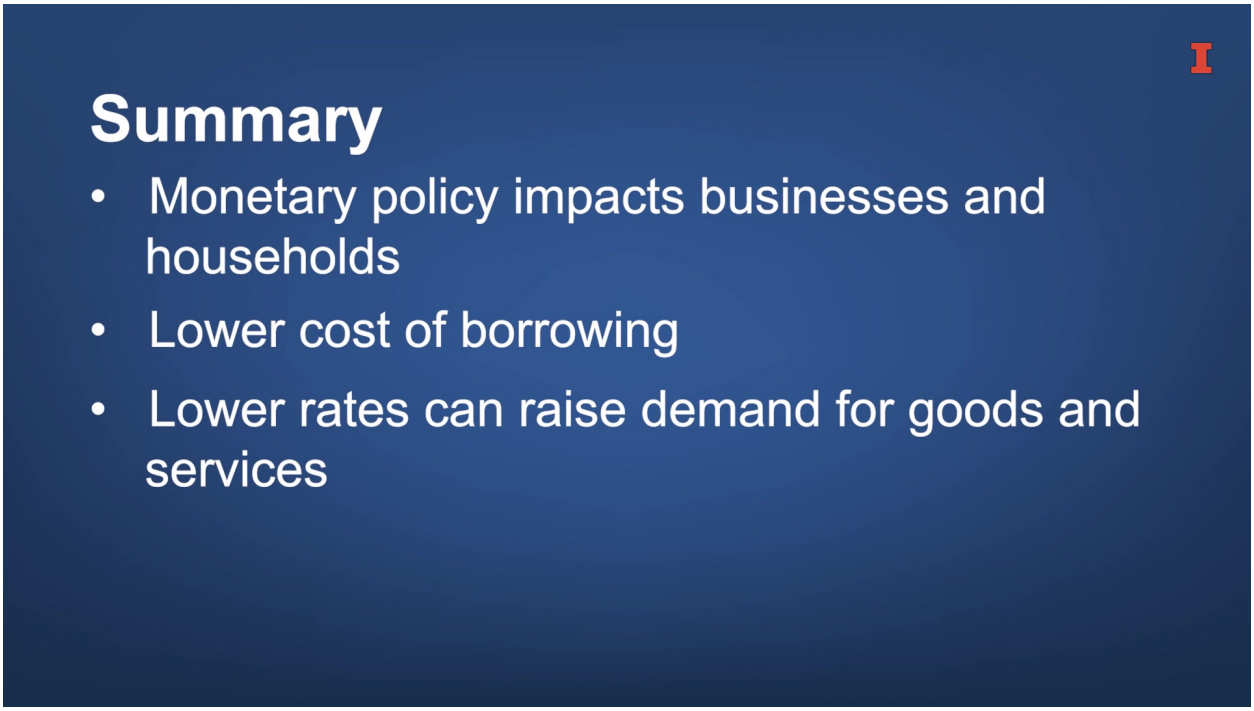
What did the households do with the extra cash? One answer that Demachio and co-authors in their research is buying cars.



They find that households that got lower mortgage rates were 35% more likely to purchase a new car. More generally, households that save on mortgage payments tend to consume more.

For instance, people may go out for dinner or start renovating the house in addition to buying cars. That is, the demand for goods and services goes up, which also benefits firms. A study by Luke and Zimmerman finds that lower mortgage interest rates lead to a higher local consumption and high employment. This is called the refinancing channel

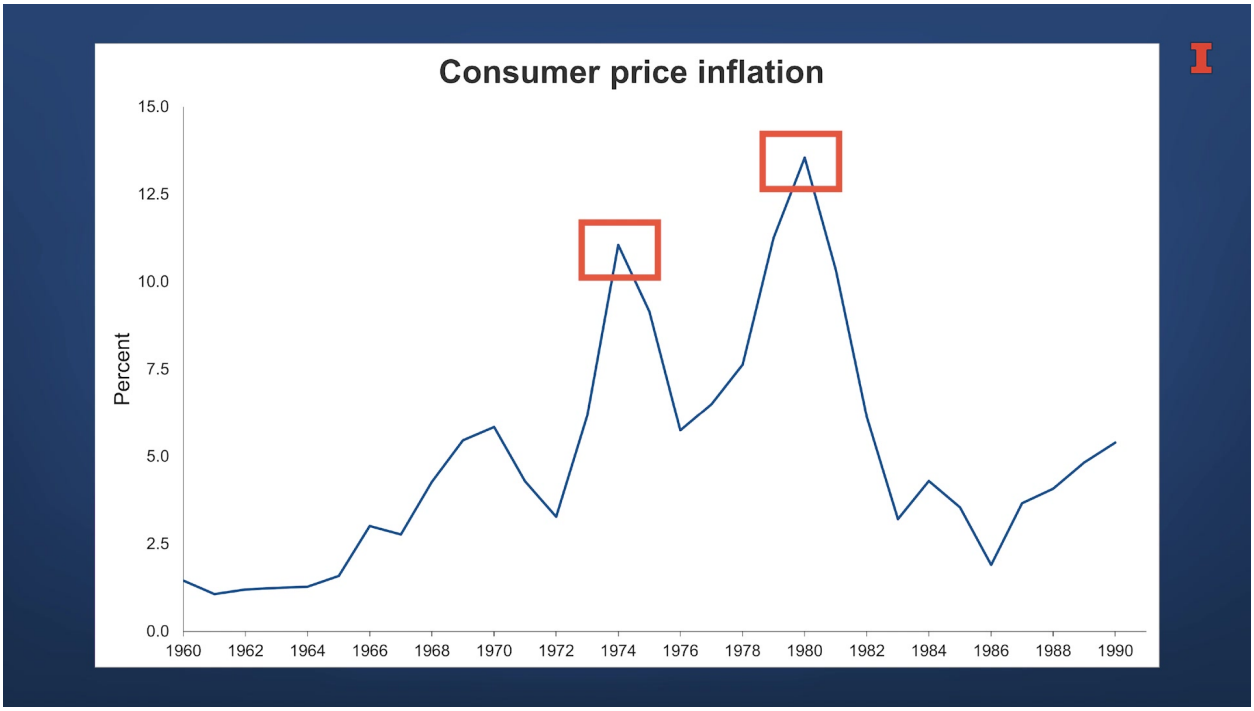
of monetary policy. Of course, these effects will be larger the higher the mortgage balances are.



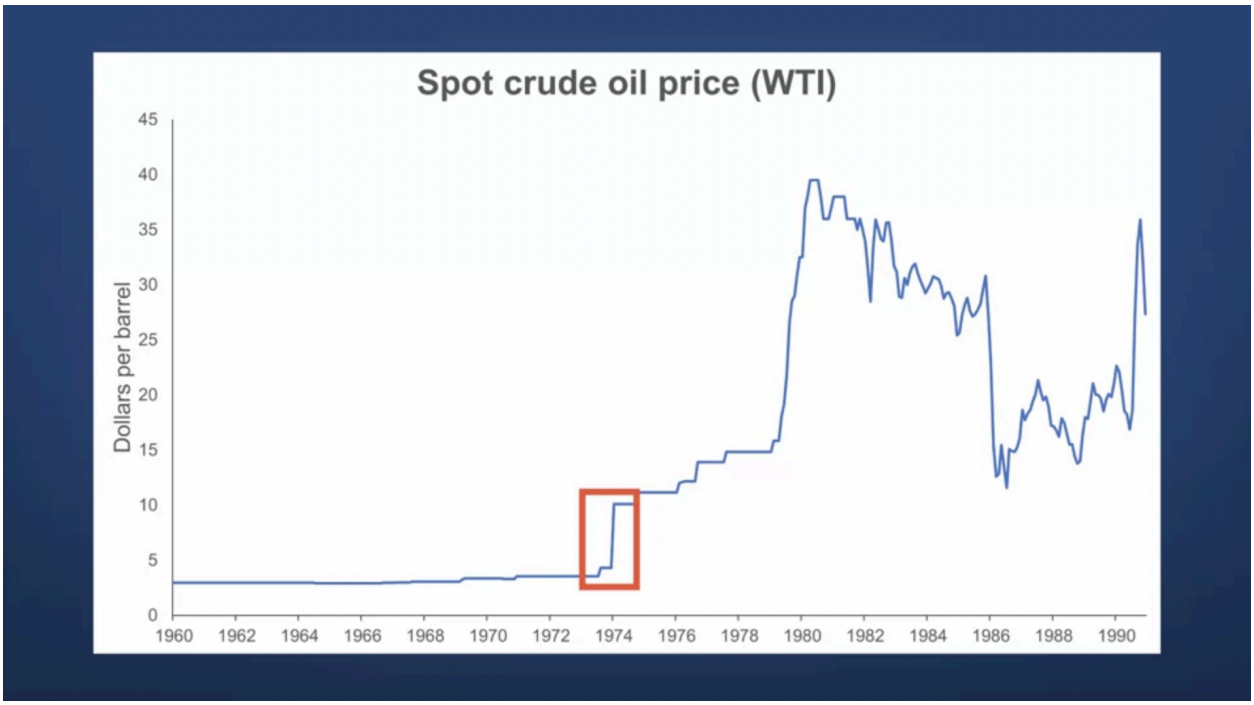
What have we learned in this lesson? First, the balance sheets of firms and households matter for the transmission of monetary policy. Second, decreases in the federal funds rate lower the financing costs of firms and reduce mortgage payments of households. Third, lower interest payments result in more consumption and investment. That is, the overall demand for goods and services goes up.

Lesson 3-3: Case Studies

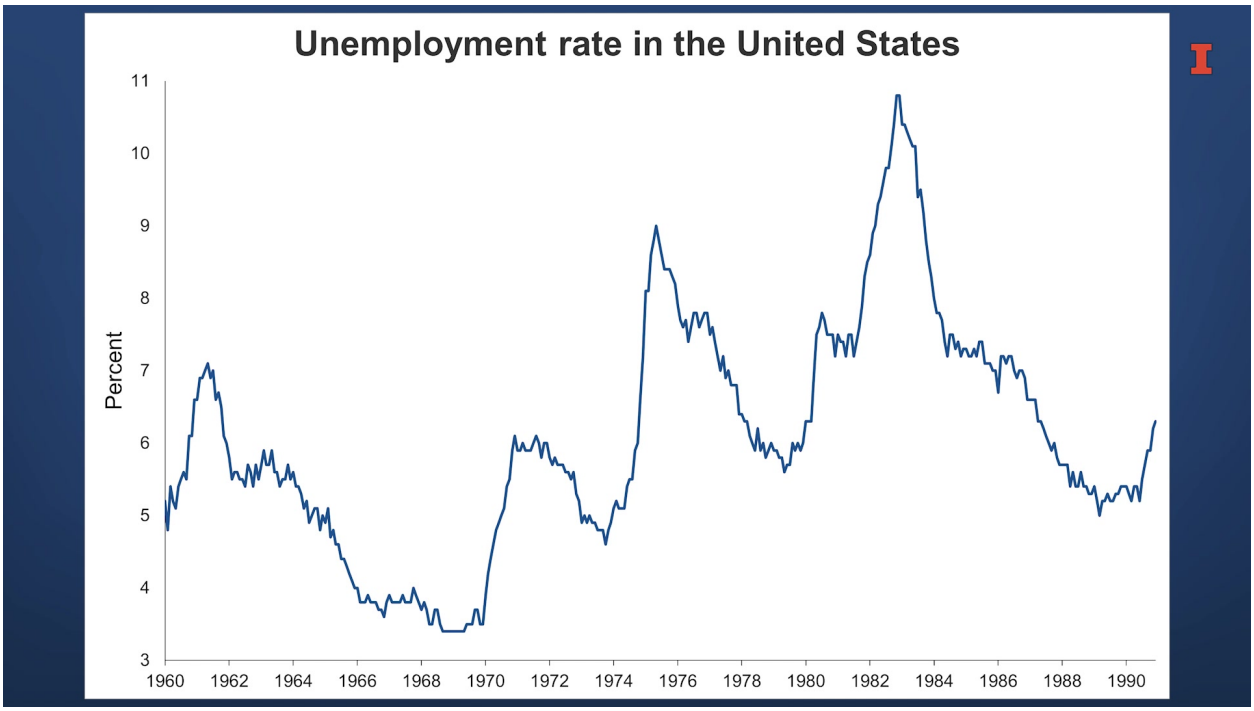
Lesson 3-3.1: Supply Shock: Stagflation



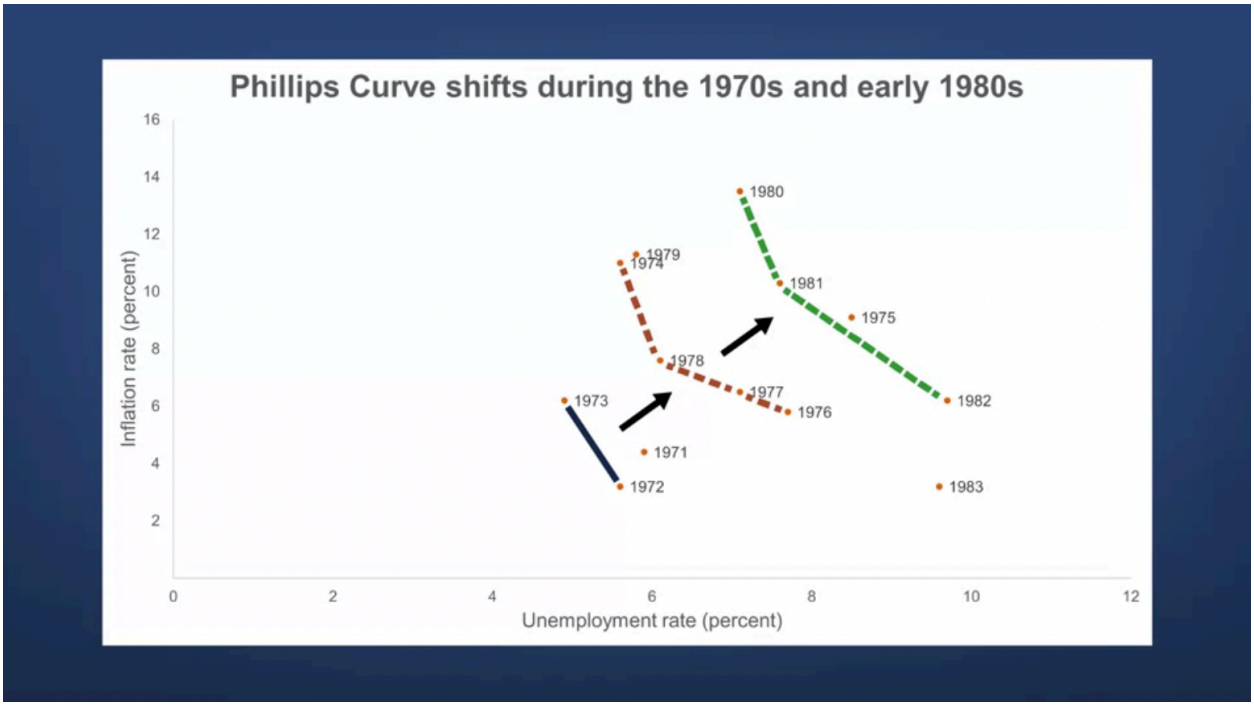
Hello and welcome to this lecture on stagflation. In this class, we consider the period in the 1970s that was marked by low growth, high inflation, and high unemployment. This case study will help us to better understand the tradeoffs and limits of monetary policy. The term stagflation is a combination of stagnation and inflation. Stagflation is particularly challenging for central banks. To stimulate the economy, central banks lower interest rates, however, lower interest rates also tend to increase inflation in a situation where growth is low and inflation is high central banks have limited options. The graph shows you consumer price inflation from 1960 to 1990. You can see that during the late 1960s, inflation started to accelerate. The largest spikes are in 1974 and 1980 when the inflation rate hit 11% and 13.5% respectively. Let's look at the reasons for these spikes. The main reason are too large oil shocks.



The first oil shock was triggered by an oil embargo of OPEC against the United States and other mostly western countries in the wake of the Yom Kippur war. Within a few months, the price of oil rose nearly 300% from $3 per barrel to about $11. This was an enormous cost shock to the economy, since almost all parts of the economy used oil as an input. For instance, in form of gasoline, or for power generation, or in the chemical industry for two surprises increased drastically. At the same time, consumers had to pay more for gas and heating, reducing their spending on other consumption goods. Just a couple of years later, the second oil shock hit the economy, in the wake of the Iranian Revolution in 1979. And the beginning of the Iran-Iraq war in 1980, oil production declined, as a result of declining oil supply and uncertainty about future oil supply oil prices skyrocketed. In 1980, the price of oil reached $39 and 50 cents per barrel, a more than tenfold increase since early 1973. In the US, the car manufacturers were particularly hard hit as they struggled to offer more fuel efficient cars. These large shocks led to a slowdown of the economy.



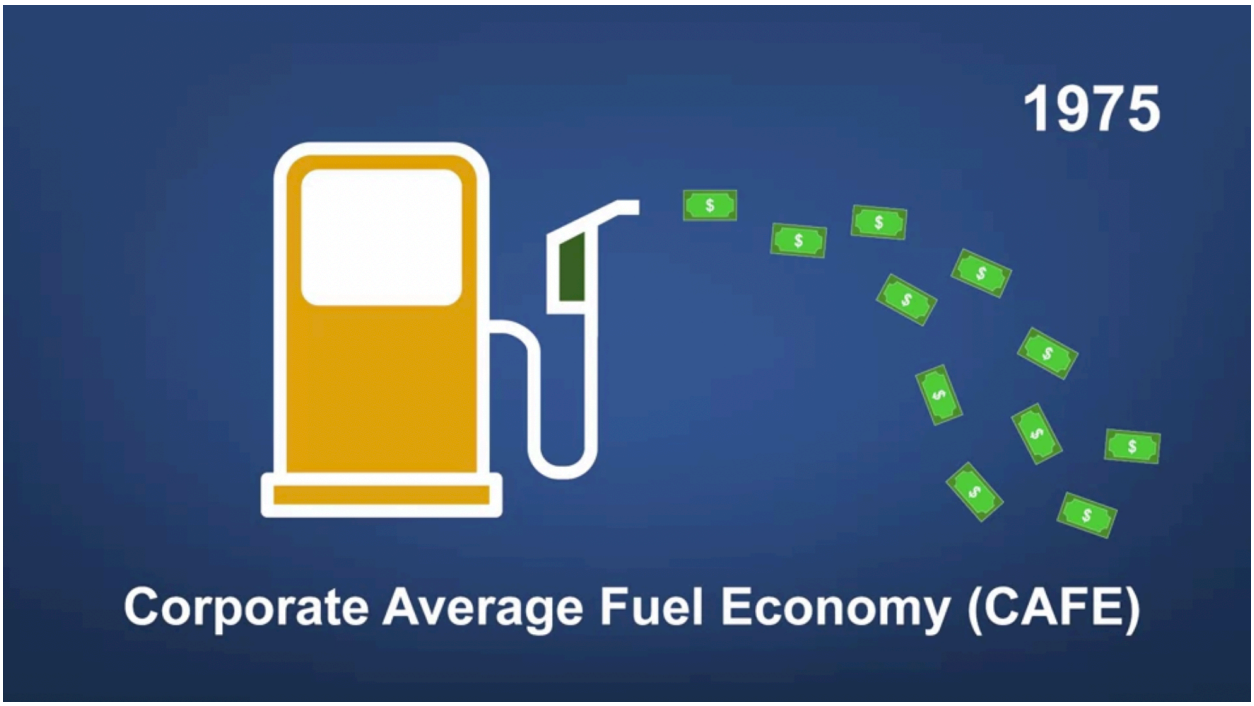
In the graph you see the unemployment rate, it reached a post-World War II high of 9% in 1975. And decreased again with the second oil shock in 1981, reaching 7.8%. Recall that the Federal Reserve's mandate is stable prices and maximum employment, but the oil shocks produced the opposite effects, high inflation and high unemployment. The oil shocks are examples of supply shocks.



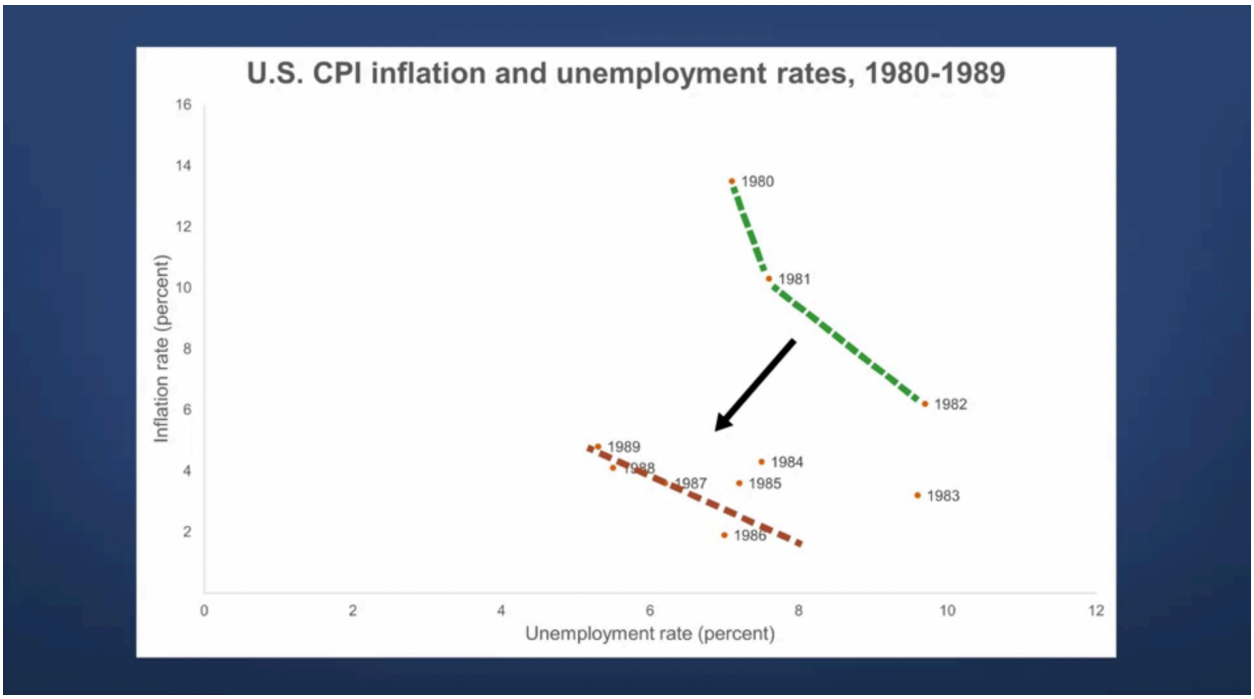
The graph illustrates how supply shocks shift out the tradeoff between unemployment and inflation, which is also called the Phillips curve. We discussed the Phillips curve in detail in a

separate lecture, when facing supply shocks, the options of monetary policy are limited as lower interest rates do not affect supply constraints. Indeed, many responses to the oil shocks were not monetary, but affected oil demand in the short and in the long run. The most drastic short-term response to the 1973 oil shock was rationing gas in the United States. For instance, vehicle with license plates having an odd number, could buy gas only on odd numbered days, while others could buy only on even numbered days.

Responses with considerable long-term impact on oil demand eventually helped to reduce oil prices. Here are a couple of examples. To reduce gas consumption, a national maximum speed limit of 55 miles per hour was imposed in 1974.

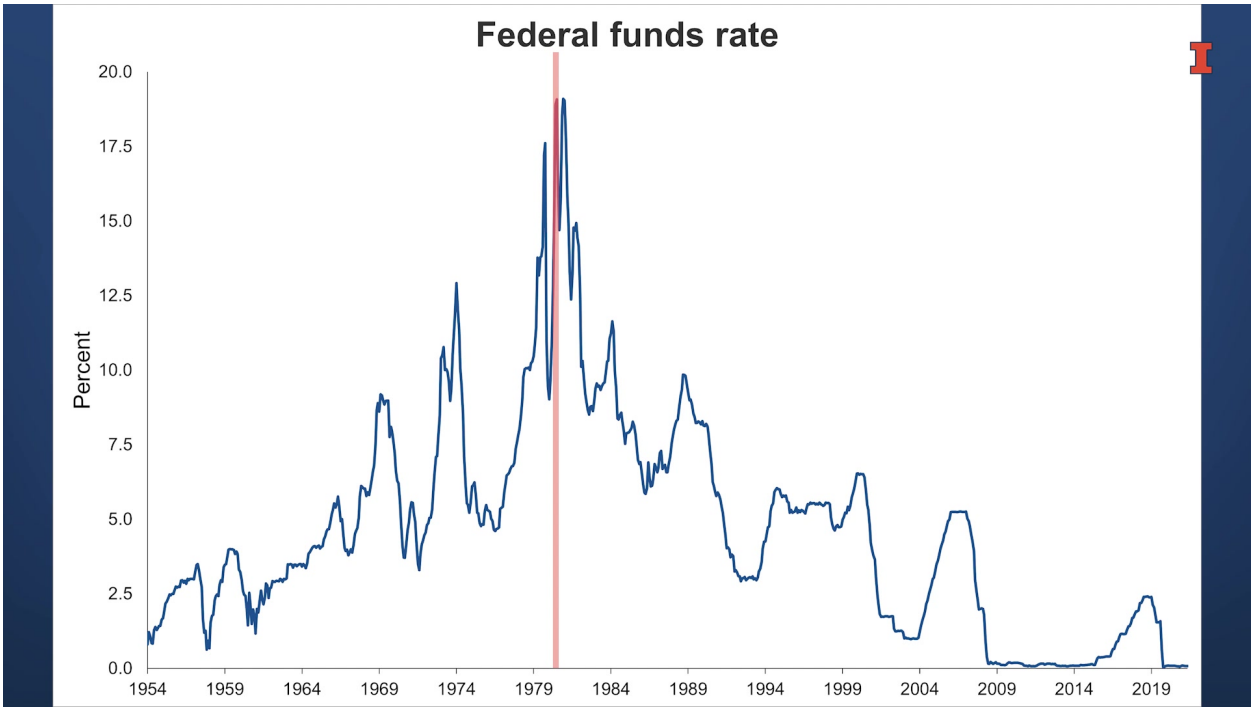


A year later in 1975, the corporate average fuel economy standards were created. These standards required better fuel economy for cars and light trucks in the US. At the same time, the US developed the Strategic Petroleum Reserve. These measures and increases in production eventually led to the so-called oil Kludd in the 1980s. Oil prices dropped considerably and contributed to bringing down inflation.

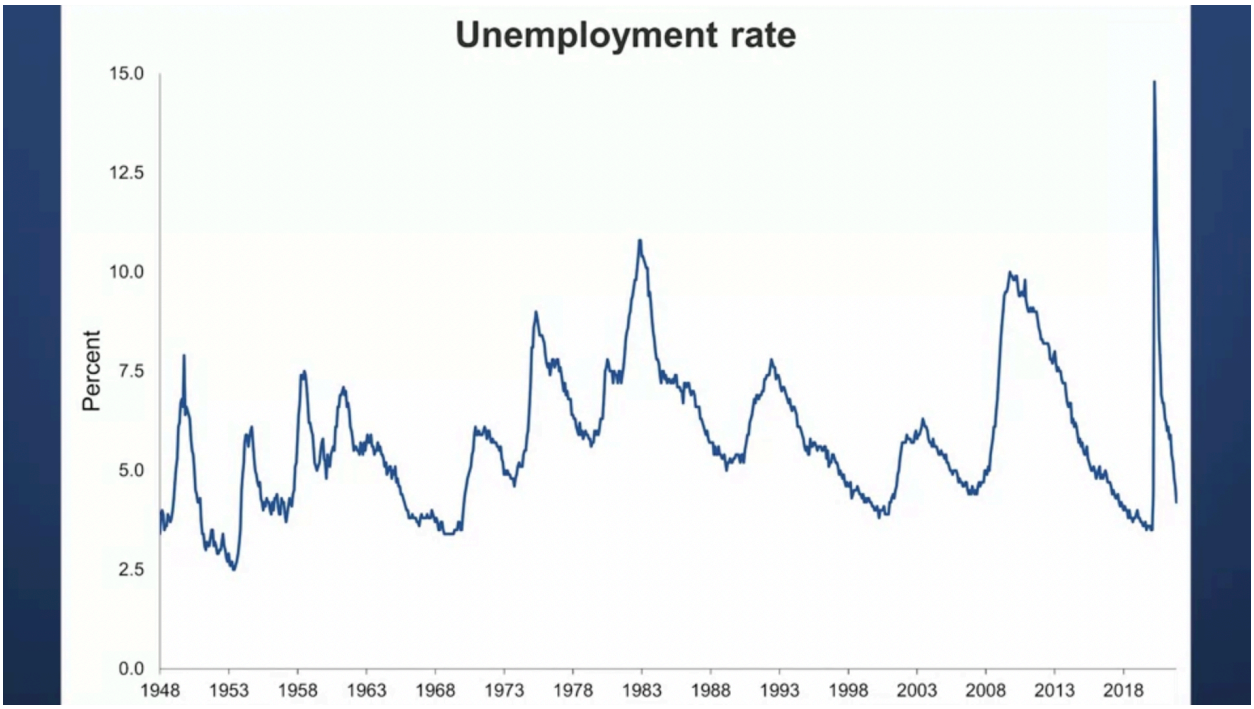


These supply shocks in the 1980s have shifting back the tradeoff between inflation and unemployment. As you can see in the graph, in the second half of the 1980s, considerably less

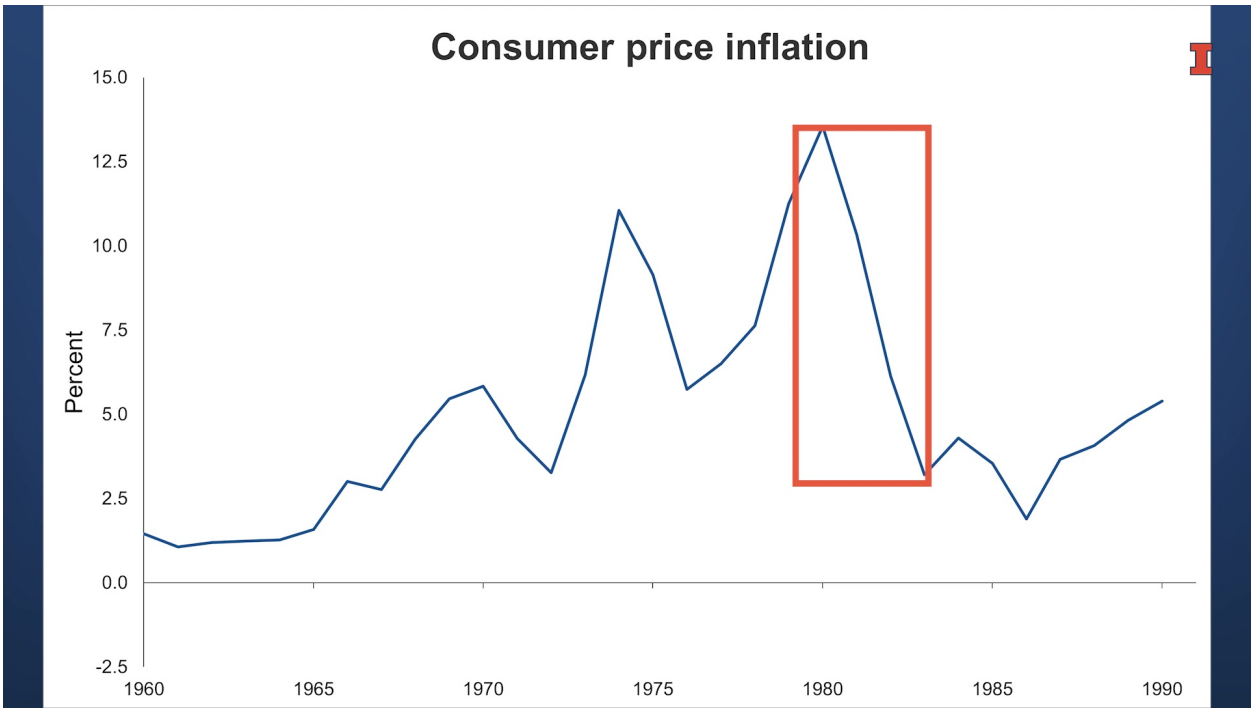
inflation was needed to reduce unemployment when compared to the early 1980s. Even so, monetary policy can do little to counteract supply trucks, this period caused a change in inflation expectations. That is the consensus shifted from a low inflation regime to regime in which inflation would remain high. High inflation expectations lead to high wage demands, which in turn increase inflation. When Paul Volcker became the chairman of the Federal Reserve in 1979, he wanted to bring down inflation and inflation expectations.



He did so by raising the federal funds rate which reached 19% in December 1981. The sharp increases in interest rates, together with increasing oil prices, triggered the 1980 and 1982 recessions.

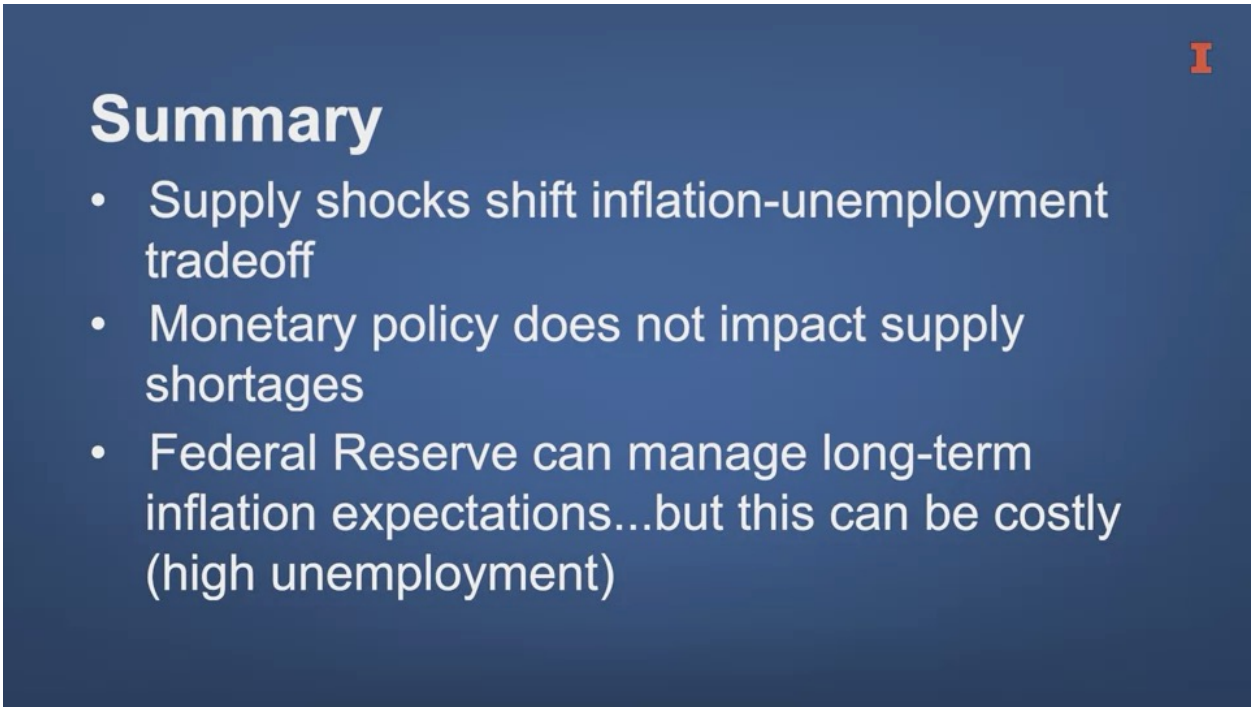


Unemployment rose to over 10%, the highest level between the end of World War II and the COVID-19 pandemic. In other words, in this period, the Federal Reserve chose to focus on inflation rather than unemployment despite the dual mandate of stable prices and maximum employment.



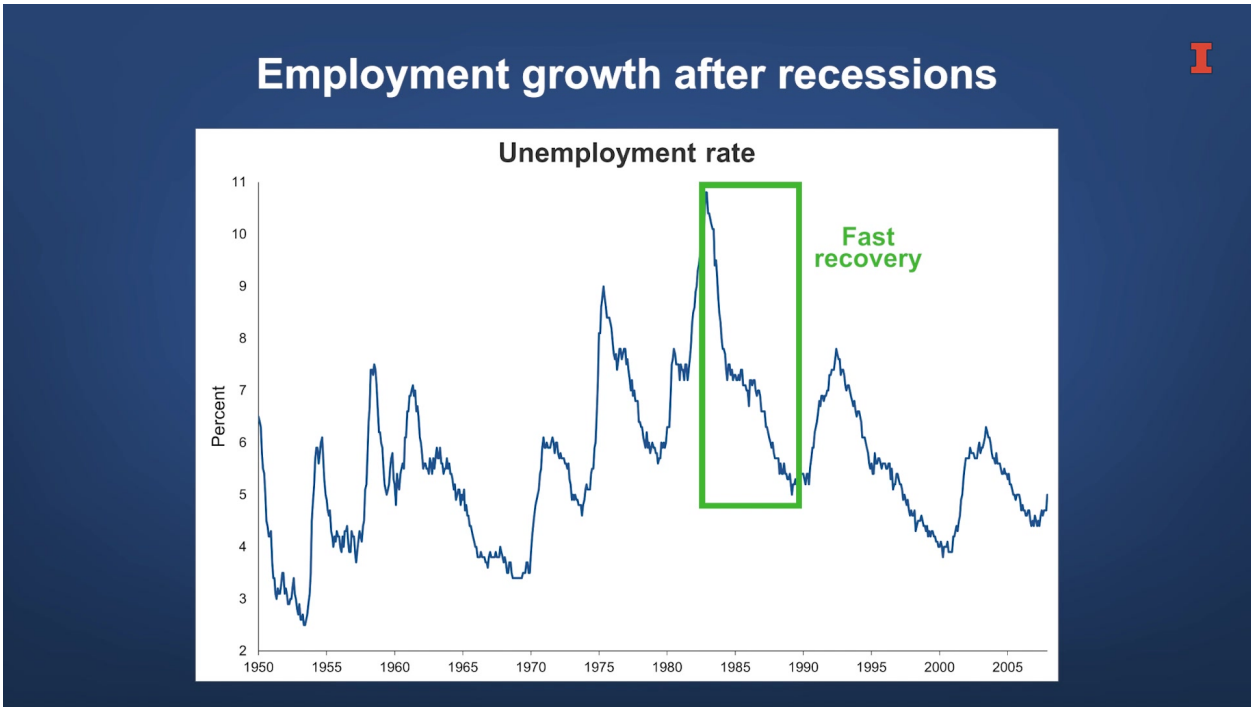
Raising the federal funds rate led to a large drop in inflation. More importantly, the Federal Reserve accepted the price of temporary higher unemployment to bring down inflation. This was seen as a credible commitment to low inflation in the future. This commitment in turn brought

down inflation expectations, which helped to establish a low inflation regime. The insights from the stagflation period were also useful in the COVID-19 pandemic. In early 2021, future supply chain issues and other shortages inflation shot up in the United States. That raised questions whether the Federal Reserve should raise the federal funds rate. However, supply chain issues and shortages are supply shocks and were seen as temporary. The conclusion was that inflation will come down as soon as these shortages are resolved. This was supported by the observation that inflation expectations did not move.

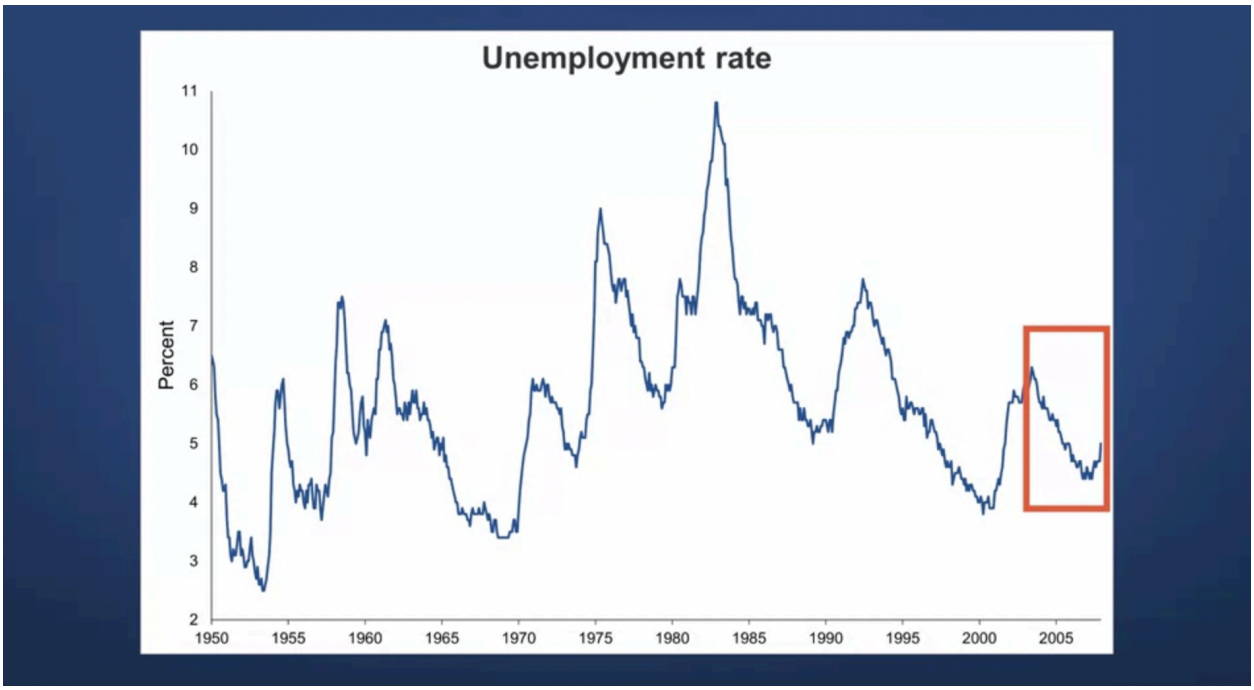


What have we learned in this lesson? First, supply shocks such as oil price shocks can shift the tradeoff between inflation and unemployment. Second, monetary policy is not an effective tool to counteract supply shocks. Third, if supply shocks move inflation expectations permanently, central banks may have to accept high unemployment temporarily to bring down inflation and inflation expectations.

[Lesson 3-3.2: Jobless Recovery and Consequences of Accommodative Monetary Policy]



Hello and welcome to this lecture on the jobless recovery and the consequences of accommodative monetary policy. In this class, we consider the early 2000s when despite accommodative monetary policy, the labor market only recovered slowly. This case study will help us to better understand the limits of monetary policy and how monetary policy affects risk taking. The term jobless recovery was first applied to the recovery from the 1990-1991 recession. Historically, unemployment had dropped sharply after previous recessions ended. Look for instance, at what happened after the recession of 1982. After the 1990-1991 recession, the unemployment rate came down only gradually. Even so, the federal reserve did not raise the federal funds rate until 1994 and GDP growth was over 5% between 1992 and 1995. This slow recovery in the labor market, despite accommodative monetary policy, here low interest rates for three years, puzzled economists.



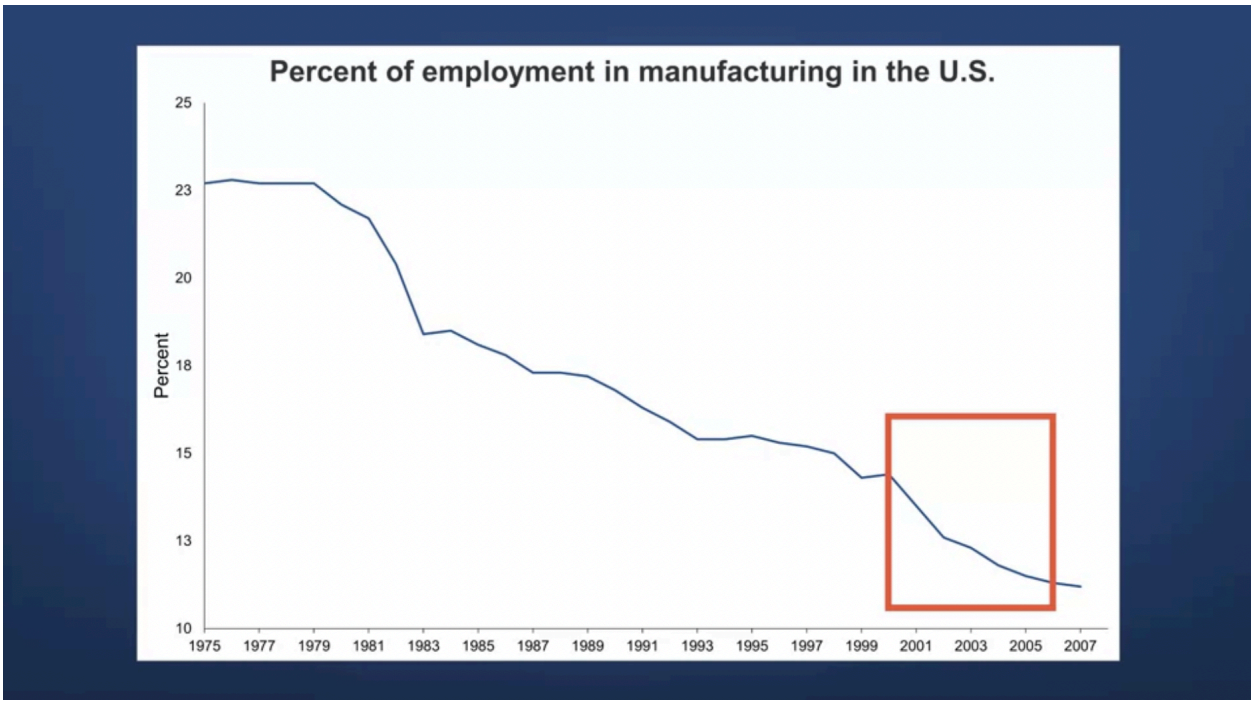
The same pattern emerged after recession in 2001. The federal reserve had cut the federal funds rate from 6.5% to 1% in response to the recession and did not increase the federal funds rate until summer 2004. This type of monetary policy accommodation at such low interest rates was unprecedented. Unemployment however, did not start to fall until summer 2003 and then the decline was only gradual. For this reason economists now referred to the early 2000s as the jobless recovery.

Let us examine first what data tell us about the labor market and the jobless recovery. The

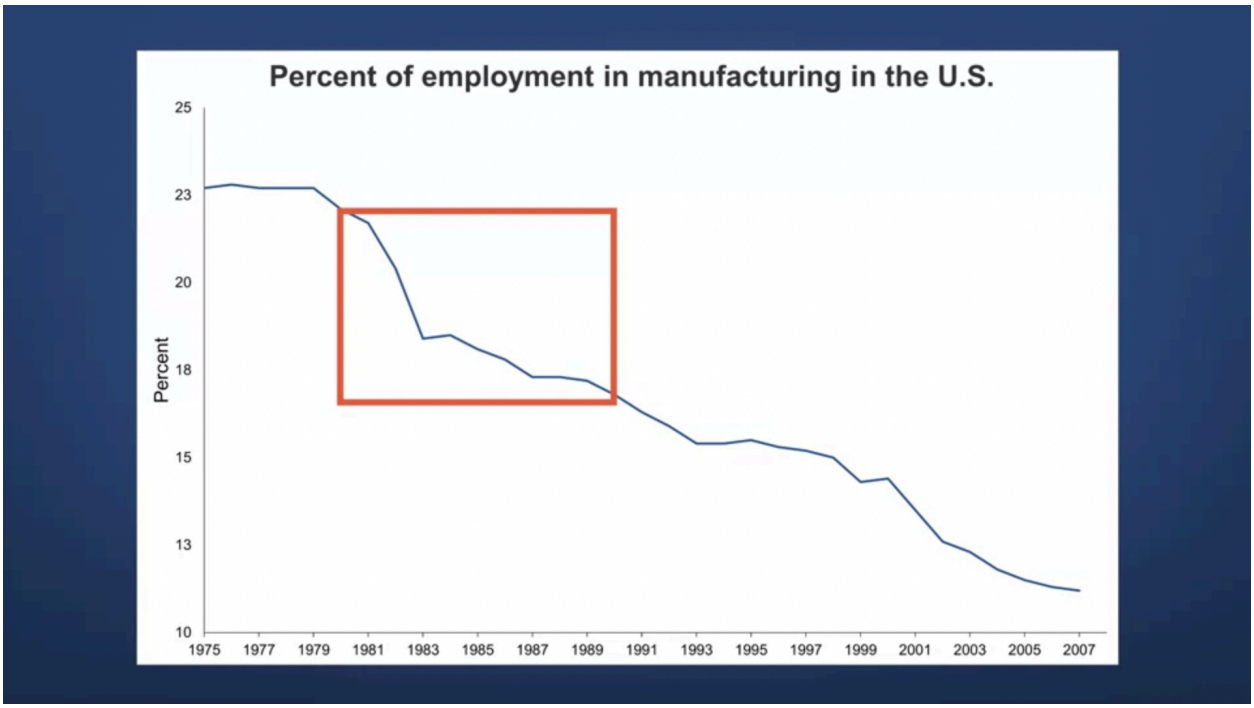
current employment statistics survey, which is also known as the payroll survey showed that as of the end of September 2003 Nonfarm payroll employment had fallen by some 2.8 million jobs since the beginning of the recession in March 2001. The manufacturing sector was by far the hardest hit sector. About 2.4 million of the 2.8 million jobs lost, were in the manufacturing sector. The survey also indicated that non-manufacturing payrolls recovered somewhat after the recession.

Other indicators of the labor market also suggested that workers face significant challenges finding jobs. First, labor force participation, particularly among younger workers declined. Second, unemployment duration increased significantly. Third, initial meaning new claims to unemployment insurance declined only slowly. Fourth, the Conference Board Index of help wanted advertising, a measure of job vacancies remained below its recession levels.

Taken together by job losses defined as decreases in payroll employment at shrinking establishments had returned to pre-recession levels. Job gains increases in payroll employment at expanding establishments had not recovered at all. Put differently while there were no unusually high layoffs, firms were just not hiring. Why was the response of the labor market too accommodative monetary policy so slow? There are two main explanations. The first is high uncertainty about economic developments, which makes firms reluctant to invest or hire. Among the obvious sources of uncertainty in the early 2000s, where (a) the September 11th attacks and their aftermath, including the wars in Afghanistan and Iraq. And (b) the accounting and corporate governance scandals, most prominently Enron and the collapse of Arthur Andersen, a big accounting firm.



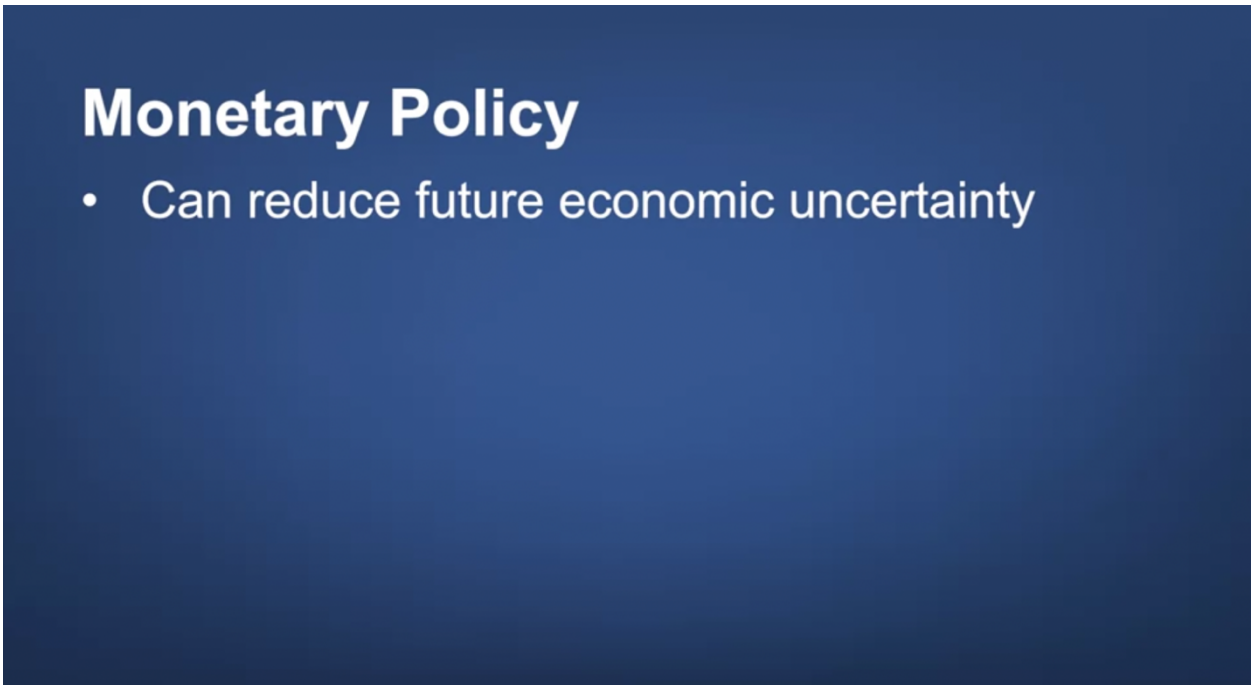
Second, the employment losses during the early 2000s, especially in manufacturing, where the result of an increased pace of structural change in the US economy. Structural change implies the permanent decline of certain industries. The decline of manufacturing was not new. The share of workers employed in the manufacturing sector had been decreasing since the early 1980s, driven in part by international competition.



Most notable was the increased competition in the auto market, where Japanese and Western European automakers expanded their market share in the US following the 1980 oil crisis.

However, structural change is usually a slow process and the consequences are hard to gauge for policymakers in real time. When you look back at the discussions of the early 2000s, one factor is notably absent. China became a member of the World Trade Organization on December 11, 2001. As a consequence, US trade policy changed and eliminated potential tariff increases on Chinese imports.

Recent research has found that shop losses in manufacturing were concentrated in US firms that faced import competition from China. To be clear, we would expect jobs lost in declining industries to be replaced eventually with jobs and growing industries for instance, the tech industry. However, this process can take time. New jobs need to be created and workers need to relocate and retrain. Its monetary policy effective when uncertainty is high or when structural changes underway.



In general, monetary policy can reduce uncertainty about future economic development by promising accommodative monetary policy. But in the case of the early 2000s, the more uncertainty was caused by terrorist attacks and subsequent wars. The accommodative monetary policy probably did not reduce uncertainty and therefore did little to stimulate investment and hiring.

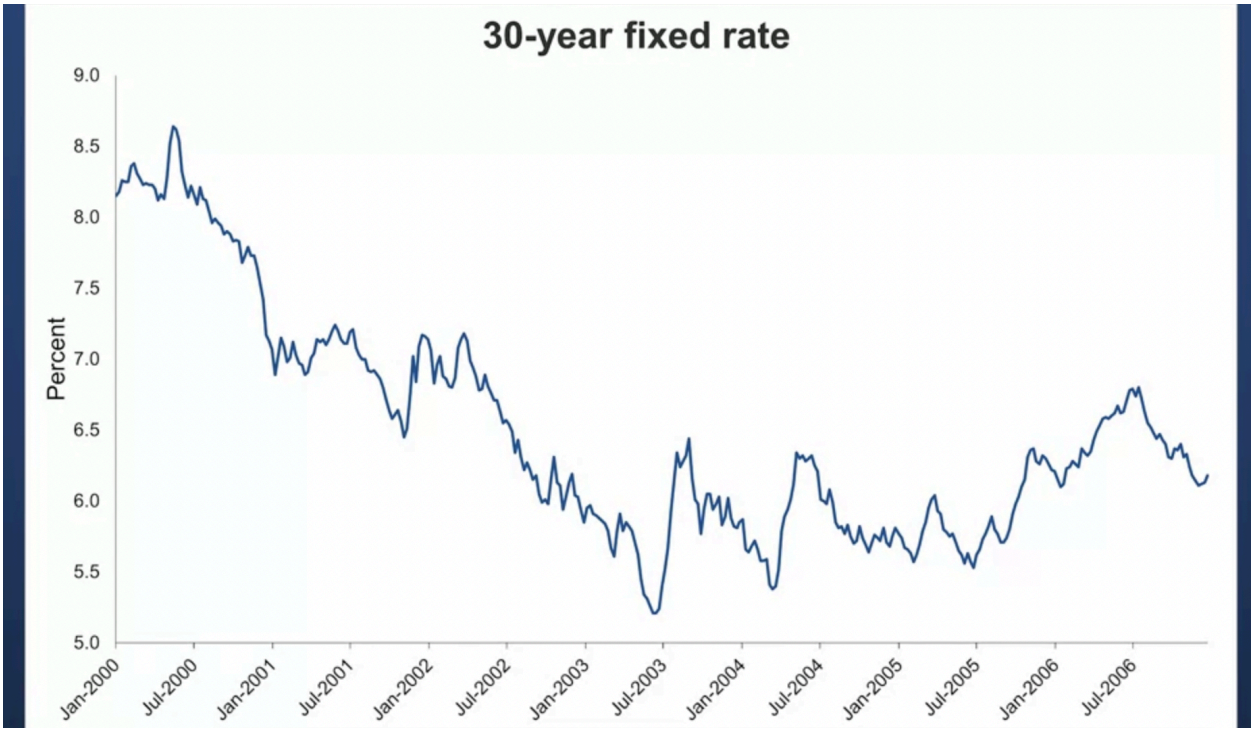
Similarly, monetary policy can do little to reduce the effects of structural change in the economy. In hindsight, it is perhaps less surprising that accommodative monetary policy did not achieve its employment goal. Monetary policy works when addressing cyclical fluctuation but can do little

when structural changes strife unemployment. You may wonder what happened with inflation. Inflation did not pick up, in part because of import competition, that reduced prices.

Accommodative Monetary Policy

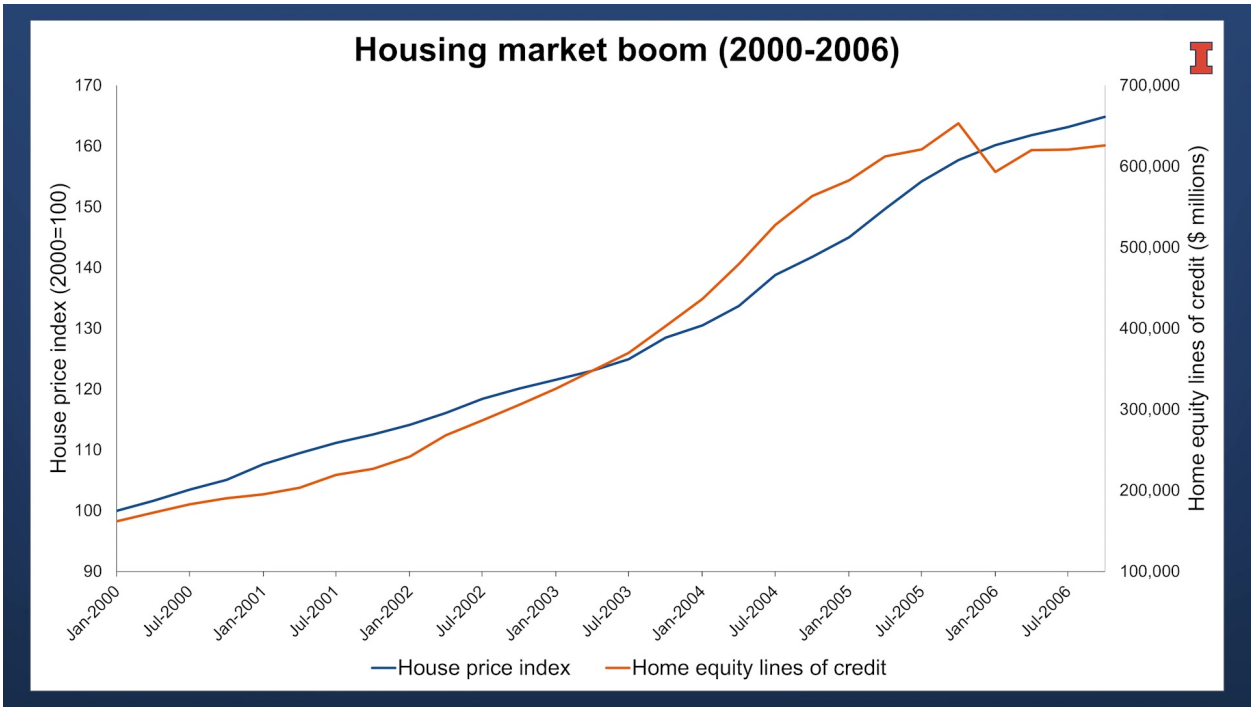
- Unintended consequences

However, the accommodative monetary policy of the early 2000s had an unintended consequence. In 2001, Paul McCulley, an economist at PIMCO, predicted that the extremely low federal funds rate set by the Federal Reserve could cause house prices to increase.

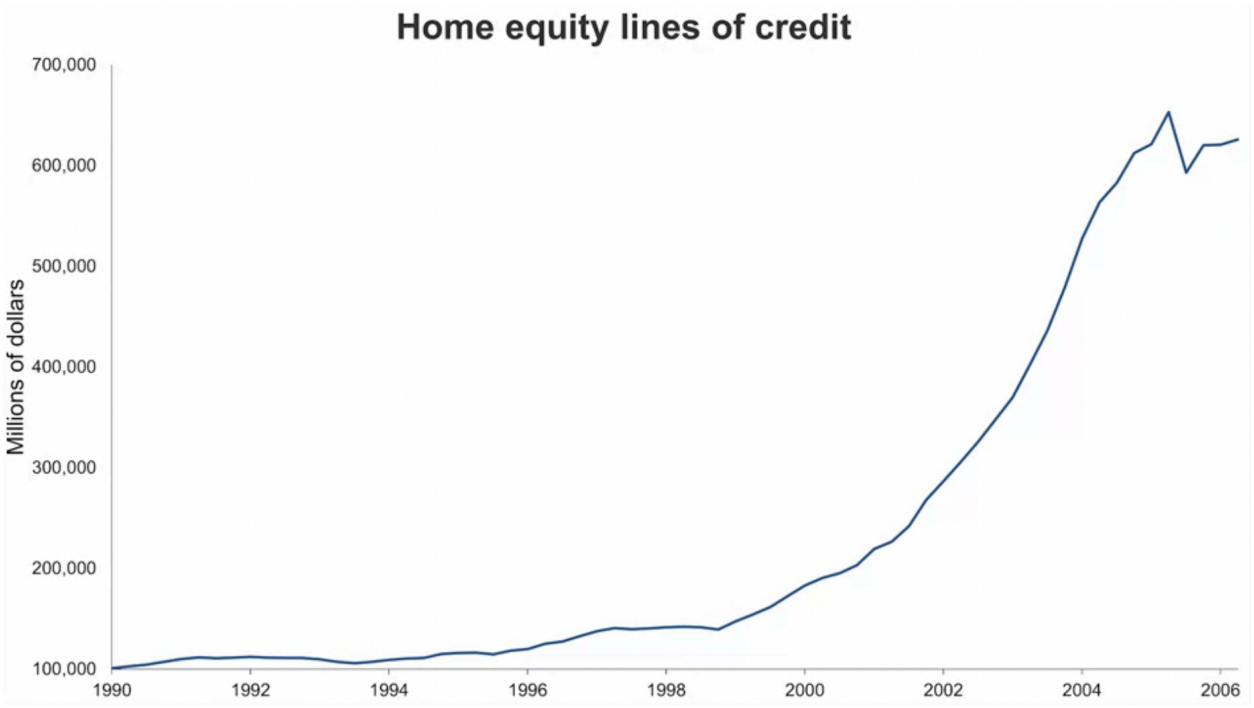


As you can see, the mortgage interest rate dropped from over 8% in 2000 to 5.5% in spring

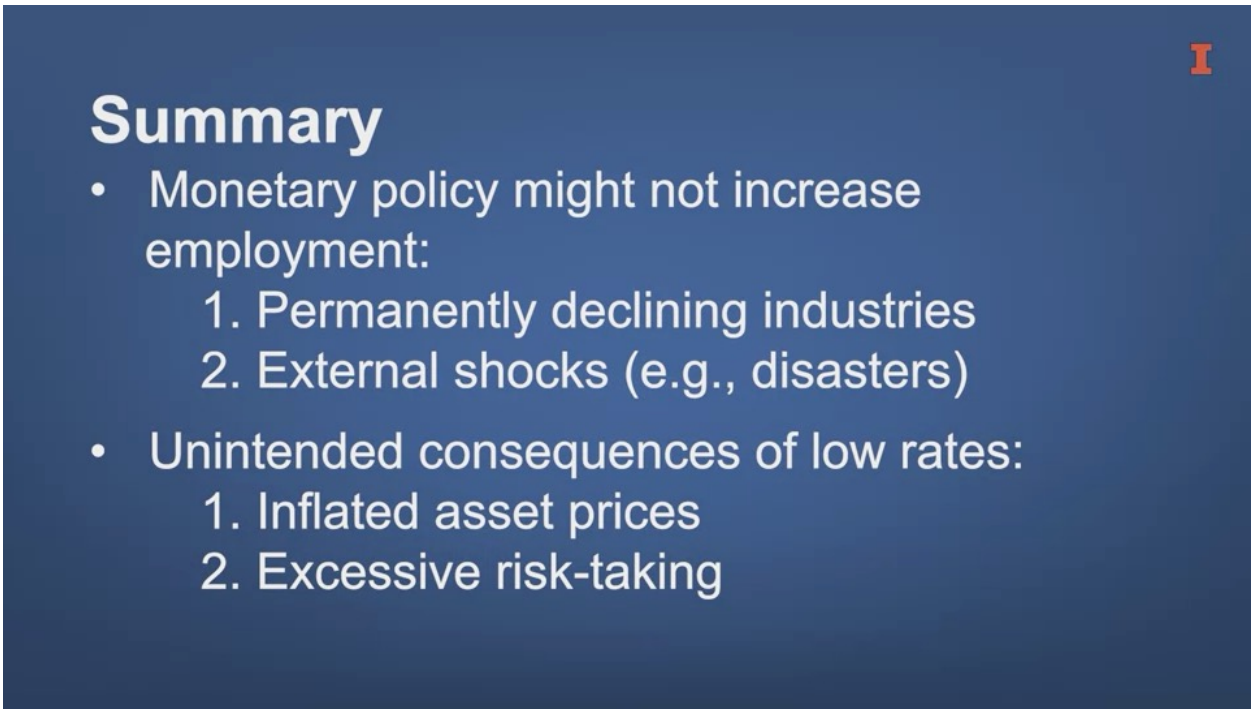
2003. Lower mortgage interest rates mean that people can afford new or larger houses increasing the demand for houses and house prices.



This graph shows you that house prices increased by over 60% between 2000 and 2006. As a result of rising house prices, construction boomed. Moreover, homeowners use mortgage refinancing and home equity lines of credit to borrow more against their houses, and spend the proceeds on consumer goods, for instance, cars and appliances.



As you can see in the craft, home equity lines of credit increased from $150 billion dollars in 2000 to $ 650 billion in latest 2005. This is a huge increase in the credit supply to consumers who subsequently spent this money. Construction and consumer spending eventually created jobs. By 2005, the then IMF chief economist Raghuram Rajan expressed concerns about the housing bubble. He argued that low interest rates and financial innovation created a situation in which financial market participants took more and more risk. He concluded that this risk could threaten the stability of the financial system. In hindsight, we know that his analysis was put on. The more general point to keep in mind is that low interest rates increase risk taking incentives. This includes higher leverage. The link between low interest rates and risk taking has been shown not only for the United States, but for all major economies. While encouraging risk taking, is one way to stimulate the economy, central banks need to be mindful of the effects of accommodative monetary policy on the overall soundness of the financial system. Since the 2008 financial crisis, financial stability has been added to the Federal Reserve's mandate. And the Federal Reserve is monitoring the buildup of risks in the US economy.



What have we learned in this lesson? First, monetary policy can do little when structural change or uncertainty about external events drive up unemployment. Second, monetary policy in the early 2000s supported a house price boom. Third, lower interest rates encourage risk taking and can lead to build up of risk in the economy.