

# International Money and Banking:

## 15. The Phillips Curve: Evidence and Implications

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# Monetary Policy and Tradeoffs

- We have seen how monetary policy is a powerful tool that can affect the economy by influencing all the key interest rates that affect spending decisions.
- So, why don't central banks always intervene to keep interest rates low and growth high?
- You probably have an idea of the answer already: There's no such thing as a free lunch. Life is full of tradeoffs.
- For monetary policy, the problem is that stimulating the economy too much tends to boost inflation.
- We have seen how central banks that create a lot of money tend to produce inflation but we have also seen that, at low-to-medium levels of inflation, the relationship between money growth and inflation is not a strong one.
- To understand the limits to monetary policy, we need to study the link between the real economy and inflation.
- We will do that now, starting with some background on how thinking about inflation has evolved since the 1960s.

# Part I

## The Phillips Curve

# The Phillips Curve

- What are the tradeoffs facing a central bank? A 1958 study by the LSE's A.W. Phillips seemed to provide the answer.
- Phillips documented a strong negative relationship between wage inflation and unemployment: Low unemployment was associated with high inflation, presumably because tight labour markets stimulated wage inflation.
- A 1960 study by MIT economists Solow and Samuelson replicated these findings for the US and emphasised that the relationship also worked for price inflation.
- The Phillips curve tradeoff quickly became the basis for the discussion of macroeconomic policy.
- Policy faced a tradeoff: Lower unemployment could be achieved, but only at the cost of higher inflation.
- However, Milton Friedman's 1968 presidential address to the American Economic Association produced a well-timed and influential critique of the thinking underlying the Phillips Curve.

# One of A. W. Phillips's Graphs

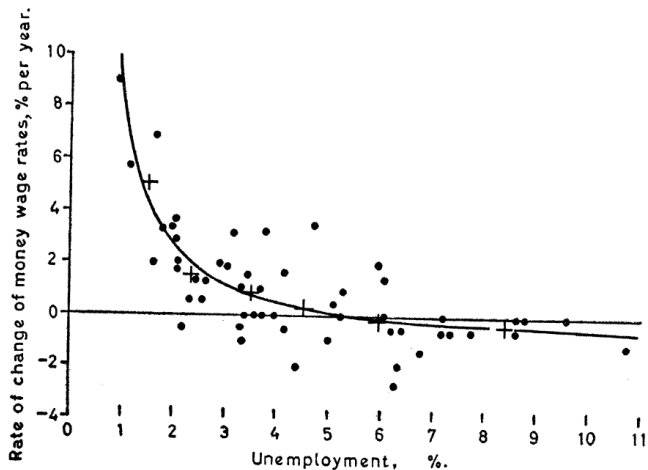


Fig.1.1861 - 1913

# Solow and Samuelson's Description of the Phillips Curve

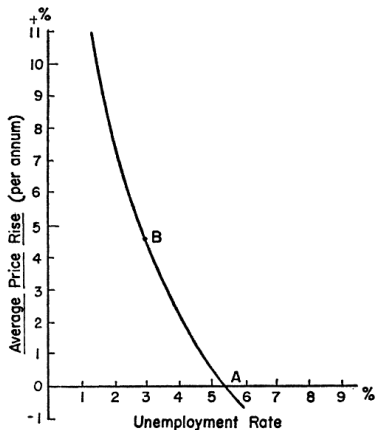


FIGURE 2

MODIFIED PHILLIPS CURVE FOR U.S.

This shows the menu of choice between different degrees of unemployment and price stability, as roughly estimated from last twenty-five years of American data.

# The Expectations-Augmented Phillips Curve

- Friedman pointed out that it was expected real wages that affected wage bargaining.
- If low unemployment means workers have strong bargaining position, then high nominal wage inflation on its own is not good enough: They want nominal wage inflation greater than price inflation.
- Assuming wage inflation gets passed through to price inflation, this gives us the following model of price inflation, known as the *expectations-augmented* Phillips curve:

$$\pi_t = \pi_t^e - \gamma(U_t - U^*)$$

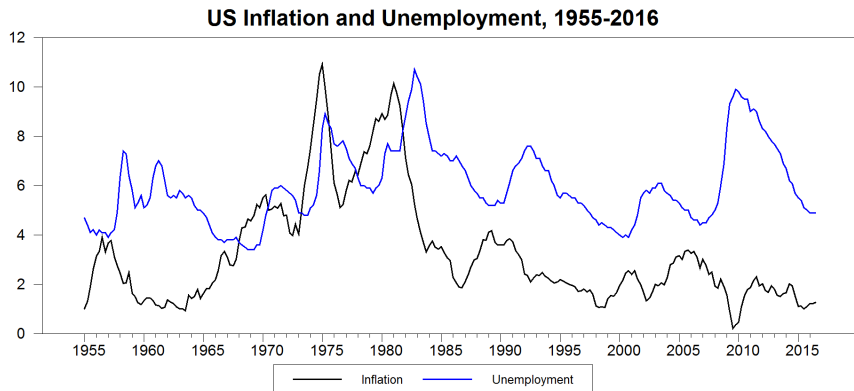
- Friedman pointed out if policy-makers tried to exploit an apparent Phillips curve tradeoff, then the public would get used to high inflation and come to expect it:  $\pi_t^e$  would drift up and the tradeoff between inflation and output would worsen.
- In the long-run, you can't fool the public ( $\pi_t^e \approx \pi_t$ ) so you can't keep unemployment away from its "natural rate"  $U_t \approx U^*$ .

# The Demise of the Basic Phillips Curve

- US monetary and fiscal policy in the 1960s were very expansionary.
- At first, the Phillips curve seemed to work: Inflation rose and unemployment fell.
- However, as the public got used to high inflation, the Phillips tradeoff got worse. By the late 1960s inflation was still rising even though unemployment had moved up.
- This *stagflation* combination of high inflation and high unemployment got even worse in the 1970s.
- This was exactly what Friedman predicted would happen.
- Today, the data no longer show any sign of a negative relationship between inflation and unemployment. In fact, the correlation is positive: The original formulation of the Phillips curve is widely agreed to be wrong.
- And the 1960s are now seen as an example of what goes wrong when monetary policy pursues the wrong goals.



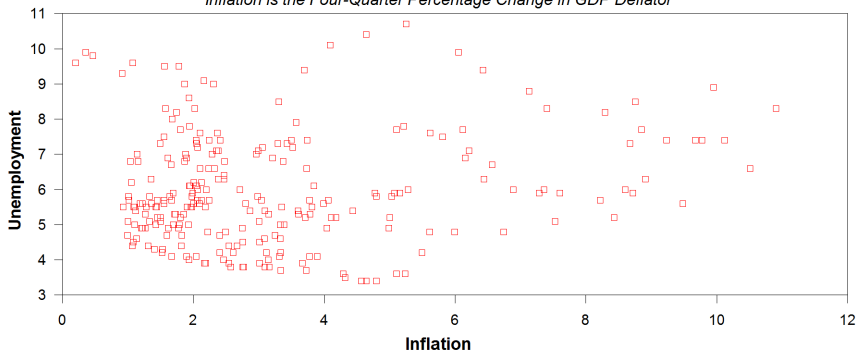
# The Evolution of US Inflation and Unemployment



# The Failure of the Phillips Curve

## US Inflation and Unemployment, 1955-2016

*Inflation is the Four-Quarter Percentage Change in GDP Deflator*



# The Accelerationist Phillips Curve

- What determines inflationary expectations?
- Friedman argued they are determined *adaptively*. For instance, people use last year's inflation rate as a guide to what to expect this year.
- In this case, this would mean  $\pi_t^e = \pi_{t-1}$ , so the expectations-augmented Phillips curve becomes

$$\pi_t = \pi_{t-1} - \gamma(U_t - U^*)$$

- This relates the *change* in inflation to the gap between unemployment and its natural rate. When unemployment is below its natural rate, inflation will be increasing; when it is above it, it will be decreasing.
- Because it relates the rate of acceleration of the price level to unemployment, this is known as the *accelerationist* Phillips curve.
- This model fits the data pretty well.

# The Success of the Accelerationist Phillips Curve

## Changes in US Inflation and Unemployment, 1955-2016

*Change in Inflation is Four-Quarter Inflation Relative to a Year Earlier*



# Real-World Complications

- The accelerationist Phillips curve relationship between the change in inflation and the unemployment rate seems to offer a key tool to central bankers, and it is indeed useful.
- However, as with all models, the real world is a bit more complicated than the simple model. Two complications are worth noting:

- 1 Supply shocks: The economy is constantly being hit with shocks that temporarily shift the inflation-output tradeoff, so that it becomes

$$\Delta\pi_t = -\gamma(U_t - U^*) + s_t$$

Bad supply shocks are ones that raise inflation even though the unemployment rate hasn't changed (oil price shocks are a good example).

- 2 The natural rate,  $U^*$ , is not a universal constant. It changes over time and, at any point in time central bankers must guess it. For instance in Europe the natural rate rose substantially in the 1980s and 1990s. More generally, central bankers are usually unsure of how fast the economy can grow without triggering inflationary pressures.

# Tradeoffs Offered by The Accelerationist Phillips Curve

- Over the short-term, the accelerationist model describes a new tradeoff for central bankers. For instance, they can choose to keep the unemployment rate below the natural rate for a while at the expense of increasing inflation.
- But it doesn't really offer an exploitable long-run tradeoff.
- Even if central bankers wanted to be popular and maintain unemployment below the natural rate, the cost of seeing ever-increasing inflation would be too high.
- Policy-makers thus have to accept that, over the long run, unemployment will be close to its natural rate.
- Also, if they did decide to exploit this relationship, people would recognise it, take it into account, and then they probably wouldn't set  $\pi_t^e = \pi_{t-1}$  anymore, so the relationship would break down.
- Note, though, this tension between something that can be exploited in the short run but not in the long run. We will come back to this in the second part of these notes.

# Long-Run Benefits of Low Inflation

- Because central banks now believe they can't really control the unemployment rate or the growth rate for long periods of time, they tend to focus a lot on what they can control: Inflation.
- In particular, most central banks in recent years have aimed for keeping inflation low and stable as their main goal.
- Ben Bernanke (see his speech, "The Benefits of Price Stability") argues that "the mandated goals of price stability and maximum employment are almost entirely compatible".
- Low inflation helps to boost economic growth over the long run by
  - ① Saving the time and energy associated with dealing with high inflation: Having to reset prices regularly, re-write contracts to deal with inflation.
  - ② Facilitating long-run decision making, with consumers and businesses not having to worry about uncertainty about the future price level.
  - ③ Enhancing the price signals and thus the functioning of the market system.
- But it is hard to argue on these grounds that, for example, there is a large welfare gain going from 4% inflation to 2% inflation.

# Part II

## Credibility and Commitment



# The Barro-Gordon Model of Central Bank Decision-Making

- We have described the expectations-augmented Phillips curve.
- We discussed how, in the short run when the public has a particular expectation of inflation, a central bank could choose to stimulate the economy and obtain lower unemployment at the cost of higher inflation.
- But in the longer run, the public's expectations of inflation would adapt and the central bank could only keep unemployment below the natural rate at the expense of ever-increasing inflation.
- This tension between what can be done in the short run and what should be done in the long run is important. It has a significant influence on how modern central banks behave.
- We will now discuss a simplified formal model that explains these issues. The model is discussed in full in UC Berkeley professor Brad DeLong's notes, linked to on the website.
- It is a simplified version of the models of Kydland and Prescott (*JPE*, 1977) and Barro and Gordon (*JPE*, 1983). It is most like the latter, so I will call it the Barro-Gordon model.

# The Model's Assumptions

- Assume that inflation is determined by an expectations-augmented Phillips curve:

$$\pi = \pi^e - \beta(u - u^*)$$

- The central bank acts so as to maximize its perception of the “social welfare function” defined by

$$S = -u - \frac{\omega}{2}\pi^2$$

- 1 Social welfare depends negatively on unemployment, and also on inflation.
  - 2 The square of inflation is used because the costs of inflation increase more than proportionately as inflation rises, e.g. 4% inflation is annoying, 20% inflation is very harmful, 100% inflation highly destructive.
- The model simplifies the “transmission mechanism” of monetary policy substantially by assuming that the central bank's control over monetary policy allows it to simply choose the current inflation rate.

# What Does the Central Bank Do?

- We assume that  $\pi^e$  has been set by the time the central bank gets to make its decisions.
- What inflation rate will they pick?
- Let's simplify their problem by re-arranging the Phillips curve to describe unemployment as a function of inflation and two other parameters ( $\pi^e$  and  $u^*$ ) that are fixed.

$$u = u^* + \frac{\pi^e - \pi}{\beta}$$

- So the central bank's problem reduced to picking the  $\pi$  that maximizes

$$S = -u^* - \frac{\pi^e}{\beta} + \frac{\pi}{\beta} - \frac{\omega}{2}\pi^2$$

- Optimisation implies taking the derivative of  $S$  with respect to  $\pi$ , setting it equal to zero, and solving for the implied inflation rate:

$$\frac{dS}{d\pi} = \frac{1}{\beta} - \omega\pi = 0 \Rightarrow \pi = \frac{1}{\omega\beta}$$

# Expected Inflation and Social Welfare

- If the public understands how the central bank makes its decisions by solving this optimisation problem, then they will set their expectations to the correct value:

$$\pi^e = \frac{1}{\omega\beta}$$

- Note that because  $\pi^e = \pi$ , the expectations-augmented Phillips curve tells us that  $u = u^*$ .
- And social welfare is

$$S = -u^* - \frac{\omega}{2} \left( \frac{1}{\omega\beta} \right)^2 = -u^* - \frac{1}{2\omega\beta^2}$$

- Despite the central bank's best intentions, it turns out that it could perhaps do better than this.

## Committing to an Inflation Rate

- Suppose that instead of picking the optimal inflation rate each period, the central bank could credibly commit to a particular inflation rate,  $\pi_c$ , knowing that this rate would then be expected by the public.
- In this case, they would know that  $\pi^e = \pi_c$  and  $u = u^*$  and social welfare would be

$$S = -u^* - \frac{\omega}{2}\pi_c^2$$

- In this case, committing to zero inflation,  $\pi_c = 0$ , provides the best outcome of  $S = -u^*$ .
- Remember that, in the previous example, where the central bank did not commit and took the expectations as outside its control, social welfare was  $S = -u^* - \frac{1}{2\omega\beta^2}$  which is lower.
- The ability to pre-commit provides a better outcome than that obtained by picking an optimal inflation rate each period, taking expectations as given.

## So Why Not Just Commit?

- Suppose the central bank convinced the public that it will set the inflation rate equal to zero.
- If it then decided to pick the optimal rate, contingent on taking the zero inflation expectations as given, it would again pick  $\pi = \frac{1}{\omega\beta}$ .
- In this case, the inflation “surprise” would be engineered by having unemployment below the natural rate

$$u = u^* - \frac{1}{\omega\beta^2}$$

- And social welfare turns out to be

$$S = -u^* + \frac{1}{2\omega\beta^2}$$

which is an even better outcome than obtained under commitment.

- So, having made the commitment, the central bank (and society) would be better off *this period* if it broke the commitment. This may make the public skeptical about the central bank’s commitment.

# Implications for Central Bank Institutional Design

A better outcome is obtained if the central bank can commit to a low inflation, and this commitment be believed by the public. This suggests the following ways of achieving the best outcome:

- 1 **Political Independence:** A central bank that plans for the long-term (and does not worry about economic performance during election years) is more likely to stick to a low inflation commitment. So, independence from political control is an important way to reassure the public about the bank's credibility.
- 2 **Conservative Central Bankers:** If the central banker has a high  $\omega$ —really doesn't like inflation—and the public believes this, the economy gets closer to the ideal low inflation outcome even without commitment. So the government may choose to appoint a central banker who is more inflation-averse than they are (Paul Volcker's appointment as Fed chair in 1979 might be an example of this happening.)
- 3 **Consequence for Bad Inflation Outcomes:** Introducing laws so that bad things happen to the central bankers when inflation is high is one way to make the public believe they will commit to a low inflation rate.

# Influence of this Research

This research has had a considerable influence on the legal structure of central banks around the world:

- 1 **Political Independence:** There has been a substantial move around the world towards making central banks more independent. Close to home, the Bank of England was made independent in 1997 (previously the Chancellor of the Exchequer had set interest rates) and the ECB/Eurosystem is highly independent from political control.
- 2 **Conservative Central Bankers:** All around the world, central bankers talk much more now about the evils of inflation and the benefits of price stability. Mainly, this is because they believe this to be the case. But there is also a marketing element. Perhaps they can face a better macroeconomic tradeoff if the public believes the central bank's commitment to low inflation.
- 3 **Consequence for Bad Inflation Outcomes:** Many central banks now have legally imposed inflation targets and bad things happen when the inflation target is not met. For instance, the Governor of the Bank of England has to write a letter to the Chancellor explaining why the target was not met.



## Problems with a Low Inflation Target

- Most central banks have adopted a target inflation rate of about 2 percent over the past two decades. And inflation has been kept in check in most advanced countries since the mid-1980s.
- More recently, there has been a debate about whether 2 percent is too low an inflation target. When inflation averages two percent, then relatively small shocks can bring the economy close to deflation.
- Perhaps with a higher inflation target, economies would be less likely to fall into “liquidity trap” conditions and central banks would have more room to cut interest rates before hitting lower bounds on policy rates and conducting unorthodox policies like QE.
- See the IMF paper called “Rethinking Macroeconomic Policy” for a discussion of the potential benefits of higher inflation targets.
- There are also some signs now that some policy makers are reconsidering the idea of focusing purely on inflation targeting. The New Zealand central bank, the first pure inflation targeter back in the 1990s, was given a changed mandate on March 26, 2018 to also take employment into account when making monetary policy decisions.

# Recap: Key Points from Part 15

Things you need to understand from these notes:

- 1 The original Phillips curve and its demise.
- 2 The expectations-augmented Phillips curve.
- 3 The accelerationist Phillips curve.
- 4 Tradeoffs implied by the expectations-augmented Phillips curve.
- 5 Benefits from low inflation.
- 6 Problems caused by a low inflation target.
- 7 The assumptions of the Barro-Gordon model.
- 8 The model's predictions for outcomes with and without commitment.
- 9 Implications of Barro-Gordon for central bank institutional design.
- 10 The influence Barro-Gordon-style research has had on central banks.