The Phillips curve

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One of the shortcomings of the Real Business Cycle (RBC) model is that there is very little reference to the analysis of macroeconomic policy. Indeed, the cycles are predominantly explained by technological shocks. A solution would be to take a RBC model and simply add a variable that captures monetary policy. However, in the absence of any price or wage frictions such a variable would have little effect. To model monetary policy more realistically a model is needed where the prices don't simply follow the money supply and where nominal interest rate and inflation don't just move together. This is basically what the Keynesian model sets out to do and in these types of model the prices are sticky. This entails that the real interest rates can be influenced by the central bank, i.e. via monetary policy. On its own turn, the real interest rate can affect economic performance which will influence inflation. A well-known relationship between economic performance and inflation is the Phillips curve. In these notes the history and development of the Phillips curve will be briefly discussed.

The idea behind the Phillips curve

In early economic work there has long been the idea that there is some sort of positive relationship between inflation and output. The modern incarnation of this relationship is traced back to a 1958 study by A.W. Phillips, who used data on the British economy. Phillips showed that there is a negative relation between unemployment and inflation: low employment levels are associated with higher inflation rates (upper graph in figure 1). This is presumably due to the fact that tight labour markets stimulate wage inflation. The results for the original Phillips study were replicated in 1960 by Samuelson and Solow using data on the U.S. economy (bottom graph in figure 1). The trade-off of the Phillips curve became the based for a discussion on macroeconomic policy, where lower unemployment levels could be attained but at the cost of higher inflation rates.

Phillips argued that unemployment influenced the inflation rate. About 30 years earlier in 1926 Fischer published a paper on this particular topic finding a similar relation, but the direction of causation was reversed where changes in the inflation rate influence the level of unemployment.

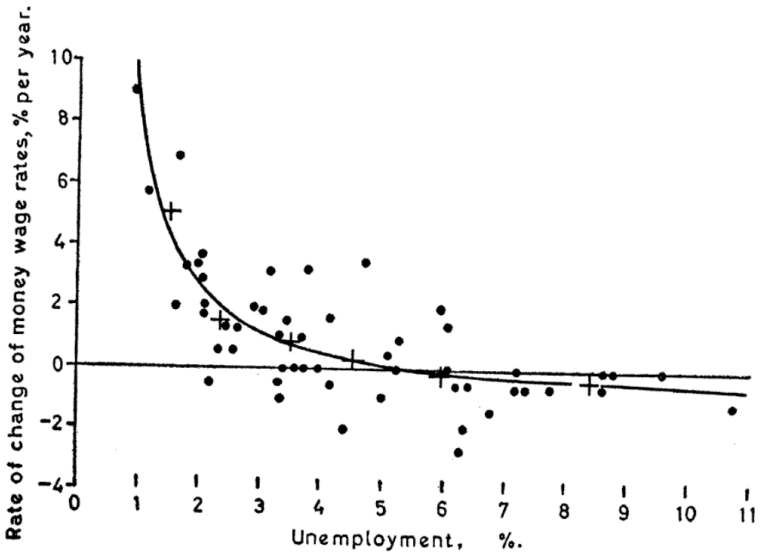

Figure 1: The graph by A.W. Phillips (top) showing the relation between unemployment and inflation and by Solow & Samuelson (bottom) for the US economy.

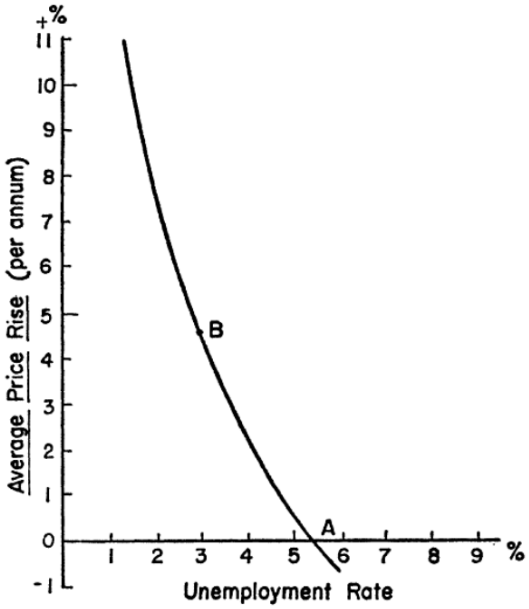

FIGURE 2

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.

Failure of the Phillips curve

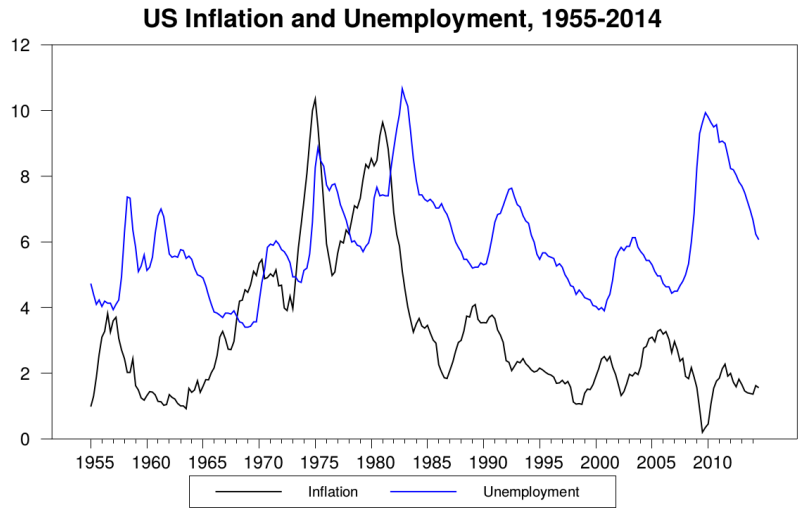

Figure 2: Development of inflation and unemployment in the U.S.A. Graph produced by Karl Whelan

A sort of natural law in economics like the Phillips curve almost sounds too good to be true, which it was. Friedman predicted the collapse of the Phillips curve in his 1967 presidential address of the American Economic Association meeting. Consider for instance the attempt of a government to reduce unemployment, below it's natural rate, by using a monetary stimulus. Due to the stimulus income and spending will increase. Initially this can be observed in increases in employment levels and output, but not prices. Now due to the increase in output and employment people will expect that prices will start to rise, and as a result demand higher nominal wages. To keep unemployment below the natural level this means that an extra monetary stimuli is required, accelerating inflation.

Friedman noted that the failure to distinguish between nominal and real wages as the main failure of the model.

The idea Friedman described can be roughly formalised in the following model

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

Now, if policy makers tried to exploit the Phillips curve trade-off, then the public would get accustomed to high inflation rates and come to expect it. As a result of this $E\pi_t$ would drift upwards and the trade-off between inflation and unemployment would worsen. In the long run you can't fool people ($E\pi_t \approx \pi_t$), so you can't keep unemployment away from its natural rate $U_t \approx U^*$.

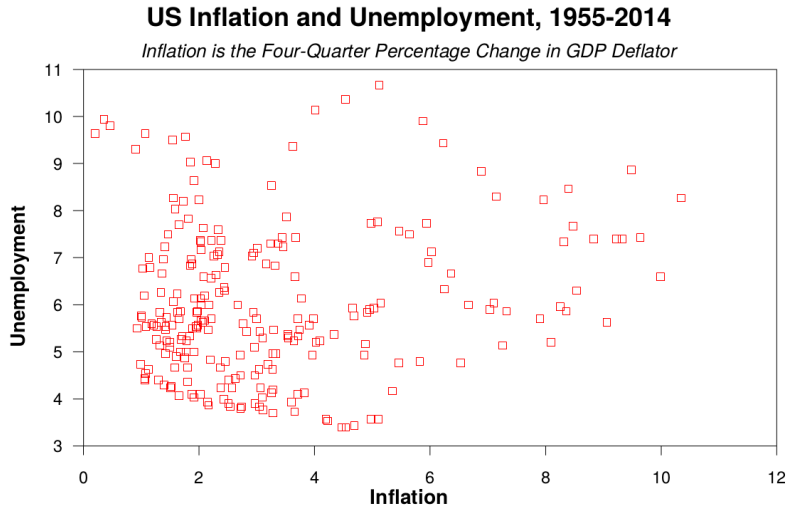

Figure 3: Failure of the Phillips curve. Graph produced by Karl Whelan

Accelerationist Phillips curve

Friedman's idea was that expectations about inflation are determined adaptively. So practically, people will use last year's inflation rate as a guide to what to expect this year. This sort of behaviour can be used to create what is called an expectation-augmented Phillips curve. By setting $E\pi_t = \pi_{t-1}$ the curve becomes

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

In this model the change in inflation is linked to the gap between actual unemployment levels and its natural rate. So when unemployment is below its natural rate, inflation will increase and similarly when unemployment is above the natural rate, inflation will decrease. Since unemployment below the natural rate implies an increase or accelerating price level, this relationship is known as the accelerationist Phillips curve.

The NAIRU

Non Accelerating Inflation Rate of Unemployment

Although the augmented Phillips curve addresses some issues with the original Phillips curve, there are still some complications in practice. Inflation expectations are likely best captured by a weighted average of past inflation rates, rather than just a simple lag like last year's value. The model becomes

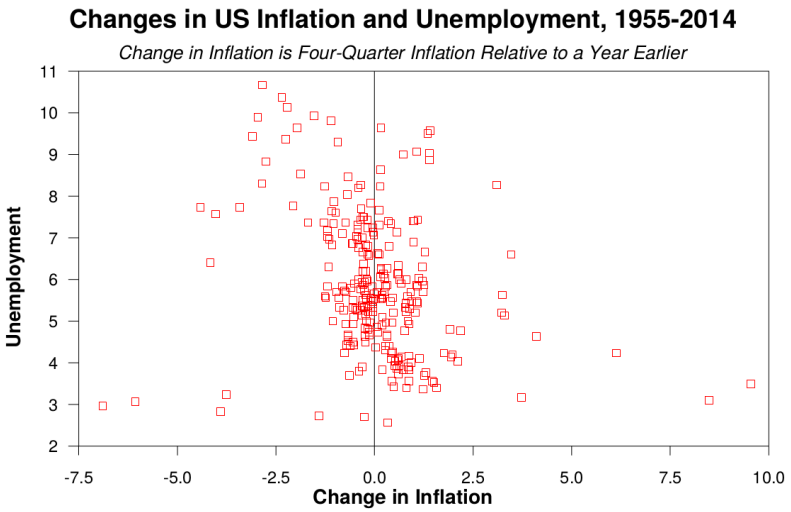

Figure 4: Marginal improvements for the accelerationist Phillips curve. Graph produced by Karl Whelan

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

$\sum_{i=1}^{N} \beta_i = 1$

The natural inflation rate is unknown of course, but it can be estimated using

$$\pi_t = \alpha - \gamma U_t + \sum_{i=1}^{N} \beta_i \pi_{t-i}$$

$$\alpha - \gamma U^* = 0$$

$$U^* = \frac{\alpha}{\gamma}$$

This model is usually supplemented in empirical research including additional supply shock terms, recognising for instance that inflation of food and energy prices can change more rapidly. There are some important policy implications as well

Modern variations also allow for the possibility of variation in the NAIRU, and this approach is regularly used in policy analysis.

- Inflation is highly inertial
  - A shock to inflation today takes a long time to disappear
- Inflation largely predetermined by backward-looking expectations at any point in time
  - Hard to get inflation down quickly without inflicting a lot of unemployment
- Probably best to have monetary policy act to reduce inflation gradually over time

The Lucas critique

Lucas (1972) and Sargent (1972) criticized the assumption of adaptive expectations and argued that

1. Expectations should be based on perceived policy regime and not just on recent history
2. If the policy regime changes, there is no need for people to use the recent past as their guide
3. Coefficients of all reduced-form econometric models (including Phillips curves) will change (following 1 and 2)
4. Econometric models not reliable for analyzing effects of policy changes

This critique implies that econometric NAIRU estimates are not useful and stresses the need to have the correct structural model to do useful policy analysis.

E.g. If policy credibly commits to keeping inflation close to 2% at all times, then random deviations from the target should not budge inflation expectations from 2%.

Critique of Keynesianism

There has been some additional critique on the Keynesian school. Consider for instance the expectations-augmented Phillips curve

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

When there is unexpected inflation $\pi_t \neq E\pi_t$, it must be the case that

$$U_t \neq U^*$$

This entails, that in the case that expectations are rational, these actually must be random and unpredictable based on the publicly available information. Subsequently, this means that there is no room for predictable (Keynesian) stabilisation. The rational expectations school developed a different approach with models based on individual agents pursuin optimizing behaviour. Adherents of this school argue that monetary policy has little to do with business cycles, and instead they theorised that cycles are largely caused by real shocks to technology.