

MODELLING INFLATION AND UNEMPLOYMENT BY USING SYSTEM DYNAMICS

Most discussions about inflation begin with the Phillips curve, which describes the relationship between inflation and unemployment and takes into account expectations about the future rate of inflation. In the short-term outlook, the expectations are constant, the Phillips curve does not shift, and therefore, a certain correlation between inflation and unemployment can be considered, which, in general, can be written as:

$$\pi = f(u) + \pi^e$$

where π is the inflation, π^e is the expected inflation, and u is the unemployment rate.

Consider a simple inverse relationship between inflation and unemployment, that is, we assume that the unemployment rate u is equal to the natural rate of unemployment u_n (therefore the nominal wage does not change) satisfying $f(u) = 0$ and $\pi = \pi^e$. Given that the rate of changes in wages corresponds to that in the price level, we can write

$$\pi = -\gamma(u - u_n), \gamma > 0$$

where γ is the coefficient of the inflation rate sensitivity to the change in the level of cyclic unemployment. Given the inflationary expectations, the equation of the short-term Phillips curve will take the form.

$$\pi = -\gamma(u - u_n) + \pi^e, \gamma > 0$$

We construct a model of system dynamics for studying changes in the level of prices and inflation and analyzing their dynamics. In the model, inflation is described as a stock variable (Stock), and inflation growth is respectively the biflow variable (Fig. 1).

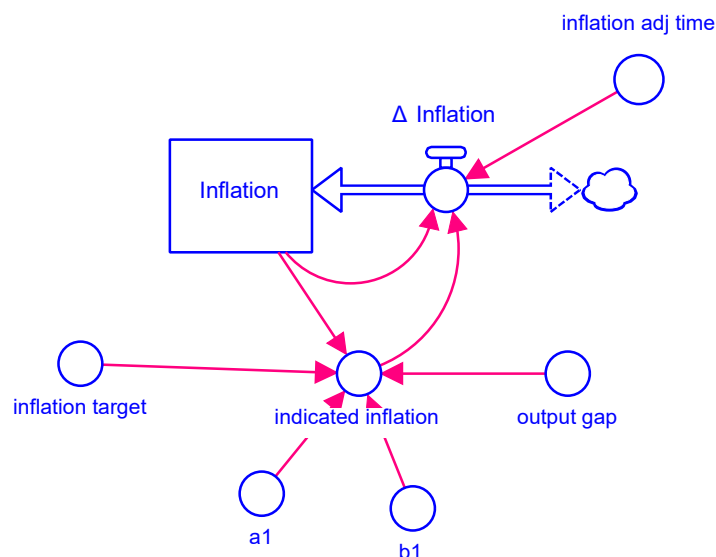


Figure 1. **Inflation as a function of the previous inflation, expected inflation and the output gap**

By setting the initial values one can observe the dynamics of the curve and analyze the changes that occur as a result of economic shocks, supply shocks, and demand shocks in particular. Supply shocks occurs when the conditions of the national economy functioning change dramatically that affects the cost of production of goods and services, and consequently, the prices set by companies. In the case of unfavorable supply disturbances, the production costs increase, and hence the prices. This means that the inflation rate is changing and the Phillips curve shifts upward. And vice versa, in case of favorable disturbances of the aggregate supply, for example, due to decline in the world oil prices, the inflation rate will decrease and the Phillips curve will shift downwards. That is, the rise in the inflation rate will shift the Phillips curve upwards.

One type of economic disturbance that is likely to affect in unemployment and inflation is a supply shock (an adverse supply shock causes a burst of inflation, which may lead people to expect higher inflation). An adverse supply shock also tends to increase the natural unemployment rate, although the reasons for this effect are different in the classical and Keynesian models. From the classical perspective, an adverse supply shock raises the natural rate of unemployment by increasing the degree of mismatch between workers and jobs. For example, an oil price shock eliminates jobs in heavy-energy-using industries but increases employment in energy-providing industries.

An adverse supply shock has no effect on the supply of labor, but it does reduce the marginal product of labor and thus labor demand. With a rigid efficiency wage, the drop in labor demand increases the excess of labor supplied over labor demanded, raising the amount of unemployment that exists when the economy is at full employment. Thus, an adverse supply shock will raise the natural unemployment rate. Because adverse supply shocks raise both expected inflation and the natural unemployment rate, they should cause the Phillips curve to shift up and to the right. Similarly, beneficial supply shocks should shift the Phillips curve down and to the left. Overall, the Phillips curve should be particularly unstable during periods of supply shocks.

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