Econ 302 Intermediate Macro Handout 8

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Chapter 14 AS and the Short-run Tradeoff Between π and u

When we introduced the aggregate supply curve of Chapter 10, we established that aggregate supply behaves differently in the short run than in the long run. In the long run, prices are flexible, and the aggregate supply curve is vertical. When the aggregate supply curve is vertical, shifts in the aggregate demand curve affect the price level, but the output of the economy remains at its natural rate. By contrast, in the short run, prices are sticky, and the aggregate supply curve is not vertical. In this case, shifts in aggregate demand do cause fluctuations in output. In Chapter 10, we took a simplified view of price stickiness by drawing the short-run aggregate supply curve as a horizontal line, representing the extreme situation in which all prices are fixed. So, now we'll refine our understanding of short-run aggregate supply to better reflect the real world in which some prices are sticky and others are not.

The Basic Theory of Aggregate Supply

In the long-run, aggregate supply is indepent of inflation:

$$LRAS : \bar{Y_t} = A_t F(K_t, \bar{N_t})$$

In the short-run, aggregate supply depends on price level, expected price level and natural level of output:

$$SRAS : Y = \bar{Y} + \alpha(P - EP), \alpha > 0$$

Why unexpected movement in the price level affects aggregate output in the short run?

The Sticky Price Model

Until now we assumed that firms are perfectly competitive(i.e. firms are price-takers). Now we assume that firms have some monopolistic power in order to talk about price-setting behavior. (Refresher: In perfect competition, firms cannot charge more than their competitors because they will lose all their customers. Think of the goods as being very close substitutes (e.g. blue and red matches). Price equals marginal cost. However, in imperfect competition when a firm has some market power, e.g. because there are no perfect substitutes for its products (think of a BMW vs. Mercedes), increasing its prices will not cost the firm all its customers. Price exceeds marginal cost.)

Consider an economy is consisted of two types of firms, a fraction of $s$with sticky prices and $1 - s$ with flexible prices.

For firm with flexible prices they set their prices according to

$$p = P + a(Y - \bar{Y}), a > 0$$

where the desired price p depends on the overall price level P and the level of aggregate income Y relative to the natural level $\bar{Y}$:

For firm with sticky prices they set prices according to

$$p = EP + a(EY - E\bar{Y}) = EP, a > 0$$

where E is for expected value of a variable and assuming that for these firms the expected output equals to its natural level.

Then the overall price level is

$$P = sEP + (1 - s)[P + a(Y - \bar{Y})]$$

$$\text{that is, } P = EP + [(1 - s)a/s](Y - \bar{Y})$$

That is to say, firstly, a high expected price level leads to a high actual price level P, and this effect does not depend on the fraction of firms with sticky prices. Secondly, a high output level leads to a high actual price level P, and the more firms that have sticky prices, the less the price level responds to the level of economic activity.

Rearranging the equation we have

$$Y = \bar{Y} + \alpha(P - EP), \text{where } \alpha = s/[(1 - s)a]$$

The Imperfect Information Model

At a given point of time, producers don't observe simultanously the prices of all goods and services in the economy. Suppose producers face an increase of their prices, and they do not know whether this is because the demand for their

commodity is stronger or because all prices increase. In the first case producers would supply more, but in the second their supply should not respond. So individual producers will price their goods and services relative to an expectation of average price level. The higher the producers price relative to the expected price level, the more they will supply.

$$Y = \bar{Y} + \alpha(P - EP)$$

The two models both can be summarized by the equation, that is, the deviations of output from tha natural level are related to deviations of the price level from the expected price level.

$$Y = \bar{Y} + \alpha(P - EP)$$

Phillips Curve

Deriving the Phillips Curve from the AS

Phillips curve is a supply-side relationship between inflation and unemployment. This is just the SRAS, with unemployent substituting for output.

Starting from the equation we derived in the last part,

$$P = EP + (1/\alpha)(Y - \bar{Y}), \text{ where } \alpha = [(1 - s)a/s]$$

we first add a supply shock v to represent exogenous events that alter price level and shift the short run aggregate supply curve:

$$P = EP + (1/\alpha)(Y - \bar{Y}) + v, \text{ where } \alpha = [(1 - s)a/s]$$

By subtracting P_{-1} on both sides, approximately that is

$$\pi = E\pi + (1/\alpha)(Y - \bar{Y}) + v, \text{ where } \alpha = [(1 - s)a/s]$$

Lastly, remember the labor market, by Okun's law(the deviation of output from its natural level is negatively related to the deviation of unemployment from its natural rate):

- When $Y = \bar{Y}$,we have $u = \bar{u}$(frictional or structural unemployment)
- When $Y < \bar{Y}$, we have $u > \bar{u}$(cyclical, involuntary unemployment)

So instead of having

$$\pi = E\pi + (1/\alpha)(Y - \bar{Y}) + v$$

we now have the Phillips curve:

$$\pi = E\pi - \beta(u - u^n) + v$$

This equation says that inflation in the short-run is mainly caused by two elements:

- cost-push inflation: inflation resulting from supply shocks. Adverse supply shocks typically raise production costs and induce firms to raise prices, "pushing" inflation up.
- demand-pull inflation: inflation resulting from demand shocks. Positive shocks to aggregate demand cause unemployment to fall below its natural rate, which "pulls" the inflation rate up.

Adaptive Expectations and Inflation Inertia

According to Friedman and Phillips, there are different SHORT-RUN Phillips Curves for different expected prices, while in the LONG-RUN the Phillips Curve is Vertical at the natural unemployment rate. This means that the Trade-off between inflation and unemployment holds only in the short-run while in the long-run there is no trade-off. What is the adjustment process from the short-run to the long run? The answer depends on how the expectations are formed. Friedman and Phillips assume that expectations are ADAPTIVE. We know that this means that expectations adjust just for a fraction every period and systematic errors can occur.

Adaptive expectations are formed according to:

$$EP = EP_{-1} + a(P_{-1} - EP_{-1})$$

Suppose the simplest case of Adaptive expectations when a = 1. This implies that expectations are given by:

$$EP = P_{-1}$$

Therefore, in terms of inflation we can assume that agents form their expectations as:

$$E\pi = \pi_{-1}$$

Agents expect for tomorrow the same inflation as today. This implies that there is inflation INERTIA.

Under this assumption about expectations, the Phillips curve, $\pi = E\pi - \beta(u - u^n) + v$, becomes:

$$\pi = \pi_{-1} - \beta(u - u^n) + v$$

In this particular case the natural level of unemployment is also called NAIRU, Non Accelerating Inflation Rate of Unemployment that is the rate of unemployment at which inflation remains constant.

The implication of this assumption about expectations has the following impact on the Phillips curve. Suppose a situation where the government wants to reduce unemployment from u_1 to u_2 permanently.

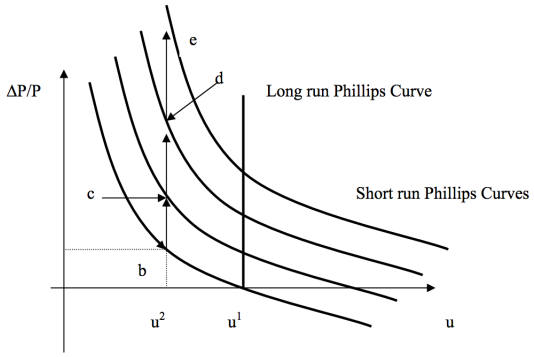

Figure 1:

Suppose we start at u_1 where inflation and expected inflation are zero. Now the government increases aggregate demand to decrease unemployment. We move at point b where actual inflation is higher than expected inflation (that is zero at the moment). At point b agents revise their expectations for the next period to be equal to the actual rate of inflation. If the government wants to keep the economy at u_2, the increase in the expectations will shift the Phillips curve and we move to point c. At point c, inflation has increased again. Agents revise their expectations and the Phillips curve shift again and we move to point d. At point d the inflation is higher than at c and so agents revise their expectations. The process may continue forever. This implies that in order to keep a lower unemployment rate than the natural level inflation must accelerate over time. After a while, a restrictive policy must be used to reduce inflation and to bring back the economy at the long-run equilibrium.

According to this view, any expansionary policy creates problems in terms of inflation and should be avoided.

Short-run Tradeoff Between Inflation and Unemployment

The true importance of the Phillips curve is that it is consistent with the Keynesian economic theory. According to Keynes we cannot have high unemployment and high inflation at the same time. If what matters in the economy is the aggregate demand, then when aggregate demand is low unemployment should be high but inflation should be low .

As the equation of Phillips curve derived earlier, there is a tradeoff between inflation and unemployment rate.

This trade-off provides a clear result for economic policy: if a government wants to reduce unemployment, it can do it at the price of increasing inflation. Furthermore, if the objective of the government is to reduce inflation, then it must accept a higher unemployment rate. Governments can do that by affecting aggregate demand using policies. Therefore, according to the Phillips curve, the

problem of economic policy is to choose the optimal trade-off between inflation and unemployment. How do we choose the optimal trade-off? It depends on the preferences of the society. Suppose we live in a society that prefers low unemployment (since a government is voted by the society, its policy should reflect the preference of the society). Then a government would have an incentive to choose a point on the Phillips curve where inflation is higher and unemployment is lower.

Sacrifice Ratio

Given the trade-off in the short-run implied by the Phillips curve, to reduce inflation, policymakers can contract aggregate demand, causing unemployment to rise above the natural rate.

The sacrifice ratio measures the percentage of a year's real GDP that must be foregone to reduce inflation by 1 percentage point. A typical estimate of the ratio is 5. This is an estimate that comes from a Phillips curve with inflation inertia (if expectations are calculated differently from the simplest adaptive expectations case then this number can be different).

Example: To reduce inflation from 6 to 2 percent, we must sacrifice 20 percent of one year's GDP: GDP loss = (inflation reduction) * (sacrifice ratio) = 4 * 5. This loss could be incurred in one year or spread over several, e.g., 5% loss for each of four years. The cost of disinflation is lost GDP. One could use Okun's law to translate this cost into unemployment.

Rational Expectation and Hyteresis

There is widespread disagreement about what we've discussed above.

One example is that, instead of using adaptive expectations as a way of forming expectations, some argue that people use rational expectation, that is, they base expectations on all available information, including current and possible future policies. This implies painless disinflation and a smaller sacrifice ratio.

Another example is an challenge to natural rate hypothesis. According to natural rate hypothesis, changes in aggregate demand affect output and employment only in the short run. However, some economist suggest that recessions can leave permanent impacts on the economy by raising the natural rate of unemployment.

Exercises

1. Some economists believe that taxes have an important effect on the labor supply. They argue that higher taxes cause people to want to work less and that lower taxes cause them to want to work more. Consider how this effect alters the macroeconomic analysis of tax changes.

   (a) If this view is correct, how does a tax cut affect the natural level of output?

   (b) How does a tax cut affect the aggregate demand curve? The long-run aggregate supply curve? The short-run aggregate supply curve?

   (c) What is the short-run impact of a tax cut on output and the price level? How does your answer differ from the case without the labor-supply effect?

   (d) What is the long-run impact of a tax cut on output and the price level? How does your answer differ from the case without the labor-supply effect?