R Gordon, Macro, ch 8: Determinants of Inflation and Unemployment

201 8-1 Introduction

202 A sustained inflation requires a continuous increase in aggregate demand so we now shift from the diagrams of chapter 7, which measure the level of the price index on the vertical dimension, to related diagrams that measure vertically the rate of change of the price index, that is, the rate of the inflation itself.

In this chapter we study the rate of unemployment as well. In the postwar US the unemployment rate -- the ratio of those seeking jobs to the total labor force -- has been highly unstable, hitting a low level of 2.9% in the spring of 1953 and a high level of 9.0 in May 1975. We will find that movements in the unemployment rate correspond to changes in real output (Q) which we have studied in chapters 3 through 7. When the economy is prosperous and output is high, firms hire additional workers from the ranks of the jobless, and the rate of unemployment falls. In a business slump, sales fall off, workers are laid off, and the rate of unemployment rises.

First we will study normal situations in which shifts in aggregate demand are the main cause of swings in inflation and unemployment. Just as we learned in chapter 7 that an increase in aggregate demand only raises real output temporarily, before worker expectations have time to adjust, so we reach the parallel conclusion here that, starting from an initial equilibrium position, higher aggregate demand only cuts unemployment temporarily. We will see that low unemployment cannot be sustained permanently without an acceleration of inflation. In the last part of chapter we examine the effects on inflation and unemployment of shifts in aggregate supply. When crops fail, a cartel raises the x price of oil, an inflation of the currency, can generate higher inflation and higher unemployment at the same time.

8-2 The Short-run Phillips Curve

Figure 8-1: In both frames the abscissa measures the ratio Q/Q*. In the upper frame the ordinate measures the increase in price level period by period. In the lower frame the ordinate measures the rate of increase of the price level. Such a rate is designated by the lower case, p. The bottom frame of 8-1 exemplifies a short-run Phillips curve. It is named after A. W. H. Phillips who first discovered the connection between Q/Q* and p.

206 8-3 The Expected Price Level and the Anticipated Rate of Inflation

Figure 8-2 contrasts the merely expected change of price level which is subsequently corrected with the correctly anticipated rate of inflation. The former is a succession of additional P^e 's. The latter is a single p.

It follows the short-run Phillips curve, when no change of P is anticipated, is now replaced by a new short run Phillips curve when a rate of inflation, p, isanticipated (figure 8-3).

The economy is in long run equilibrium only when there is no pressure for change. So the vertical line, $q/Q^* = 1.0$, is the locus of equilibrium inflation, of correct anticipations of p.

The message of figure 8-3 as a whole is simply that the combination of output and inflation that the economy can achieve depends on the anticipated rate of inflation. For any output ratio, Q/Q^*, the actual rate of inflation will be higher, the higher is the rate of inflation that is anticipated. In this sense inflation is self-propelling -- if people expect it, it will occur, even if output is at its long run equilibrium level.

Our account of inflation cannot be completed however until we show that the family of SP curves relate not only output to inflation but also unemployment-rate to inflation-rate.

8-4 Case Study: unemployment and the real output ratio.

Figure 8-4 presents graphically the US 1964-1975 correlation of unemployment (U) vertical and real output ratio (Q/Q^*) with U natural put at 5.5.
Okun's law line runs with a negative slope from Q/Q^* at 1.10 up to Q/Q^* at 0.90

8-5 Inflation and the Natural Unemployment Rate

Ratio of percentage change in U to percentage change in Q/Q^* has been between 1964 and 1976 about - 1/3. Before WW II it was placed at - 1/2. It is an empirical estimate.

The natural rate of unemployment (U^*) is the economy's long-run equilibrium level of unemployment that occurs when output (Q) equals its long-run natural level (Q^*) and is a situation in which the actual inflation rate turns out to be exactly what people anticipate.

214 Since the actual unemployment rate coincides with the natural when the economy is in long-run equilibrium, it remains that this view U* is a misnomer. It follows the terminology introduced by Milton Friedman in the 1960s, but it is not truly natural, given by nature, since many government policies and institutional restrictions make U* higher than necessary. Nor is U* immutable, because changes in government policies and private behavior can change (raise or lower) U*. In fact most economists agree that U* increased between the mid-1950s and the mid-1970s as a result of a shift in the composition of the labor force to groups with relatively high unemployment rates, particularly teenagers and women.

213 Figure 8-5 The central vertical line is at U* and when p is on this line, anticipations are correct. When p is off this line to the left actual inflation exceeds anticipation and when to the right actual inflation is less than anticipated.

214 The story told by Figure 8-5 is not a happy one. A low unemployment rate in the pink area, much less a zero U, cannot be achieved for very long, because soon an upward adjustment of anticipations will shift the SP curve and cause an upward acceleration of inflation. Only if the natural rate were zero could an actual zero rate of unemployment be maintained.

215 (1) Anything that stimulates the growth of aggregate demand tends to raise inflation while temporarily reducing unemployment, moving the economy north west along its initial SP (short-run Phillips) curve. Eg US 65-66.

(2) Anywhere to the left of the natural unemployment rate (U*) actual inflation exceeds the anticipated inflation rate, and people will beging to adjust their anticipation of future inflation, thus shifting the SP curve upward. The SP curve will shift upward continuously, and inflation will accelerate continuously, everywhere in the pink area to the left of U*.

(3) Anywhere to the right of U* actual inflation is below the anticipated rate, and people will begin to reduce their anticipation of future inflation, thus shifting the SP curve down. Thus high unemployment in excess of U* is a possible cure for excessive inflation, a cure used in the US in 70-71 and again in 74-75.

(4) Only when actual unemployment is equal to U* does the inflation rate tend to remain stable, ie, equal to anticipated rate.

215 8-6 Aggregate demand x growth and inflation.

Real GNP (Q) is defined as the ratio of nominal GNP (Y) to the GNP deflator or aggregate price index (P).

$$Q = Y/P \qquad 8.1$$

Accordingly the growth rate of real GNP is defined as the difference between the growth rates of Y and P.

$$q = y - p \qquad 8.2$$

Hence if nominal GNP growth rate is 10% and inflation rate is 10%, the real growth rate is zero. But if nominal income stays fixed and inflation is 10%, real GNP must shrink by 10%.

To define this relationship more precisely let us subtract from both sides in 8.2 the growth natural long-run equilibrium output in the US (q^*), roughly about 3.5%, which occurs as a result of population growth and advances in knowledge.

$$q - q^* = y - q^* - p$$

or

$$\hat{q} = \hat{y} - p \qquad 8.3$$

Line 8.3 uses a single symbol topped by a hat (^) to represent the deviation of actual from natural output growth and the deviation of aggregate demand growth from natural output growth. From now on we will call $\hat{q}$ adjusted output growth and $\hat{y}$ adjusted demand growth. Thus $\hat{y}$ rises whenever anything occurs that raises planned spending, such as an increase in business and consumer confidence or a monetary or fiscal stimulus. We will examine the way in which policy makers through their choice of $\hat{y}$ (for example zero, 6%, 12 %) influence unemployment in the short term and inflation in both short and long runs.

What do $\hat{q}$ and $\hat{y}$ have to do with unemployment. But Okun's law in Figure 8-4 suggests that fixed values of Q/Q^* on the horizontal axis and hence $\hat{q} = 0$, occurs only when the unemployment rate on the vertical axis is fixed as in the first line in the following table

	Q/Q^*	$\hat{q}$	(U)	Figure 8-4
1.	Fixed	Zero	Fixed	1966-68
2.	Positive	Positive	Falls	1971-73
3.	Negative	Negative	Rises	1973-75

217 When adjusted output growth equals 0 it follows that when $\hat{y} = p$ then inflation (p) uses up all of adjusted demand growth; and that U can be fixed only when this condition is fulfilled.

In figure 8-6 (p. 218) the situation with constant unemployment and $\hat{y} = 6$, $p = 6$, is plotted as the horizontal constant unemployment line CU. No matter what the rate of unemployment happens to be, for that rate to remain constant when $\hat{y} = 6$, inflation, p, must equal 6 as well.

Under what conditions will U change rather than stay constant? The assumed rate of adjusted demand growth, $\hat{y} = 6$, is the economy's budget constraint setting a limit a limit on the sum of inflation (p) plus allowable adjusted output growth (equation 8.3) Below CU line, p falls and U decreases and $\hat{q}$ and Q/Q^* increase. Above the CU line, U rises and p rises but $\hat{q}$ descends yet cannot go beyond F where $p = 12$ where upward movemnt reaches the budget constraint ($-6 = 6 - 12$) (cf p. 219). Thus point F in Figure 8-6 implies that $\hat{q} = -6$, that is, a drop in Q/Q^* output output ratio of 6%, will cause an increase in unemployment of 2 percentage points. Thus point F along the BC line in figure 8-6 plots the combination of 12% inflation with a 7% unemployment rate, the latter representing a 2% increase from last period's starting point of 5% unemployment ($U_{-1} = 5$).

Similarly a low rate of inflation means that less demand growth is needed to pay for inflation and more is available to support a real output boom. EG in figure 8-6 a zero rate of inflation allows all the assumed rate of demand growth, $\hat{y} = 6$, to go into adjusted output growth: ($6 = 6 - 0$). Thus when adjusted output growth equals 6, Okun's law indicate that unemployment can fall by 2%. Thus point G along the budget constraint line plots the combinationof zero inflation with 3% unemployment: a 2% advance over the initial $U_{-1} = 5$.

The pink area in Figure 8-6 between BC and CU lines represents the excess of inflation above $\hat{y}$, that is, the fact that $\hat{q}$ is negative and that unemployment must rise. The greater the inflation rate, the larger the pink distance between CU and BC lines, the more negative is $\hat{q}$, and the more unemployment increase as shown by the black arrows. Similarly, for situations of low inflation the gray area represents the shortfall inflation below $\hat{y}$, which allows

220 $\hat{q}$ to be positive and unemployment to fall.

What would make the two lines in figure 8-6 change their positions?

(1) An increase in $\hat{y}$ FROM X 6% to 12% caused ~~m~~ by a monetary or fiscal stimulus or by increased business and consumer confidence would cause the BC and CU lines to shift upwards by exactly the amount of the change, 6%. The BC line would continuke to intersect the CU line at A the starting point of last period's U rate.

(2) IF the U has changed from last period to this, while $\hat{y}$ REMAINS FIXED, shifts the BC line shifts the BC line to the right or left along the CU line. If in this period we are at point G in figure 8-6 and unemployment drops to 3%, then next period's starting point will be $U_{-1} = 3$. So next period's BC line will shift leftward to intersect the CU line directly above G.

In brief when unemployment is declining, the BC line shifts to the left along CU, and when unemployment is increasing it shifts to the right along CU.

(3) When does the BC line stop shifting to the right or left?

Only when the inflation equals $\hat{y}$, AS at point A in 8-6 (see second last paragraph on p. 218), because only then can the economy have constant employment by being on the CU line and at the same time satisfy budget constraint by being on the BC line.

8--7 Effects of an Acceleration in aggregate Demand Growth

Figure 8-7: The Impact of Inflation and Unemployment of Faster Demand Growth when the Anticipated Inflation Rate Fails to Adjust.

Graph starts from SP_0, CU_0, BC_0, intersecting at E_0 with $\hat{y}$ initially at zero but soon shifting to 6. CU shifts at once to p = 6, but BC successively cuts SP_0 at H, J, K, and eventually at E_1 where it intersects with SP_0 and CU_1.

At E_1 which is on CU unemployment is constant and so if adjustment had been instantaneous there would have been no decline in unemployment. But there occurs temporary unemployment while the economy is moving tentatively towards E_1. See p. 223.

223 8-8 Adaptive Expectations and the Inflation Cycle

p^e this period's expected inflation

p_{-1} last period's actual inflation

p^e_{-1} last period's anticipated inflation

$p^e = gp_{-1} + (1 - g)p^e_{-1}$

where "g" is the weight given previous experience and (1 - g) is the weight given previous anticipation. $0 < g \leq 1$

Figure 8-8 represents approach to p^e when g is 0, 0.25, or 1.

226 1) An acceleration of demand growth as ■ in figures 8-7 and 8-8 raises the inflation rate and temporarily reduces unemployment.

2) In the long run, if expectations adjust even partially to the actual behavior of of inflation, the inflation rate rises by exactly the same amount as $\hat{y}$, and the decline in unemployment is only temporary. The economy eventually arrives at point E_3 where unemployment reaches its natural level of U* from which it started.

3) Inflation always overshoots its final equilibrium value (say 6%) rising above it temporarily and then returning to it. The reason for this is that the ecooomy initially arrives at its long run inflation rate before its expected rate has adjusted to actual rate at some point K. Points above K are due to the upward adjustment of expectations and to the continued upward demand pressure that raises actual inflation above expected inflation whenever the economy is to the left of its long run LP line.

8-9 Case Study: U.S. inflation cycle and stagflation 1964-71

Stagflation: when inflation and recession are simultaneous, when inflation and unemploymnet increase simultaneously. Figure 8-8 cf red and upper black lines.

Gordon, Macro-, ch. 8

201 8-1 Dist: change in price of some goods
change across the board
sustained change across the board (INFLATION)

202 8 studies inflation and unemployment

First, variations in U due to changes in output
raise output, U drops
lower output, U rises

Second, variations in U due to shifts in aggregate demand
larger DD increases output, lowers U, moves P up
changes in Q and U temporary ($P \neq P^e$)
higher P becomes base when P^e catches up to P

fig 8-1 p 204 when Fed accommodates shift, inflation, replace P by p
frame one: horizontal, QQ, vertical P, curves SS, DD
frame two: horizontal, Q/Q^*, vertical p. curve Shortrun Phillip

fig 8-2 p 207 delayed expectations of rising prices
proleptic anticipation of rising prices

fig 8-3 p 209 <u>The relation between output and inflation depends on depends upon the rate of anticipated inflation</u>

Horizontal: Q/Q^*, vertical p

When people bring p^e up to p, the economy moves to central line (Long run Phillips curve)

Until they do so, P keeps on rising

fig 8-4 p 211 <u>A high output ratio goes with low unemployment and vice versa</u>

Hence what is referred to as Okun's law:

Roughly, a rise of Q/Q^* of 3%gives a lowering of U by 1%. while a fall of Q/Q^* of 3%, lowers U by 1%.

fig 8-5 p 213 <u>Change of variables</u>: U on x-axis, p on y-axis

LP ($p = p^e$) cutting x-axis at U*

SP now mirror images of earlier SP: increasing Q is decreasing U

When economic expansion begins creating jobs and removing unemployment, it raises prices and moves economy along SP from E_0 to E_1; if operators alert they will adjust expected pricas, lead to a new SP, move economy from E_1 to E_3, so that the rate of inflation will not increase further.

Gordon, Macro-, ch. 8 con'd

215 Summary 8-1 to 8-5

1. Anything that stimulates aggregate demand tends to increase inflation while temporarily reducing unemployment, moving the economy northwest al ng its initial SP.

2. Anywhere to the left of U*, actual invlation exceeds anticipated inflation. People to adjust anticipations of future inflation, moving SP curve upward. The SP curve will shift upward continuously and inflation will increase conintuously as long as the economy is to the left of U*

3. Anywhere to the right of U*, actual inflation is below the anticipated rate. People will begin to reduce their anticipations of future inflation thus shifting the SP curve down. High unemployment is a cure for excessive inflation. It was employed in the US in 1970-71 and again in 1974-75.

4. Only when actual unemployment is equal to U* does the inflation rate tend to remain stable, equal to the rate that people anticipate.

5. These conditions are true but they are not the whole story. Stagflation is a possibility so that increasing P is accompanied by increasing U,etc., see 8-9 p 226 ff.

215 AGGREGATE demand ~~and~~ growth and inflation.

$Q \equiv Y/P$ by definition

Real income is nominal income divided by price level.

216 Let growth rate of Q be q
of Y be y
of P be p, so that

$$q = y - p \qquad (8.2)$$

NB Rates can decrease, change from positive to negative, without passing through a zero stage.

Conclude that when inflation exceeds demand growth, then q must decrease, and when q decreases, U increases.

More precisely, add to the picture q*, the growth of long-run natiral output, which occurs as a result of population growth and advances in knowledge, in the US about 3.5%.
Subtracting q* from q and from y in (8.2) one gets

$$q - q^* = y - q^* - p$$

or $$\hat{q} = \hat{y} - p \qquad (8.3)$$

where $\hat{q}$ is adjusted output growth
and $\hat{y}$ is adjusted demand growth

217 From table when $\hat{q}$ is zero, Q/Q^* is fixed
but when Q/Q^* is fixed, U is fixed
or when $\hat{q}$ is zero, $\hat{y} - p$ is zero
so that inflation is eating up the whole of adjusted demand grwoth

218 Fig 8-6
Constant U line: p is 6, y is 6, and so $\hat{q}$ will be 0and U fixed.
Budget constraint line: shows all combinations of inflation and U consistent ~~x~~ with $\hat{y}$ is 6 and U_{-1} was 5.
If p moves up to 12, U moves up to 7.
If p moves down to 0, U moves down to 3.

Cf. problem, p 242 Optional, #1.
NB p. 220 #1: An increase in $\hat{y}$ from any of various stimuli, would cause both CU and BC curves to move upward by exactly the amount of the change, 6%. BC would continue to intersect CU at the strating point of last periods rate of U.
When U declines, BC shifts left along CU; when U increases, shift is to the right.
The compound equation p. 243 is obtained by adding LHS of (a) to LHS of (b), and RHS of (a) to RHS of (b), equating the sums, and dividing through by 2.

Goddon, Macro-, 8-7
and LP

222 SP, CU, BC intersect at E_o and p is 0
Various stimuli increase ẏand tendency is for BC and CU to move vertically up level of p is 6.
However p^e takes time to adjust and so movement is along SP_o because p^e is zero
As long as p^e is unadjusted, series of positions of Fig 8-7
As soon as p^e is adjusted, economy in long term equilibrium at E_3

223 But between these extremes there is adaptive expectation represented by ꝛ equation (8.4)