Recitation 12

Topics: Phillips curve, IS curve, hand-to-mouth consumers and the multiplier

1 Okun's Law

Okun's Law is an observed negative relationship between output and unemployment.

Formula:

$$u_t - u^n = -0.5\tilde{Y}_t$$

When output is above trend, unemployment is below its natural level since firms are producing more and need more workers than normal. When output is below trend, unemployment is above its natural level since firms are producing less and need fewer workers than normal.

2 Phillips Curves

2.1 Medieval Model Phillips Curve

2.1.1 General

We derived our first Phillips Curve from the Medieval model of price setting:

$$\pi_t = \theta\tilde{Y}_{t-1}$$

Thus, there's a positive relationship betwen output yesterday and inflation today.

We can also rewrite this using Okun's Law as:

$$\pi_t = -2\theta(u_t - u^n)$$

Thus, there's a negative relationship between unemployment yesterday and inflation today.

2.1.2 Long Run

In the steady state, $\bar{\pi} = \theta\bar{\tilde{Y}}$. This suggests that a country could set prices to grow at 100% per year and output would be double its natural level forever.

However, this doesn't seem very realistic. It seems that after some time shopkeepers would realise that prices are rising every year and would set even higher prices than the rule they were using before would suggest. Thus, they'll be a shift up in the Phillips curve (so that any given level of output requires a higher level of inflation).

Unfortunately, the Medieval model of price setting Phillips Curve does not capture this shift in prices. This is why we need the expectations augmented Phillips Curve.

2.2 Expectations Augmented Phillips Curve

2.2.1 General

$$\pi_t = \mathbb{E}_{t-1}[\pi_t] + \bar{v}\tilde{Y}_t + \bar{o}$$

We can also rewrite this using Okun's law:

$$\pi_t = \mathbb{E}_{t-1}[\pi_t] - 2\bar{v}(u_t - u^n) + \bar{o}$$

2.2.2 Graphical Short-Term

When unemployment is below its natural rate (or equivalently, by Okun's Law, output is above trend) or there is a positive cost push shock ($\bar{o}$):

$$\pi_t > \mathbb{E}_{t-1}[\pi_t]$$

Since $\mathbb{E}_t[\pi_{t+1}] = \pi_t$:

$$\mathbb{E}_t[\pi_{t+1}] > \mathbb{E}_{t-1}[\pi_t]$$

Thus, expectations of inflation rise over time.

Conversely, when unemployment is above its natural rate (or equivalently, by Okun's Law, output is below trend) or there is a negative cost push shock ($\bar{o}$):

$$\pi_t < \mathbb{E}_{t-1}[\pi_t]$$

Since $\mathbb{E}_t[\pi_{t+1}] = \pi_t$:

$$\mathbb{E}_t[\pi_{t+1}] < \mathbb{E}_{t-1}[\pi_t]$$

Thus, expectations of inflation fall over time.

Figure 1: Short Term Expectations Augmented Phillips Curve (Unemployment)

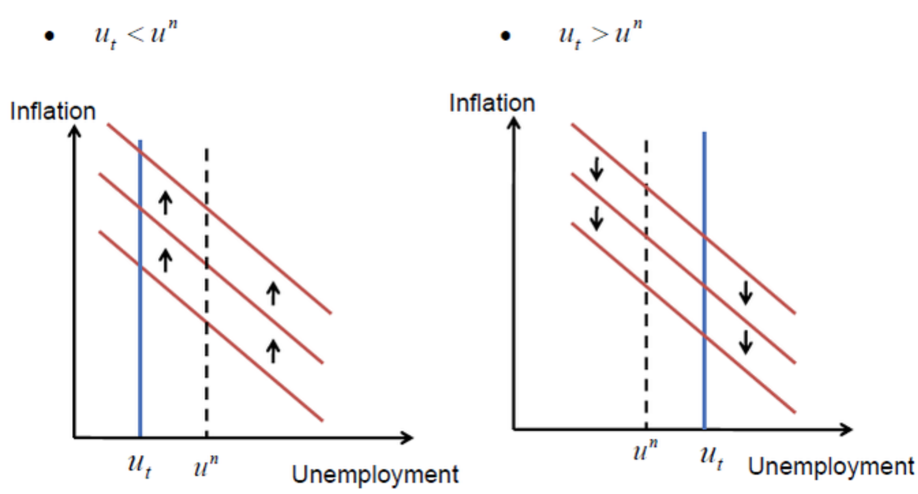
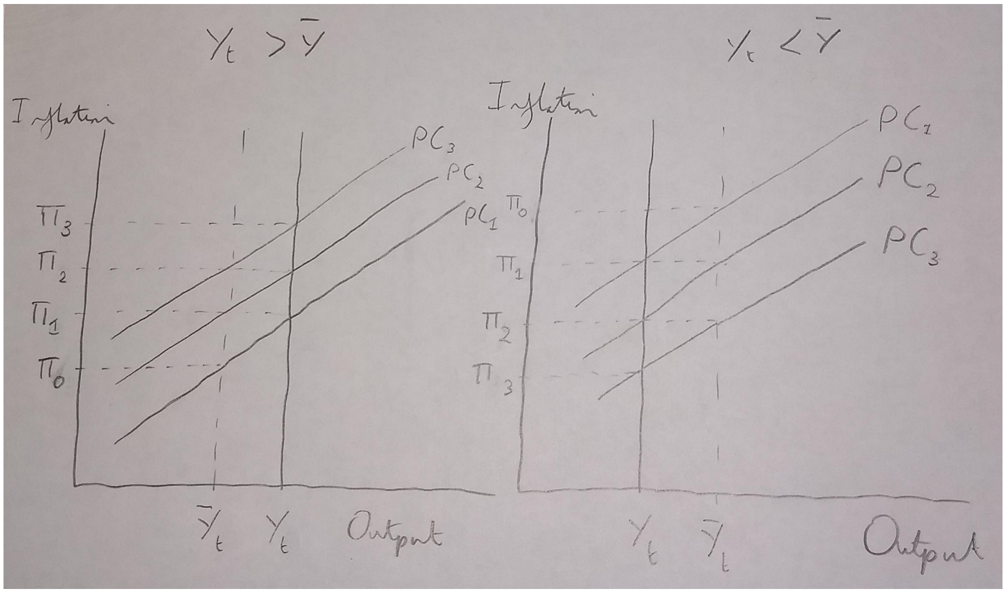


Figure 2: Short Term Expectations Augmented Phillips Curve (Output)



2.2.3 Long-Term

Applying the steady state to the output Phillips Curve (setting the cost-push shock $\bar{o}$ to be zero):

$$\bar{\pi} = \bar{\pi} + \bar{v}\bar{\tilde{Y}}_t$$

$$\bar{\tilde{Y}}_t = 0$$

By Okun's Law:

$$\bar{u} - u^n = -0.5\,\bar{\tilde{Y}}_t$$

$$\bar{u} = u^n$$

We can also rewrite this using Okun's law:

$$\pi_t = \mathbb{E}_{t-1}[\pi_t] - 2\bar{v}(u_t - u^n) + \bar{o}$$

3 IS curve

The IS curve is the relationship between output and interest rates. As interest rates rise, output decreases. Why does an increase in interest rates lead to less output?

- More expensive to borrow so less investment for the future.
- Can relatively more consumption by waiting to consume until tomorrow (from Euler equation).

Formula:

$$\widetilde{Y}_t = \overline{a} - \overline{b}\,(R_t - \overline{r})$$

Potential shocks that shift the curve:

- Government spending shocks: A positive government spending shock i.e. the government spending more, shifts the curve to the right. For a given interest rate, output is higher.
- Export shock: If exports increase, it shifts the IS curve right since savings increase.

4 Credit Constrained Households and the Multiplier

Credit constrained (hand-to-mouth) consumers: we have assumed so far that households can borrow and lend to smooth consumption over the business cycle. But some agents are credit-constrained. They are unable to obtain all the borrowing they would like.

What do consumers who are credit constrained do when they receive extra income? Spend all of it until they are no longer credit constrained!

The rule we assumed for consumers' consumption during the derivation of the IS curve was:

$$C_t = a_C\bar{Y}_t - b_C\bar{Y}_t(R_t - \bar{r})$$

However, if some proportion of consumers is credit-constrained, they will spend all the extra income they receive. Therefore, there will be additional $\bar{x}\tilde{Y}_t$ consumption so:

$$C_t = a_C\bar{Y}_t + \bar{x}\tilde{Y}_t - b_C\bar{Y}_t(R_t - \bar{r})$$

The revised IS curve is:

$$\widetilde{Y}_t = \overline{a} + \bar{x}\tilde{Y}_t - \overline{b}\,(R_t - \overline{r})$$

Look at what happens here when R_t increases by 1 (a shock that lowers output since it becomes more expensive to invest):

1. $\tilde{Y}_t$ goes down by $\bar{b}$.
2. But this means $\bar{x}\tilde{Y}_t$ falls by $\bar{x}\bar{b}$.
3. But this means $\bar{x}\tilde{Y}_t$ falls by $\bar{x}^2\bar{b}$.
4. etc.

The cumulative effective of the shock is:

$$Sum = -\bar{b} - \bar{x}\bar{b} - \bar{x}^2\bar{b} - \ldots$$

$$= -\bar{b}\frac{1}{1-\bar{x}}$$

Therefore, the cumulative effect of an interest rate shock increases under higher numbers of credit constrained households since they effectively amplify the shock by responding to the initial shock (by reducing (increasing) their consumption and thus output under negative (positive) shocks).

We can also show this directly:

$$(1-\bar{x})\widetilde{Y}_t = \overline{a} - \overline{b}\,(R_t - \overline{r})$$

$$\widetilde{Y}_t = \frac{1}{1-\bar{x}}[\overline{a} - \overline{b}\,(R_t - \overline{r})]$$

We see that an increase of 1 in R_t leads to the following change in $\tilde{Y}_t$:

$$-\bar{b}\frac{1}{1-\bar{x}}$$