Macroeconomics II
Lecture 07: AS, Inflation, and Unemployment

Tomáš Lichard

IES FSS (Summer 2017/2018)
Section 1

Introduction
We already mentioned frictions - we said that one cause of frictions are sticky prices

So far we have not discussed AS much:

- IS-LM is a model of aggregate demand
- In our analysis, we were pretending that the aggregate income was changing by exactly the same amount as was the shift aggregate demand (but why?)

Now we will relax this assumption: These frictions cause upward sloping AS curve in the short run, implying some possible short-run relationship between inflation and unemployment

But first let’s discuss frictions and this relationship in greater detail
Section 2

Aggregate Supply
But why is AS upward sloping?

- **Sticky-Wage models**
  - long-term wage contracts

- **Worker-Misperception models**
  - workers confuse nominal and real wage

- **Imperfect-Information models**
  - both employees and firms confuse increase in price level with individual prices

- **Sticky-Price models**
  - firms do not adjust instantly due to transaction costs

- **Rational inattention models (most recent)**
  - if processing information is costly, it is rational not to pay attention to everything
Subsection 1

Sticky-Price Models
Recall our discussion on what may make the prices sticky:

- Firms may be bound by long-term contracts;
- Or they want to avoid frequent changes of prices to avoid angering their customers;
- Structure of markets matter too – price setting may be a costly task for some firms;
Simple model

2 types of firms:
Type 1 firms have flexible prices and can set prices optimally:

- Simple representation of the price decision:

\[ P_{1,t} = P_t \left( \frac{Y_t}{\bar{Y}_t} \right)^a \]

- where at time \( t \): \( P_t \) the aggregate price level, which determines the cost of the firm; \( Y_t \) is the aggregate output, \( \bar{Y}_t \) is its natural level, and \( a > 0 \) is the elasticity of desired price w.r.t. excess demand (or supply);
- \( \left( \frac{Y_t}{\bar{Y}_t} \right)^a \) can be thought of as markup in \%; if demand goes up, firms may want to charge higher markups
- by taking logarithms and setting \( p_{1,t} = \log P_{1,t} \) etc. we get:

\[ p_{1,t} = p_t + a \left( y_t - \bar{Y}_t \right) \]
Simple model

Type 2 firms face sticky prices, they have to set prices in advance according to their expectations of future demand and prices:

\[ p_{2,t} = p_t^e + a (y_t^e - \overline{y}_t^e) \]

where \( p_t^e \) is firms expectations of period \( t \) (log-)price level formed at period \( t - 1 \) (similarly \( y_t^e \) and \( \overline{y}_t^e \))

- for simplicity we will assume that \( y_t^e = \overline{y}_t^e \).
Implications

- If the share of firms with sticky prices is \( s \), the overall price level in the economy is then:

  \[ p_t = sp_t^e + (1 - s)[p_t + a(y_t - \bar{y}_t)] \]

- This implies:

  \[ p_t = p_t^e + [(1 - s)a/s](y_t - \bar{y}_t) \]

- This can be viewed as a simplification of the so-called Calvo (1983) pricing (cf Taylor (1980) pricing)

- Further rearrangement yields:

  \[ y_t = \bar{y}_t + \alpha(p_t - p_t^e) \]
Subsection 2

Imperfect-Information Models
Basic Idea

- Coming from Lucas
- There are many types of goods, each has one supplier
- Suppliers do not know all the prices in the economy, they watch their market most closely
  - They may confuse a rise in the overall price level with a rise in relative prices (rise in the price of their product)
  - So if they see an unexpected rise in price level, they will increase their supply, or:

\[ y_t = \bar{y}_t + \alpha (p_t - p_t^e) \]
Lucas concluded that if his imperfect information model is true, countries with wild fluctuations of AD should have steeper AS, because agents would learn that change in prices is usually aggregate, whereas in countries where AD is stable, a large portion of price changes would be relative.

He tested this in Lucas (1973) and concluded that data he examined is consistent with this model.

Another implication: in countries with long-term high average inflation it is more costly for firms to not change prices, so in these countries AS should be steeper.
This is supported by recent international data as well:

These two models are not mutually exclusive.
Although they depart from different assumptions, their conclusions can be formalized by one relationship:

\[ y_t = \bar{y}_t + \alpha (p_t - p_t^e) \]
Shock to AD

Price level, $P$

$P_3 = EP_3$

$P_1 = EP_1 = EP_2$

Long-run increase in price level

Short-run increase in price level

Short-run fluctuation in output

Income, output, $Y$

$Y_1 = Y_3 = \bar{Y}$

Shock to AD
Section 3

Inflation and Unemployment
Subsection 1

Phillips Curve
Previous discussion implies there is some relationship between price level and unemployment in the short run.

It is called *Phillips curve*.

Its modern form is:

$$\pi_t = \pi^e_t - \beta (u_t - u^n) + \nu_t$$

It’s linked to aggregate supply equation $y_t = \bar{y}_t + \alpha (p_t - p^e_t)$.
Inflation expectations

- In order for this relationship to be useful, we have to know how people form inflation expectations.
- One assumption that is used is called **adaptive expectations** - people think that next year’s inflation will be same as this year’s:

  \[ \pi_t^e = \pi_{t-1} \]

- then

  \[ \pi_t = \pi_{t-1} - \beta (u_t - u^n) + \nu_t \]

- This would imply that there is inflation inertia.
the effect of $-\beta (u_t - u^n)$ is called **demand-pull inflation**

- low unemployment pulls the inflation up, high unemployment down

the effect of $\nu$ is called **cost-push inflation**

- supply (cost) shocks that push inflation up/down
Short-run tradeoff

\[ \text{Inflation, } \pi \]

\[ E\pi + u \]

\[ u^n \]

Unemployment, \( u \)

\[ \beta \]

1
Subsection 2

Costs of Disinflation
Theory

- The above implies that if we want to decrease inflation, the cost is a period of higher unemployment and reduced output.

- The drop in RGDP that corresponds to 1 bps drop in inflation is called **sacrifice ratio** (also rise in unemployment rate through Okun’s law):

  \[ s.f. = \frac{\Delta RGDP}{\Delta \pi} \]

- However, another channel through which inflation may be decreased is the term \( \pi_e^t \) – inflation expectations:
  - if a change in policy is credible, it can change people’s predictions of inflation – inflation may have less inertia.
  - what happens in the extreme case where \( \pi_e^t = \pi_t + \varepsilon_t \)? (\( \varepsilon_t \) is a random iid prediction error with mean 0)
Empirics

- Recall our discussion about Paul Volcker’s fight against inflation:

![Graph showing economic data](research.stlouisfed.org)

- Recall that the estimate of the coefficient in Okun’s law is around 2 for the US, and over four years the sum of $u - u^n$ is 9.5% and inflation dropped by 6.7%. What is the sacrifice ratio?
Before the disinflation, the predictions of the impact were higher... implication?
Subsection 3

Long-Run Effects of AD on Output
Recall our discussion about short-run vs. long run, i.e. potential product and natural rate of unemployment. However, some economists argue that there are channels through which AD can influence output even in the long run. Recession may leave permanent effects on the economy, altering natural rate of unemployment - this is called hysteresis.

- e.g. workers losing jobs during recession may lose their skills
- insiders become outsiders in wage setting
- it would imply that costs of disinflation are higher

Proponents argue that this may be one of the causes of the difference in unemployment rate between US and Europe (what were the other ones?)
Section 4

Conclusion
Conclusion

- We covered 2 models of AS - sticky prices and imperfect information
  - however, conclusions of both of them were similar
- We talked about the relationship between inflation and unemployment - Phillips curve
  - there are still unresolved issues about importance of rational expectations and hysteresis