

## LECTURE 12 NOTES

These notes elaborate upon slides and lecture for part 1 and part 2 of lecture 12. There are some hints for problem set 5.

### Extension of Basic Keynesian Model

Here we look at a model that can explain inflation. That is, what economic forces bring about changes in inflation (the rate of change in prices). It enables us to study what might prevail in the long run, when prices can and do adjust. We will consider only the graphical analysis of this model.

We note at the outset that the Basic Keynesian Model (BKM) we have just studied was a SR model which showed that that changes in spending are the source of output gaps. Removing those gaps requires, according to BKM, stabilization policy (fiscal and monetary). In addition, this model considers that firms meet demand at set prices.<sup>1</sup> High menu costs of changing prices justifies this assumption. In reality, firms do adjust prices ultimately, perhaps in the medium and long run.

The present model (Extension to BKM) has three basic components: the aggregate demand curve (AD), the level of inflation at any given time called the short run aggregate supply curve (SRAS) and the level of potential output called the long run aggregate supply curve (LRAS). We consider the meaning of each of these curves, then define what is meant by SR and LR equilibrium and discuss the dynamic of inflation when there are output gaps. In this model, output gaps can go away by two means: self-correction and stabilization policy. The latter is particularly desirable when self correction is slow or output gaps are large. In either case, the costs of gaps (unemployment for recessionary gaps and high inflation for expansionary gaps) can be considerable.

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<sup>1</sup> More precisely, that there may indeed be some level of inflation, but that this level is unchanging within the model.

## Shapes of Curves

### I. AD

The AD curve shows that output and inflation are negatively related. The primary reason for this is that as inflation rises, the FED follows its behavioral rule or reaction function and increases interest rates. When this happens, C and I fall and spending falls. Each point on the AD curve represents a point of SR equilibrium from BKM (each is a point where output equals PAE or spending). Since each point represents spending, it makes sense to say that this is a type of “demand” curve for the whole economy.

A second reason why the curve has this shape is that as inflation increases, uncertainty for economic actors (firms and consumers) increases. When inflation is high, a potential spender may become cautious since the purchasing power of his dollars are eroding. Hence he may hesitate to spend. A third reason is that as inflation is high, foreigners wish to purchase less of the economy’s goods, since prices may be rising relative to those in other countries, NX falls, so that spending falls.

However, the primary reason for the shape we shall focus on is FED behavior over real interest rate.

### II. SRAS

The horizontal (flat) SRAS or inflation adjustment line (or just inflation line) says that in the SR (that is, at any given time) there is some stable level of inflation (some stable rate of increase of prices). The reasons are elaborated upon in the slides: inflation expectations and long term contracts. It is important to recognize the importance of this assumption. Without it, there is no reason to say that there is inflation inertia; instead one would say prices adjust frequently and easily. Inflation inertia on the other hand says that prices are sticky or adjust only slowly or that wage and price rigidities exist.

### III. LRAS

The vertical LRAS is familiar to us from BKM. It simply is the level of output that the economy can produce (its capacity). It is the level of output that prevails when resources are used at capacity: potential output.

#### SR Equilibrium

In the SR (that is at any instant of time) the level of output (and spending) given by AD is consistent with the prevailing (steady) level of inflation (SRAS). In a graph it is the intersection of SRAS and AD.

#### LR Equilibrium

In the LR the level of inflation will be such that output in SR equilibrium (at any given point in time) is at the level of potential output. So, indeed  $SRAS = AD$ . But, also,  $SRAS = AD = LRAS$ .

#### Out of LR Equilibrium: Output Gaps

These are SR equilibria that are associated with output in excess of potential (expansionary gap) or output which falls short of potential (recessionary gap).

Given an expansionary gap, firms will ultimately raise prices so that inflation will rise (SRAS line shifts up gradually over time) until  $SRAS = AD$  at the level of LRAS. Vice versa for recessionary gap.

Hence we say that from a point of SR equilibrium with an output gap, the economy ultimately self corrects via changes in inflation (SRAS).

#### Disturbances to Equilibrium

These can be changes in AD or aggregate supply shocks. The latter can then either be inflation shocks (SRAS) or shocks to potential output (LRAS). Each type of disturbance to LR equilibrium involves a shift in the respective curve.

Following each type of shift an output gap will emerge. Then, the economy may self-correct or policy intervention can remove the gap quickly.

### Shocks & LR Equilibrium

#### *Adverse Inflation Shock & Self Correction (see slide 34)*

Step 1: Begin at LR equilibrium (SRAS=AD=LRAS) at point A. With the adverse inflation shock, SRAS rises to SRAS' (higher).

Step 2: Now note that an output gap has emerged in SR. New SR level of inflation is SRAS'. SR equilibrium output (and spending) is given by AD at that level of inflation. It is now  $Y'$ , inflation is at  $\pi'$ , at point B. The gap is  $Y^*-Y'$ . It is recessionary.

Step 3: Over time the economy can self-correct as producers see that sales are low. Here (unlike in BKM) producers ultimately adjust prices in LR. They adjust them down. The rate of change in prices falls: inflation falls. Until it reaches the old level at  $\pi$ . (Adjustment is shown with the arrows. You can think of arrows as what happens in medium run.)

Step 4. New LR equilibrium is back at A.

#### *Adverse Inflation Shock with Stabilization*

Same through step 2.

Step 3: Monetary policy (FED easing reaction function) or Fiscal policy (increase in  $G$ ) shifts out AD to close GAP, at new level of inflation  $\pi'$ . Labelled as point C.

Difference is higher level of inflation in LR. But with quick closing of gap, avoid costs of recessionary gap (cyclical unemployment).

*Adverse Potential Output Shock (slide 35)*

Step 1: Begin at LR equilibrium (SRAS=AD=LRAS) at point A. With potential output shock, new capacity level of output is  $Y^*$ .

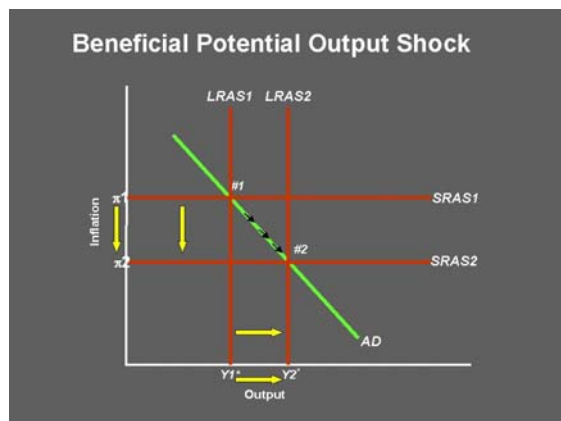
Step 2: A gap emerges at SR level of inflation  $\pi$ . The gap is  $Y^* - Y < 0$ . It is expansionary.

Step 3: Sales & production is above capacity. Ultimately producers adjust prices upward. The rate of change in price increases: inflation rises to  $\pi'$ . Indicated by arrows.

Step 4: At level  $\pi'$  (SRAS  $\pi'$ ), inflation is just high enough so that output is just at the new lower potential. Indicated by point B.

Here any intervention to close the gap would have meant tighter monetary policy or reduction in G to shift AD in at initial level of inflation  $\pi$ .

*Beneficial Potential Output Shock (slide 38 relabelled)*



Step 1: Start at initial LR equilibrium at level of inflation  $\pi_1$  and level of output (given by intersection of AD and  $\pi_1$ ) at potential  $Y=Y_1=Y_1^*$ . Labelled #1.

Step 2: With beneficial shock (due to dramatic productivity increases (say like US in 90s) new potential output is  $Y2^*$ . At initial SR level of inflation  $\pi1$ , recessionary gap emerges ( $Y2^*-Y1$ ).

Step 3: producers adjust prices down. Rate of change in price level falls: inflation falls to  $\pi2$ . Indicated by arrows.

Step 4: New LR equilibrium is at lower level of inflation  $\pi2$ , where  $SRAS2=Y2=AD$ . Lower inflation and higher output.

### *Adverse Potential Output Shock & Adverse Inflation Shock*

Figures at End of document.

Step 1: Start at initial LR equilibrium at level of inflation  $\pi1$  and level of output (given by intersection of AD and  $\pi1$ ) at potential  $Y=Y1=Y1^*$ . Labelled A.

Step 2: Inflation shock increases inflation to  $\pi2$ . At that level of inflation output is given by intersection of AD and  $\pi2$ , at  $Y'$ . The potential output shock reduces capacity to  $Y2^*$ . [Note  $Y2^*$  drawn to right of  $Y'$ . We could have drawn it to left of  $Y'$ .] Output gap emerges. In the SR, relative to old potential output  $Y1^*$ , there is a recessionary gap of  $Y1^*-Y'$ .

Step 3: With the recessionary gap, inflation adjusts down via the self-correction mechanism. But to what level? Well, to point where  $LRAS2=AD=SRAS$ . This is at  $\pi3$ . Now output  $Y=Y2^*$ . Inflation is higher than original at  $\pi1$  and output lower than at  $Y1^*$ . Labelled C.

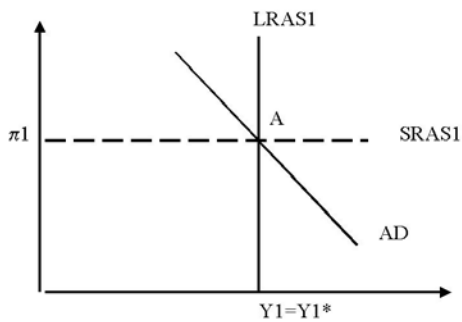
Step 3': Suppose  $LRAS2=Y2^*$  drawn to left of  $Y'$ . Then, inflation would adjust upward and new level of inflation  $\pi3$  would be higher than  $\pi2$ . But, again in LR, inflation higher than  $\pi1$  and output lower than  $Y1^*$ .

Suppose the FED responded to the inflation shock. Possibility #1: If it eased monetary policy, it could quickly close the gap so that new LR equilibrium occurs where  $LRAS2=Red-AD=SRAS2$  at inflation  $\pi2$ .

Possibility #2: If it reacted to inflation shock by tightening monetary policy, new LR equilibrium would be where  $\text{Green-AD}=\text{LRAS2}=\text{SRAS4}$  at inflation rate  $\pi_4$ . Note that in this case the SR recessionary gap would have been more severe (since  $\text{green-AD}=\pi_2$  further left), but the LR level of inflation  $\pi_4$  would be less relative to  $\pi_1$ . (Since  $\pi_4 < \pi_3$ ).

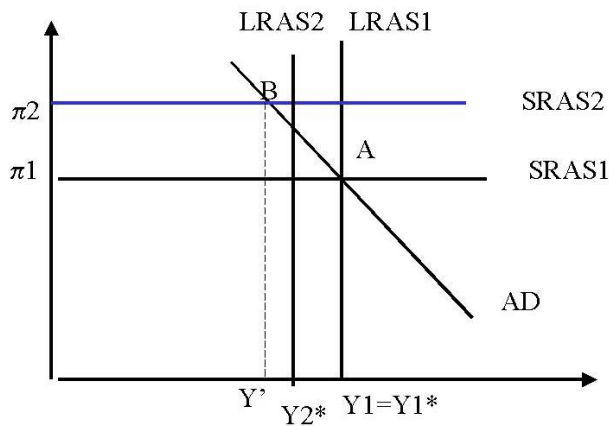
Step 1:

Step 1: Initial LR Equil

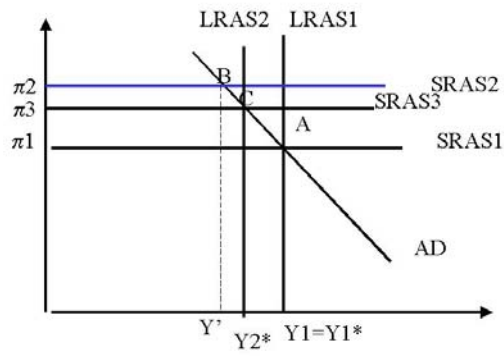


Step 2

Step 2: Adverse Inflation & Potential Output Shock



Step 3: Self-Correction to new LR Equilibrium C



## FED Intervention

FED Intervention to new LR Equilibrium

