

3-Equation Macro Model Exam Guide

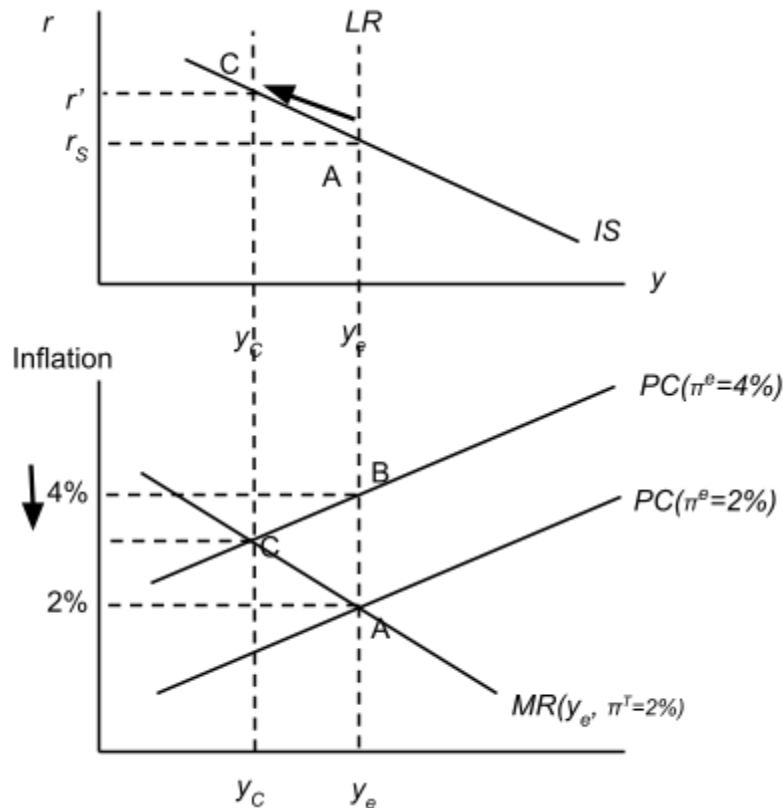
What should you know for the 3-Equation Macro Model exam questions?

- 1) Where do the *IS*, *PC*, and *MR* (or *FR*) curves come from, and what shifts them?
 - a) *IS*: Exogenous changes in Consumption, Investment, Government spending on Goods & Services, Taxes & Transfers, Exports, and Imports.
 - i) *IS*: $y_t = A - a \cdot r_{t-1}$, where A and a are arbitrary positive constants.
 - b) *PC*: Phillips Curve, $\pi_{Now} = \pi_{Expected} + \alpha \cdot (y_{Now}/y_e - 1)$ Expectations about the inflation rate, however there are various ways that we can model expectations about inflation. $\pi_{Expected}$ can be modeled several ways:
 - i) Adaptive Expectations: $\pi_{Now} = \pi_{Last\ time} + \alpha \cdot (y_{Now}/y_e - 1)$, where α is the slope of the Phillips Curve and $(y/y_e - 1)$ is the output gap in percentage terms. This is the form we will usually use in class.
 - ii) Forward-looking Rational Expectations: $\pi_{Now} = \pi_{LR} + \alpha \cdot (y/y_e - 1) + \varepsilon_{Now}$, where π_{LR} is the long run inflation level predicted by the model and ε_{Now} is a zero mean random shock.
 - iii) Grounded Expectations: $\pi_{Now} = \pi_{Anchored} + \alpha \cdot (y_{Now}/y_e - 1)$ unless π_{Now} differs systematically from $\pi_{Anchored}$ for some period of time T , in which case it will “ground” (or “anchor”) to some new average level. For example, suppose $T = 2$. If people expect inflation to be 2%, they will go on expecting it to be 2%, even if for one period it might be something else. It’s like Adaptive Expectations except the Phillips Curve doesn’t shift unless inflation systematically differs from target for at least T periods.
 - Simpler: People are assumed to not change their inflation expectations **until after policy makers have a chance to respond**
 - c) *MR or FR*: Monetary Rule or Fiscal Rule. Belief about the optimal level of Y and inflation, relative dispreference for being away from the desired level of Y and inflation (slope of the *MR* or *FR*)
 - i) *MR or FR*: $(y_{Now}/y_e - 1) = -\alpha\beta(\pi_{Now} - \pi_{Target})$, where α is the slope of the Phillips Curve and β is the relative preference by policy makers for deviations from target inflation and output.
- 2) How do monetary and fiscal policy work?
 - a) Monetary policy: Changing r along the *IS* curve to get the desired y
 - b) Fiscal policy: G or T to shift *IS* to get the desired y (for a given r)
- 3) How would policy makers respond to the following cases?
 - a) Inflation expectations differ from the target rate of inflation (a shift of *PC*)
 - b) *IS* shifts
 - i) Temporarily
 - ii) Permanently
 - c) Aggregate Supply shifts (shift in y_e and *MR*)
 - i) Temporary
 - ii) Permanent

- d) A change in the spread between r_s and r_p
- e) Policy makers choose to target an unsustainable y_e (MR or FR shifts)

Response to 3a: Inflation expectations differ from the target rate of inflation (a shift of PC)

With $\pi > \pi^T$ and the PC holding to an $\pi > \pi^T$, the Fed follows its MR curve to where it intersects with $PC(y_e, \pi^e = 4\%)$. This tells the Fed what level of output to target (y_C). It then follows the dotted line upward to where it meets the IS curve, and then follows the line to the left to see that it must raise rates to r' , to get y_C , which will cause inflation on the $PC(y_e, \pi^e = 4\%)$ to come in below 4%, causing expectations to adjust downwards. As inflation expectations fall and the Phillips Curve shifts, the Fed will follow its MR curve and steadily reduce r so that it eventually returns to r_s and output returns to y_e . Once the economy is back to $(y_e, \pi^e = 2\%)$, then we're done.

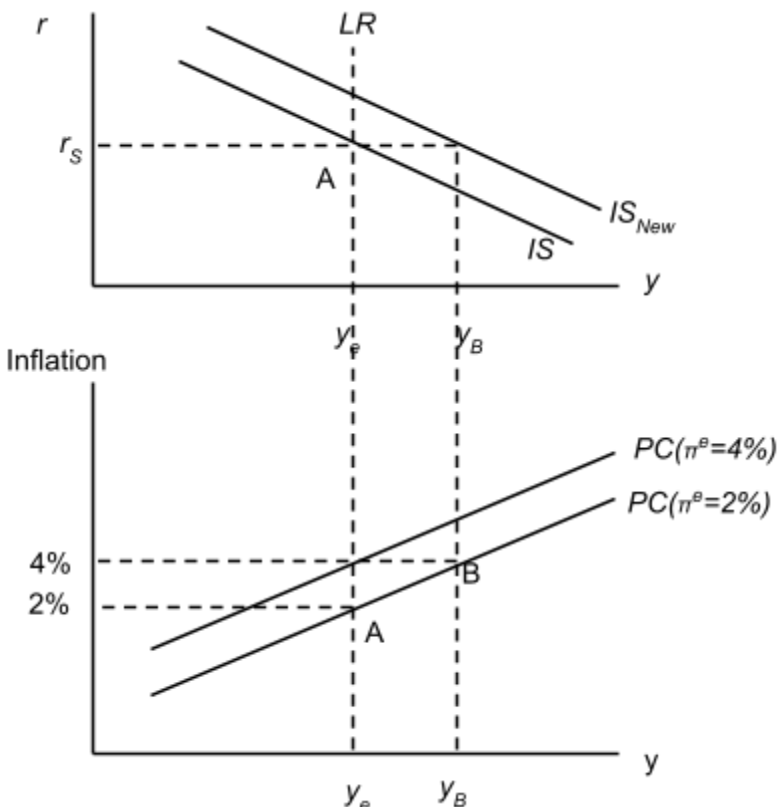


Response to 3bi: IS shifts temporarily.

Suppose IS temporarily shifts *right*. This works out pretty much as in **3a**, the temporary rise in IS raises inflation, which raises inflation expectations and so the Fed must respond by temporarily raising r to lower y , bringing in inflation below expectations and causing the Phillips Curve to shift back to where $\pi^e = 2\%$.

Response to 3bii: IS shifts permanently.

Let Aggregate Demand rise because government spending G rises *permanently*. In the short run, this would raise output to y_B and push up inflation to 4% (for example). When people see this new, higher inflation rate, it will cause them to raise the inflation expectations, and thus shift the short run Phillips Curve upward to cross the long run Phillips Curve at 4%.



Now we are at $y_B > y_e$ and inflation of $4\% > 2\%$ inflation target. Further, with $y_B > y_e$, inflation will continue to rise. What should the Fed do?

With G permanently higher, the IS curve will also be permanently higher, and require a permanently higher r_s (call it $r_{s,New}$) where it will again balance IS at y_e . However, even if it does that, inflation will remain at 4%. To reduce inflation back to the 2% target, the Fed will need to temporarily have an interest rate of r_C that is a bit above $r_{s,New}$ in order to reduce output a bit below y_e until inflation falls to 2%. People will then observe this 2% inflation and it will cause their inflation expectations to also drop to 2%, thus lowering the short run Phillips Curve to the point where it crosses y_e at the 2% inflation target.

In the long run we end up at y_e and inflation at its 2% target, with a permanently higher IS and r_s , $r_{s,New} > r_s$. This corresponds to point Z in the upper graph. It's also point Z in the lower graph, and this is the same as point A, where we started out.

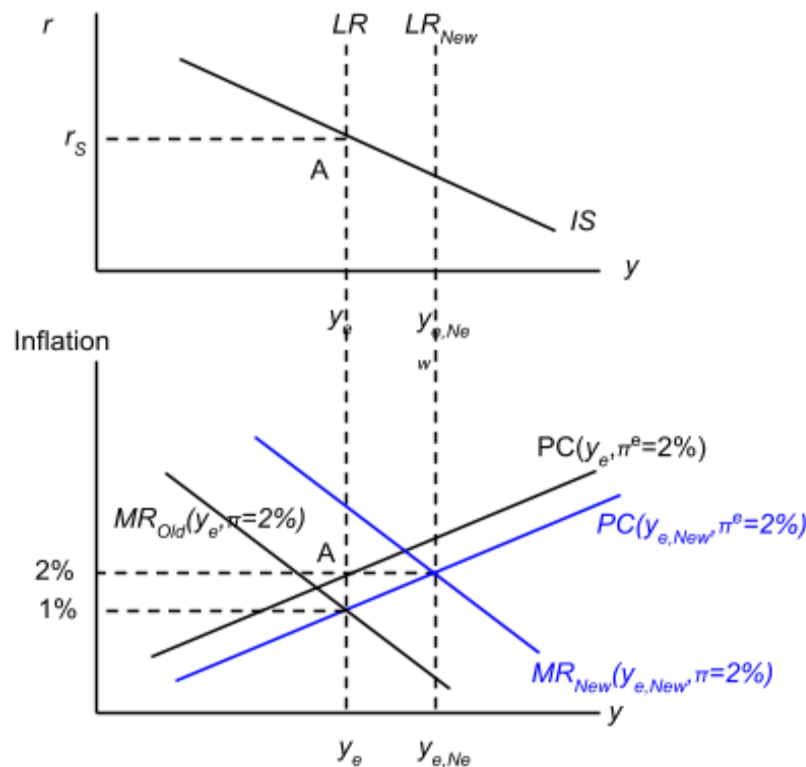
Response to 3ci: Aggregate Supply shifts temporarily (shift in y_e and MR)

This is just like 3a, but a downward inflation shock. The Fed would respond by following its MR , lowering r , raising y , causing inflation to come in above expectations, and gradually returning the Phillips Curve to $(y_e, \pi^e = 2\%)$.

Response to 3cii: Aggregate Supply shifts permanently (shift in y_e and MR)

Let Long Run Aggregate Supply shift permanently to the right so the long run potential level of output is $y_{e,New}$. The economy can now produce at this higher level of output without causing the labor market to become so tight that wages and inflationary expectations start to rise. As such, the short run Phillips Curve shifts out to $PC(y_{e,New}, \pi^e = 2\%)$ and the Fed's MR curve would move to defend the point $(y_{e,New}, \pi^e = 2\%)$.

Although the economy's productive capacity has risen, we are still at our starting point A, where current output is below the new potential, $y_e < y_{e,New}$. As a result, inflation falls to 1%.



The Fed is unhappy. With the outward shift in Aggregate Supply, the Fed's new goal is for the economy to be producing at $y_{e,New}$ and be at its inflation target of 2%, but now the economy is below both of those. What should the Fed do?

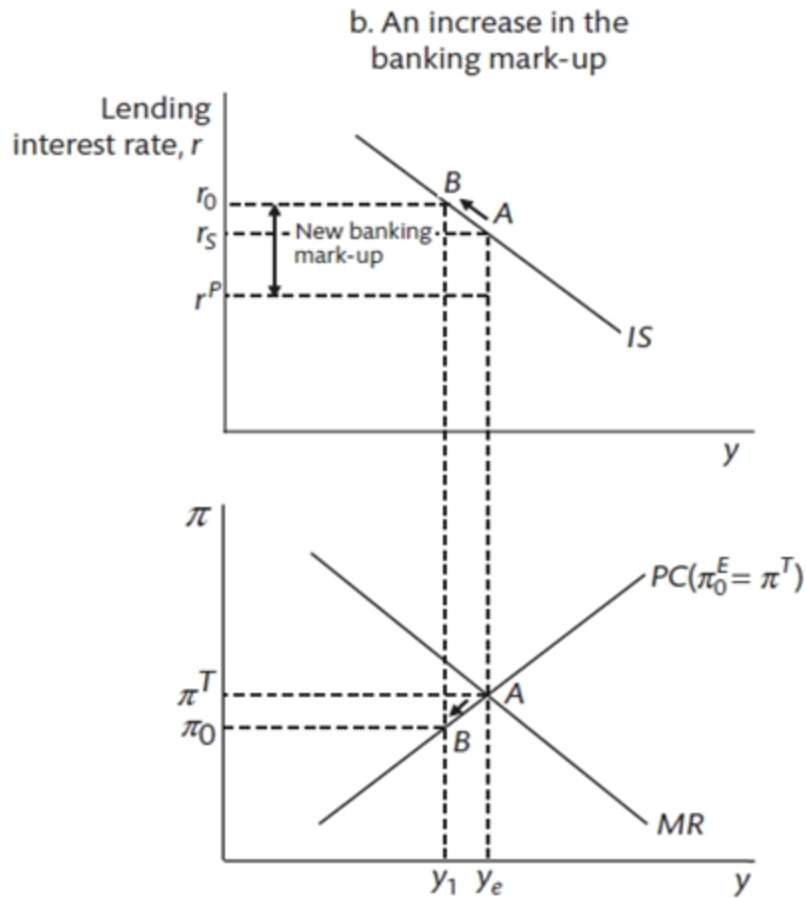
In the long run, to close the output gap, the Fed will have to match the economy's increased ability to produce with an increased level of spending. As such, the Fed will have to permanently lower r_S to $r_{S,Z}$, moving the economy to point Z.

Unfortunately, even if we get the economy to $y_{e,New}$, the inflation rate has fallen to 1% and brought inflationary expectations and the Phillips Curve down with it (Point B). To get inflation back to the 2% target, the Fed will have to temporarily run an interest rate $r_C < r_{S,Z}$ to increase output to $y_C > y_{e,New}$ until inflation and inflation expectations get us to the Fed's long run goal: output = $y_{e,New}$ and inflation = 2% (Point Z).

Response to 3d: A change in the spread between r_s and r^P

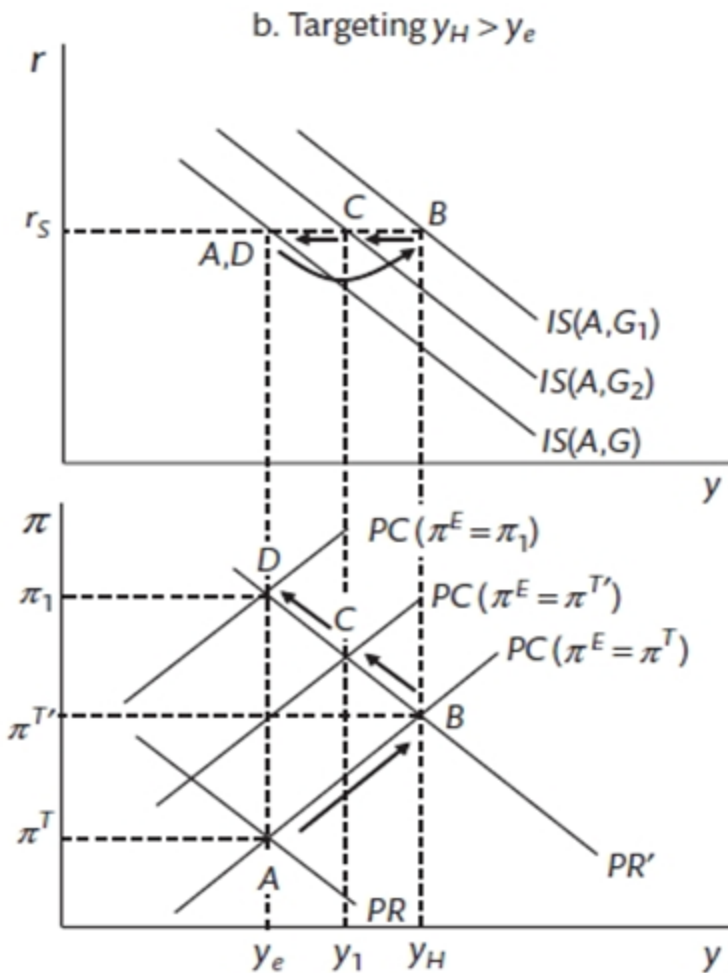
As banks increase the spread between the r^P set by the Fed and the r_s that banks charge private markets to borrow, this effectively raises interest rates and moves the economy upwards and to the left along the IS curve. This lowers output and causing inflation to be below expectations, causing the Phillips curve to shift downward.

The Fed would respond by lowering r^P , following the MR curve, to raise output by enough to cause inflation expectations to start to rise back to the target rate.



Response to 3e: Policy makers choose to target an unsustainable y_e (MR shifts)

Targeting too high a level of y , whether by monetary or fiscal policy, will result in inflation and inflation expectations rising. As the Phillips Curve shifts upward along the MR or PR curves, policy makers will raise r and lower y , until the economy reaches y_e and the resulting high inflation rate that goes with the unsustainable MR or PR rule at y_e .



References

Carlin, Wendy, and David Soskice (2015) *Macroeconomics: Institutions, Instability, and the Financial System*. Oxford University Press.