

Suggested Answers to Final Exam, for TAs

1. xx

- (a) Recall that P is the price for one good. Under our theory this is equated to a markup over the marginal labor cost of producing the good. W measures the marginal cost of one hour of labor. The parameter a measures the number of hours of labor it takes to make a good. So, if $a = 1$ then the marginal labor cost of one good is W . But, if a jumps to, say, 2, then the marginal labor cost of one good is $W/2$, because it now takes the worker only $1/2$ hour to make the good, at a labor cost of $W/2$.
- (b) The basic idea about bargaining is that the worker and employer bargain over how to split between them what the worker produces. According to the bargaining equation, the assumption is that the split they decide on is independent of how much is actually produced. The split is a function of things like the unemployment rate and the things in z , but not the total amount that is produced. So, suppose the worker and employer decide to split what is produced in half. If the worker makes 2 widgets in one hour, then the wage rate is one widget (or, the monetary equivalent) and the rest is given to the employer who allocates it to profits and other input costs. Now suppose that productivity doubles (a big jump!), so that a worker makes 4 widgets in an hour. Given the 50-50 split, the worker's wage doubles to 2 widgets per hour. This is what the specification of the bargaining equation in the exam says: if a doubles from $a = 1$ to $a = 2$, the wage rate doubles too.
- (c) The natural rate of unemployment is the level of unemployment in the medium run, when $P = P^e$. In this case, the pricing and bargaining equations imply:

$$\frac{1}{1 + \mu} = F(u_n, z),$$

so that the natural rate of unemployment is independent of a .

- (d) The formula for the AS curve is $P = [(1 + \mu)/a] aP^e F(u, z)$, with $u = 1 - Y/(aL)$. So, for a given value of P^e and Y , a rise in a induces a rise in u and so a fall in W and, hence, P . So, the AS curve shifts down with a rise in a .
- (e) The horizontal distance of the right-shift in the AS curve is $Y'_n - Y_n$, where Y'_n is the new medium run equilibrium natural rate of output and Y_n is the old one. Let a' denote the new level of productivity and a is the old. Then, Y'_n is such that $Y'_n/a' = Y_n/a$, since the natural rate of unemployment does not change. Because the AS curve has

an upward slope, the short run equilibrium involves $Y < Y'_n$, so that there is unemployment. There is also a lower price level. As a result, in the medium run, P^e falls, and the AS curve shifts further to the right, until it intersects the AD curve (which never shifted) at $Y = Y'_n$.

- (f) In the short run, output expands, but not by enough to employ all the people who were working before. So, there is a temporary rise in unemployment. In the end, all the people working before are at work again (now, producing a lot more!), and the unemployment rate is the same.

2. xx

- (a) Both are unaffected by the change in T .
- (b) The AD shifts to the right. The horizontal shift of the AD is equal to the IS-LM multiplier times $c_1 \times \Delta T$.
- (c) Graph.
- (d) The horizontal shift in the IS is equal to the Keynesian cross multiplier times $c_1 \times \Delta T$.
- (e) Note that in the medium run, $\Delta I = -c_1 \Delta T$, But $\Delta I = -b \Delta i$ because \bar{I} is constant; so: $\Delta i = \frac{c_1 \times \Delta T}{b}$.
- (f) Now $\Delta I = -\Delta T$, so $\Delta i = \frac{\Delta T}{b}$. The change is larger than in (e)
- (a) A jump in the value of ρ means that for traders to be willing to hold domestic assets, those assets must generate a higher expected return than foreign assets generate. Foreign assets generate, in expected value, $i^* + \frac{E^e - E}{E}$. The fact that traders need a higher return on domestic assets to hold them indicates that they 'don't like these assets'.
- (b) The open economy IS curve is obtained by using the (modified) UIP relation to substitute out for the nominal exchange rate in net exports. Then, aggregate demand becomes

$$Z = C^d + I^d + G^d + NX\left(\frac{E^e}{i - i^* - \rho + 1} \frac{P^*}{P}, Y^*, Y\right).$$

To think about how the IS curve shifts with a rise in ρ , we can consider the shift in the vertical direction as well as the shift in the horizontal direction. Consider the shift in the horizontal direction first. If we hold i fixed in the face of the jump in ρ , then there must be a fall in the anticipated depreciation. For this to happen, there must be an immediate depreciation (i.e., jump in E). By raising ε , this stimulates net exports, which implies a higher level of equilibrium output in the goods market. The magnitude of the jump in equilibrium output corresponds to the magnitude of the horizontal shift in the IS curve.

Now consider the shift in the vertical direction. Thus, we hold the equilibrium level of output fixed in the goods market. Suppose i rises by the same amount as ρ . Then, for the modified UIP to hold, no change in E is required, and NX remains unchanged. At the same time, the higher i produces a fall in desired investment, which is associated with a lower level of equilibrium income. From this we conclude that the vertical distance of the shift in the IS curve is not equal to the magnitude of the jump in ρ . In fact, the IS curve shifts up by less than the jump in ρ . Under the modified UIP, a rise in the interest rate that is smaller than the rise in ρ implies a depreciation of the currency. There exists a rise in i that is the right size, so that the stimulus to NX from the depreciating currency exactly offsets the cut to investment from the rise in i . This rise in i corresponds to the vertical shift in the IS curve.

- (c) With the shift in the IS relation to the right, output and i increase. You can see this by shifting the IS curve against a stationary LM curve. In words, the loss of interest by traders in domestic assets leads them to attempt to get their assets out of the country. This causes a depreciation of the exchange rate. This in turn stimulates demand for domestic output. Output itself begins to rise. The higher output raises the demand for money. Assuming no monetary accommodation, this leads to a rise in the interest rate. This attenuates somewhat the rise in demand, by cutting back a little on investment. Still, the net effect is a rise in output.
- (d) (i) Suppose people were willing to hold a given level of money balances when the interest rate, i , was i_1 . According to this specification, when ρ jumps by $\Delta\rho > 0$, then people are willing to hold the same level of money balances, even when the interest rate is $i_1 + \Delta\rho$. Since US assets are now a less attractive alternative to money, it takes people a higher interest rate to tempt them away from money. (ii) When i jumps by $\Delta\rho$, then the demand for money is unchanged. So, if the money market was in equilibrium before (i.e., we were on the old LM curve) then it is in equilibrium again after the jump in ρ , if i jumps by $\Delta\rho$. This explains why the vertical distance of the shift in the LM curve is $\Delta\rho$. (iii) As discussed before, the IS curve shifts up by less than $\Delta\rho$, while the LM curve shifts up by $\Delta\rho$. So, the new intersection occurs at a lower level of output. There is a recession. From the geometry, it is clear that the rise in the interest rate is less than $\Delta\rho$. As a result, the exchange rate depreciates. Since the fall in output and the rise in E both drive up NX , it follows that the trade balance increases.
- (e) The scenario in which everyone, including people holding US money, can rationalize the fear that a rise in ρ will lead to a sharp rise in the interest rate and produce a recession. The monetary authority can avoid this outcome by responding with an increase in the money

supply.

3. xx

(a) xx

- i. The shock is temporary. E^e is the expectation of the future exchange rate. Since the shock is temporary, the situation in the future should be back to where it was before, and so there is no reason for the exchange rate to be any different.
- ii. The variable, i^* does not enter the LM curve, so that curve does not shift. It does enter the open economy IS curve. You can see this by substituting out for the nominal exchange rate in NX using the UIP relation. There are two ways to think about the nature of the shift: how much does the IS curve shift in the horizontal direction? and how much does it shift in the vertical direction? Consider the first question. The answer is determined by figuring out how much equilibrium output would increase if the interest rate did not change (of course, it will change, but now we are trying to figure out how much the IS curve shifts...a technical question). If the domestic interest rate did not change, then the higher value of i^* would require that there be a lower anticipated rate of depreciation on the currency, i.e., that $(E^e - E)/E$ fall (see the UIP relation). For the anticipated rate of depreciation to be lower requires that there be an immediate, instantaneous depreciation. This jump in E would stimulate NX and shift the IS curve to the right. The magnitude of the right shift is the jump in NX induced by the jump in E , times the multiplier. The multiplier in this model is $1/(1 - \gamma)$, where γ is the marginal propensity for households to consume domestically produced goods (i.e., c_1 minus the amount by which NX falls with a unit jump in Y).

Now consider the vertical distance of the shift in the IS curve. To figure this out you have to answer the question of how much i has to change so that the goods market remains in equilibrium at an unchanged level of Y after the jump in i^* (again, Y will change with the change in i^* , but we can't figure this out without first knowing how the IS curve shifts, and now we're taking a second stab at this technical question). Here's a conjecture: imagine the IS curve shifts up by the full amount of the jump in i^* . If i jumps by the amount of the jump in i^* will the goods market be in equilibrium at the old level of output? With this jump in i there is no need for the exchange rate to change, according to the UIP relation. So, net exports would not change. However, the jump in i would drive down investment, and this is not consistent with equilibrium at the old level of output. So, the IS curve does not shift up by the amount of the jump in i^* . In fact, it jumps up by

less. With a smaller jump in i the cut to investment is reduced, plus the exchange rate must depreciate somewhat. The latter stimulates output. So, the IS curve shifts up by less than the jump in i^* . The vertical jump corresponds to the rise in i having the property that the cut in investment is exactly matched by the rise in NX .

Now that we've figured out how the IS curve shifts, we can determine what actually happens. The new intersection between the IS and LM curves involves a higher level of output and a higher interest rate, because the LM curve is upward sloped (at the higher level of output, a higher i is required to keep people happy holding the given quantity of money). The rise in the interest rate is less than the increase in the foreign interest rate, and so there is a depreciation in the exchange rate that occurs at the same time.

(b) xx

- i. The analysis under a fixed exchange rate is simple. The monetary authority has to move M around so that the LM curve intersects the IS curve at $i = i^*$. So, when i^* rises, the monetary authority has to reduce the money supply and shift the LM curve to the left, producing a recession. This recession would presumably be unpopular and people would be unhappy to hear that it is the price to pay for a fixed exchange rate. They would call for abandoning the fixed exchange rate.
- ii. Traders who observe that a commitment to a fixed exchange rate requires imposing an unpopular recession on the economy, and who observe political forces calling for the abandonment of the fixed exchange rate, could start speculating that the exchange rate might be abandoned soon. If so, E^e rises. With E^e higher, the UIP says that a given exchange rate requires a higher domestic interest rate. The interest rate has to rise by *more* than the jump in i^* because it has to compensate holders of domestic assets for the depreciation that they anticipate. So, if the foreign interest rate hike stimulates an attack on the currency and the central bank chooses to defend, then the recession the central bank needs to impose on the domestic economy is even greater.

4. xx

- (a) A higher value of ρ means that to hold domestic assets, people require a return greater than they would expect from foreign assets. This means there is something they don't like about domestic assets that is not captured in their anticipated rate of return. Discussions about how foreigners may suddenly take their money out of the country generally proceed under the assumption that it is something about

the foreigners themselves (they suddenly feel overinvested in the US, or something like that) that leads them to take the money out, and not something evident in the assets themselves, like a sudden deterioration in their quality.

- (b) The answer is that same as for 3a(ii). So, the IS curve shifts right and up. The magnitude of the shift up is less than the magnitude of the rise in ρ for the same reason that the shift up in the IS curve is smaller than the rise in i^* when i^* goes up.
- (c) The IS curve shifts right, so the interest rate rises. It rises by less than the rise in ρ . There is an expansion in output. For the same reason that there is a depreciation in question 3, there is a depreciation here too.
- (d) xx
 - i. According to our portfolio theory, the interest rate matters in the money demand equation because it is the opportunity cost of holding money. Before the jump in ρ from zero to something positive, we wrote money demand as $L(i, Y)$. Thus, for the given i , and Y , people want to hold the specific amount of money, $L(i, Y)$. For a higher interest rate, they would want to hold less money because the return they are giving up on alternatives to money would be too much. But now suppose ρ jumps to a positive value. Now there is something people don't like about the alternative assets and so they don't feel they're giving up as much when they hold money. In particular, they are willing to hold a given fraction of their wealth in the form of money even if the interest rate is high. This is captured by the specification, $L(i - \rho, Y)$. When ρ jumps, they are willing to hold the same amount of money as before if i jumps by the same amount.
 - ii. The vertical distance of the shift in the LM curve answers the question: by how much does the interest rate have to rise to ensure that at an unchanged level of income, people want to hold the same quantity of money balances? With the indicated money demand equation, it is clear that the jump in the interest rate is exactly ρ .
 - iii. The vertical distance of the shift in IS is less than the vertical distance of the shift in LM. As a consequence, the intersection occurs at a level of income below the original level, and at an interest rate that is above the initial value by an amount less than the jump in ρ . Because the interest rate rises by less than ρ , it follows from the UIP that the exchange rate depreciates instantly. This is because the given rise in i implies that the anticipated rate of depreciation of the currency must fall. The only way for this to happen, given that E^e is unchanged, is for a depreciation to occur right away. Because the exchange rate depreciates and output falls, net exports must increase.

(e) xx

- i. They're most likely to be justified when people holding US money also dislike US assets.
- ii. The Fed can deal with the increased money demand by holders of US money, by increasing the money supply.