1 The Greek Tragedy Revisited

Throughout the problem, consider the Mundell-Fleming model for a small, open economy.

Greece is a small country in the Eurozone. Its nominal exchange rate against other Eurozone countries is fixed through the Euro. The European Central Bank (ECB) sets the Eurozone risk-free nominal interest rate.

1.1 Part I: The Problem

a) Consider the definition of real exchange rates.

Letting \( P_G \) be the price level in Greece, and \( P_{EU} \) the general price level in the Euro Zone, write down an equation for the real exchange rate between Greece and the Euro Zone.

The real exchange rate \( R \) is given by:

\[
R = \frac{P_G}{P_{EU}}
\]

b) Draw the open-economy IS curve (“IS$”) for Greece in Y-r space.

You could draw this graph with Greece’s domestic interest rate \( r^d \) or the EU interest rate \( r^{EU} \) on the Y-axis.

If Greece were truly fully small and 100% open, its IS$ curve would be perfectly flat if we had \( r^d \) on the Y-axis (which is not very useful to work with). More likely and more intuitively, the Greek IS$ curve drawn in \( r^d \)-Y space would have a slight downward slope, similar to the "Very Open" case on Slide 20 of the Mundell-Fleming lecture notes.

With \( r^{EU} \) on the Y-axis:
Consider now the divergence in unit labor costs between most EU countries and Greece as seen in the lecture notes.

c) Explain in words why and how this divergence would affect the real exchange rate you derived in part (a).

*Hint:* Remember that prices are proportional to unit labor costs, which are defined as wages divided by average labor productivity.

We saw in our derivation of the Phillips curve earlier in the course that prices are essentially proportional to unit labor costs. We can thus rewrite the real exchange rate as:

\[
R = 1 \cdot \frac{P^G}{P^{EU}} = K \cdot \frac{(W^G/A^G)}{(W^{EU}/A^{EU})}
\]

where \( K \) is some constant of proportionality, \( W \) are wages, and \( A \) is average labor productivity.

An increase in unit labor costs in Greece relative to the rest of the Eurozone will thus lead to an increase in the real exchange rate between Greece and the rest of the Eurozone.

d) Show how this change would manifest itself in your graph from part (b). Explain the intuition for the change.

Describe both how and why output and the real exchange rate would be affected by this change.

We saw in part (c) that an increase in unit labor costs leads to an increase in the real exchange rate. This increase in \( R \) will, in turn, lead to a decrease in net exports, \( NX \). Remembering that the \( IS$ \) curve is given by:

\[
IS$ = C + I(r) + G + NX(R)
\]

we thus see that the increase in \( R \) leads to an inward shift of the \( IS$ \) curve.
Consider now the addition of a risk premium to Greek government bonds.

e)
Show the new equilibrium on your graph from part (d). What happens to output?
With a risk premium, output decreases:

f)
We have previously studied various ways in which the U.S. Federal Reserve can stimulate the economy by decreasing the real interest rate (even in a liquidity trap). Can the Greek Central Bank undertake similar measures in the current situation? Explain why not.

The Greek Central Bank cannot decrease interest rates, because the Eurozone risk-free nominal rates are set by the ECB. That is, by being in the Eurozone, Greece has given up its ability to conduct independent monetary policy, in exchange for keeping fixed exchange rates with the rest of the Eurozone.
1.2 Part II: Two Proposals

Analyze the following two policy proposals in light of your answers to part I. Specifically, describe (i) the underlying mechanism through which the policy is expected to have an effect, (ii) what impacts you predict the policy to have on output and real exchange rates, and (iii) what, if any, problems you foresee with implementing this policy.

g) **Policy 1**: Take strong austerity measures that raise unemployment and lower labor costs (by cutting public spending and weakening labor unions).

Austerity measures would presumably have three main effects.

First, a decrease in labor costs would decrease \( P_G \) relative to \( P_{EU} \), and thus decrease the real exchange rate. This change would increase \( NX \), and thus shift the IS$ curve outward, which would increase output, holding all else constant.

Second, a decrease in public spending could ease market worries about Greece’s ability to repay its debts, thus potentially lowering the risk premium on Greek bonds. A decrease in \( \theta \) would allow a movement along the relevant IS$ curve, also increasing output. (\( R \) would not be immediately affected by this effect.)

Third, however, a decrease in public spending \( G \) would also lead to an inward shift in the IS$ curve, which would decrease output. That is, cutting government spending would decrease aggregate demand and thus reduce output. (Again, \( R \) would not be immediately affected by this effect.)

The third effect is a main problem in this policy proposal. In addition, the Greek public would likely be unhappy with this policy. If public unrest becomes sufficiently bad, the beneficial effect on Greece’s risk premium may be reversed as well, thus posing another potential problem with this policy.

h) **Policy 2**: Leave the EU monetary union (that is, bring back the Greek Drachma), allow it to float freely. [Hint: Think about the impossible trinity.]

Leaving the EU and bringing back a floating currency would allow Greece to conduct its own monetary policy again. This would allow Greece to engage in a monetary expansion, which would devalue the Drachma, thus increasing \( NX \) and output.

Many students were asking about what monetary policy means in a (almost fully) small open economy. Of course, the Greek Central Bank would not be able to decrease the Greek domestic interest rate by much (or by anything, in a truly small, open economy) by selling bonds. However, by selling Drachma-denominated bonds and by buying foreign-currency denominated bonds, the Greek Central Bank could increase \( CF \) and thus drive down the exchange rate, which would increase output.

(In the Mankiw framework of a purely open economy, you can think of an increase in the supply of Drachma-denominated bonds as an increase in the supply of high-powered money, which decreases the exchange rate.)

The main concern with this policy is that a breakup of the Eurozone is unchartered territory, and could potentially lead to catastrophic destabilization of global financial markets.
2 The Swiss Comedy

Consider now the situation of Switzerland, a small, open economy which is not a member of the EU, and has a floating exchange rate.

a) Draw a graph with the Swiss MP curve and its open-economy IS curve on a graph with output $Y$ on the x-axis and the real exchange rate $e$ on the y-axis.

Note that the notation in this problem was to use $e$ to refer to the real exchange rate (which is different from the previous problem).

In the graph, we have the IS$ curve decreasing in the real exchange rate (since net exports are decreasing in the real exchange rate). In addition, the MP curve looks vertical, because it does not depend on the real exchange rate. Note that we draw the MP curve at the level of output $Y^*$ that is consistent with equilibrium in the relevant IS-MP diagram (more on this issue below).

Over the past year, Switzerland has become subject to a large “safety premium” relative to other countries, meaning that the prevailing interest rate is the world interest rate minus a certain amount.

b) On your graph from part (a), show how this safety premium would manifest itself. Is it a boon (advantage) to the Swiss economy? Describe what happens to output and the real exchange rate. Explain why Swiss exporters and ski resorts would be very unhappy with the outcome.

The IS$ curve is given by:

$$IS$ = C + I(r) + G + NX(e)$$
If $r$ decreases from $r^w$ to $r^w - \gamma$, investment $I(r)$ will increase, because it is now cheaper for Swiss entrepreneurs to borrow. For a given exchange rate $e$, IS$ thus increases. On our graph from part (a), the IS$ curve thus shifts outwards (higher $Y$ for a given $e$).

However, this is not the whole story. Consider now what happens in the Swiss IS$-MP$ diagram. A lower interest rate shifts the IS$ curve inwards/downwards:

We can think about this shift in two ways:

In a truly small open economy, we know the IS$ curve is flat at the world interest rate. Now, with Switzerland’s safety premium, the IS$ curve shifts to being fully elastic at the risk-adjusted rate $r^w - \gamma$.

In an almost fully open/almost fully small open economy, you could think of this as coming from a shift in the CF curve, which is then part of the IS$ curve. What a safety premium means is that,
for any given domestic interest rate in Switzerland, lenders now want to put more of their money into Switzerland, which decreases \( CF = \text{net capital outflow} \) for any given \( r^d \).

Either way, the new equilibrium level of output is now lower at \( Y' \) than without the safety premium. Since we were drawing the "MP Curve" in the diagram of part (a) as vertical line at the equilibrium level of output, this curve needs to be shifted as well:

![Diagram showing the MP curve and IS schedule](image)

The total effects of the Swiss safety premium are thus a decrease in output, and an increase in the exchange rate. Swiss exporters and ski resorts are very unhappy with this outcome, because the appreciation of the Swiss Franc makes skiing in Switzerland much more expensive to, say, skiing in France or Austria, and so their sales will decrease.

Consider now the Swiss Central Bank’s response to this situation, which was to set an upper bound on the exchange rate between the Swiss Franc and the Euro.

c)

Assume this ceiling is below the equilibrium you found in part (b). What specific steps must the Swiss Central Bank take to enforce the exchange rate ceiling? Redraw your graph from part (b) and show the Swiss Central Bank’s monetary policy response on this graph. How do you predict that the actions of the Swiss Central Bank will affect output?

To get to a lower exchange rate than \( e' \) in the graph from part (b), we know the Swiss Central Bank must shift the MP curve back out. Specifically, if \( e_{\text{bar}} \) is the exchange rate ceiling, MP must be shifted as follows:
And, looking at the corresponding IS$-MP$ graph:

The actual steps the Swiss Central Bank needs to undertake to shift its MP curve outwards is to sell a large amount if Swiss-Frank denominated bonds, and buy a large amount of Euro-denominated bonds. The Swiss Central Bank is increasing $CF$ and thereby reducing exchange rates.

The model tells us that these steps by the Swiss Central Bank are predicted to increase output.

3 China and the Impossible Trinity

In the following questions, use the large open economy version of the Mundell-Fleming model.

a) Assume that China has standard IS, MP, CF, and NX curves. Also assume for now, counterfactually, that China allows free capital flows. Illustrate equilibrium in a three-paneled diagram. Label all curves and axes, and
indicate the equilibrium levels of output (Y*), the real interest rate (r*), capital outflows (CF*), the exchange rate (e*), and net exports (NX*).

b) Next, suppose that to follow a development strategy known as “export led growth” the Chinese monetary authority wishes to target a lower exchange rate e’<e*. Without introducing capital market barriers, how would the monetary authority fix the exchange rate at e’? Illustrate this policy with the three-paneled diagram. Indicate the new equilibrium levels of the endogenous variables. *Hint: Assume here that the Chinese monetary authority cannot shift NX or change T or G.*

Shifting the MP curve will accomplish this:
What if the monetary authority wants to fix this low exchange rate while maintaining the original equilibrium interest rate $r^*$? Is this possible with free capital flows? Explain why not. Discuss the Impossible Trinity in your explanation.

No. As we see in the above figure, with a fixed CF curve a fall in the interest rate must devalue the currency. This is because a falling interest rate discourages capital inflow and encourages outflow, putting downward pressure on the exchange rate as investors sell the currency and look for opportunities in other countries. So, if the monetary authority fixes $r$ at $r^*$, the exchange rate must be $e^*$. This is just an illustration of the Impossible Trinity: when capital flows freely, the monetary authority cannot choose both a particular exchange rate and a particular interest rate. It must choose to fix one and let the market determine the other.

d)

Now suppose that the Chinese government is willing to interfere with the free flow of capital. Give an example of a capital control policy that would simultaneously achieve $e'$ and $r^*$. Illustrate this policy in the three-paneled diagram, and indicate the equilibrium levels of the endogenous variables.
The problem the government faces is that one requires an interest rate low enough to encourage the high level of outflow $CF'$. The solution is to shift the $CF$ curve. In particular, the government must encourage outflow or restrict inflow, at any interest rate. In reality, China limits the extent to which its citizens may borrow from abroad (they also use other capital control policies). That is, China restricts capital inflow.

This policy shifts both the $CF$ curve and the IS curve to the right. The IS shift puts upward pressure on the interest rate, so to achieve both $e'$ and $r^*$ the monetary authority must also shift the MP curve.

![Diagram showing IS, MP, CF, and NX curves]

### 4 The China Conundrum

As explained in question 3, China uses capital controls to have both an independent monetary policy and a fixed exchange rate. Suppose that under international pressure, China ends its capital controls (this is called “liberalization”) and allows its exchange rate to float (and thereby appreciate) against the dollar.
a) Using the large open economy version of the Mundell-Fleming model from the perspective of the US, illustrate the effect of the Chinese capital market liberalization and currency float. Indicate equilibrium levels of US output ($Y^*$), the real interest rate ($r^*$), capital outflows ($CF^*$), the nominal exchange rate ($e^*$), the real exchange rate ($R^*$), and net exports ($NX^*$) before and after the change in Chinese policy.

b) From the point of view of US policy makers, would this development be encouraged in today’s macroeconomic environment?

Yes, from the perspective of the Mundell-Fleming model. The Chinese capital market liberalization devalues the dollar, increases US interest rates, and stimulates output and net exports. After liberalization, Chinese citizens begin to borrow more from the US, and US investors have more financial investment opportunities in China. With new funds and an appreciated currency, Chinese citizens buy US goods.
From the perspective of the US, the downside of Chinese liberalization is that it devalues the dollar against the yuan. This makes Chinese goods relatively more expensive. Since not everyone in the US works in an industry that benefits from export growth, liberalization may make some Americans strictly worse-off.