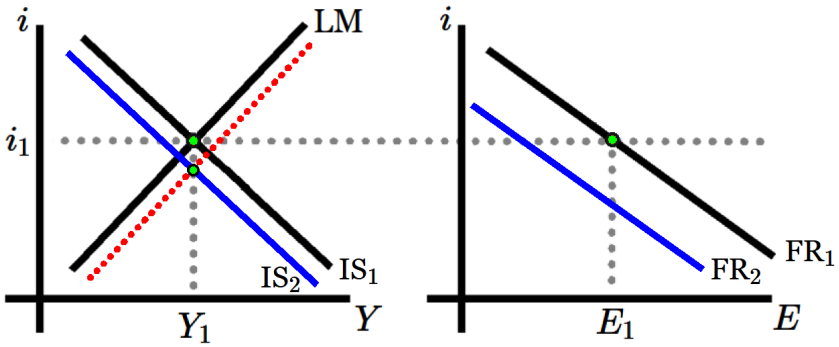
Problem 1

Using the IS-LM-FX model, illustrate what happens when Foreign country increases the money supply. Compare outcomes when Home has a floating versus fixed exchange rate.

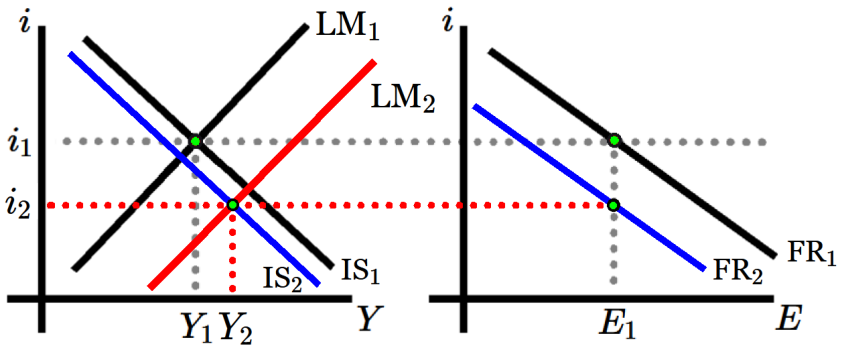
Solution Part 1: Floating Exchange Regime. When the foreign country increases their money supply, the foreign interest rate i^* will fall. This means **the FR curve falls**. Accordingly, the exchange rate falls. Since home currency has appreciated, home goods and services are now more expensive, so EX falls and IM increases, and therefore TB falls. Therefore **the IS curve shifts to the left**, and make sure the IS shift is modest relative to the FR shift.[1] If floating, this is the end of the story: we will have lower Y, lower i, and lower E; but it is important to note that here the central bank, if it wants to (and it likely does want to), can do expansionary monetary policy, move the LM curve to the right (the dotted red line), and therefore stabilize output.



The takeaway: the home country with a floating exchange rate can stabilize its output even if there's turmoil in the foreign country. That sounds like a big benefit of floating.

Solution Part 2: Fixed Exchange Regime. If the exchange rate is in a fixed regime, however, the central bank will respond to the decrease in the exchange rate by increasing the money supply, which decreases the interest rate. So **the LM curve shifts to the right** just enough so that E goes back to its original rate. We also have higher Y and lower i.

[1] If the shift in IS is larger than the shift in FR, then absent any stabilization policy, you'll end up with lower Y, lower C, lower i, higher I, and higher E. Lower Y and higher E both imply a higher trade balance. But if you look at $Y = C + I + G + \text{TB}$, you'll have C decrease by $\text{MPC} \times Y < Y$ and I increase, which means the equality can only be maintained with lower TB. Therefore we need TB to both *increase and decrease*, which obviously isn't possible, thereby illustrating that IS cannot move by more than FR.



Notice that in this case, there is nothing the central bank can do to stabilize output: the fixed exchange rate requires the large movement in LM and therefore requires output to deviate from Y_1. This is an important lesson: shocks that affect only the foreign country (an asymmetric shock) can affect home country's output, and a fixed exchange rate means home can't always pursue stabilization policy. (It loses its monetary autonomy? Oh hey, it's the trilemma again.) This is a downside to having a fixed exchange rate: another country's unique (i.e. asymmetric) economic fluctuations can affect your own economy, and there's nothing you can do about it short of switching to a floating regime.

This same logic applies when currencies, and therefore exchange rates, are all pegged to the value of gold. In a gold standard, the money supply is essentially determined by the quantity of gold in circulation. France began hoarding gold between 1927 and 1932, taking it out of circulation; the reduction in the quantity of gold reduced the world's money supply, leading to widespread deflation and perhaps the Great Depression.[2] In 1933, US President Roosevelt took the US off of the gold standard, thereby re-establishing monetary autonomy, which is widely believed to have been the key policy in ending the Great Depression in the US.[3]

Problem 2

Home's currency is the peso and trades at 1 peso per dollar. Home has external assets of \$320 billion, all of which are denominated in dollars. It has external liabilities of \$800 billion, 90% of which are denominated in dollars.

(a) What is home's external wealth? Is home a net creditor or a net debtor?

Solution. For laziness, let d denote dollar currency units and p peso currency units.

Let L_d denote external liabilities denominated in dollars and L_p external liabilities denominated in pesos. We're told home country has \$800 billion in total external liabilities, $L_d = 800(0.90) = \$720$ billion of which are denominated in dollars, and the remaining $L_p = \$80$ billion in pesos.

Let A_d denote external liabilities denominated in dollars and A_p external liabilities denominated in pesos, so that $A = A_d + A_p$. We're told home country has \$320

[2] https://voxeu.org/article/did-france-cause-great-depression
[3] https://www.npr.org/sections/money/2011/04/27/135604828/why-we-left-the-gold-standard

billion in total external assets, and all of them are denominated in dollars, so $A_d =$ \$320 billion and $A_p = 0$.

Because all external assets are denominated in dollars, all external asset value in terms of pesos depends on the exchange rate. We can therefore express the value of external assets in terms of pesos as

$$\begin{aligned}\text{value of } A_d \text{ in terms of pesos} &= A_d E_{p/d} \\ &= 320\ d \left(\frac{1\ p}{1\ d}\right) = 320\ p,\end{aligned}$$

Here you can see that as the exchange rate changes, the value of dollar-denominated assets in terms of pesos changes. Higher exchange rate/depreciated peso? The value of external assets goes up (because depreciated peso means appreciated dollar and the assets are all in terms of dollars).

Using the same idea as before, we can write liabilities as

$$\begin{aligned}\text{value of } L \text{ in terms of pesos} &= L_p + L_d E_{p/d} \\ &= 80\ p + 720\ d \left(\frac{1\ p}{1\ d}\right) \\ &= 800\ p.\end{aligned}$$

Here you can see that the peso-denominated liabilities do not depend on the exchange rate because, well, they're already denominated in terms of pesos. But you can see that the as the exchange rate changes, the value of the dollar-denominated liabilities in terms of pesos changes. Higher exchange rate/depreciated peso? The value of external liabilities goes up.

We can now conclude that initially Home's external wealth in terms of pesos is

$$W = 320\ p - 800\ p = -480\ p.$$

The minus sign indicates that home country is a net debtor.

(b) If the peso depreciates to 1.2 pesos per dollar, what is the change in Home's external wealth in pesos?

Solution. Now the exchange rate changes. The value of external assets becomes

$$A_d E_{p/d} = 320\ d \left(\frac{1.2\ p}{1\ d}\right) = 384\ p,$$

so an increase in the value of their assets. The value of external liabilities becomes

$$L_p + L_d E_{p/d} = 80\ p + 720\ d \left(\frac{1.2\ p}{1\ d}\right) = 944\ p,$$

so an increase in the value of their liabilities as well. We conclude that home's external wealth in terms of pesos is now

$$W = 384\ p - 944\ p = -560\ p,$$

which means they're now in even more debt just because the exchange rate changed. Specifically, the change in home's external wealth is

$$\Delta W = -560\ p - (-480\ p) = -80\ p.$$

There's a formula in the book that simplifies this process, given by

$$\begin{aligned}\Delta W &= \Delta E_{p/d} \times (A_d - L_d) \\ &= \frac{0.2\ p}{1\ d} \times (320\ d - 720\ d) \\ &= -80\ p.\end{aligned}$$

You can see why this country might prefer a fixed exchange rate: their debt would be a lot more predictable, and a sudden depreciation of their currency wouldn't lead to an increased debt burden. (This has happened a lot to developing countries.)

Problem 3 (Sample Final Question 4)

Use the symmetry-integration diagram to explore the evolution of international monetary regimes from 1870 to 1939, during the rise and fall of the gold standard.

(a) From 1870 to 1913, world trade flows doubled in size relative to GDP, from about 10% to 20%. Many economic historians think this was driven by exogenous declines in transaction costs, some of which were caused by changes in transport technology. Depict this shift for a pair of countries that started off just below the FIX line in 1870.

Solution. To quote the textbook and summarize:

- As integration rises, the efficiency benefits of a fixed exchange rate increase.
- As symmetric rises, the stability costs of a fixed exchange rate decrease.

As demonstrated in the previous problem, asymmetric shocks are problematic for fixed exchange rate regimes. When a shock hits only the foreign country and affects the exchange rate, home country has no choice but to respond to maintain the fixed exchange rate, even though home country was not hit by the shock. That can cause output fluctuations as the LM curve shifts in a way that it would not have shifted under a floating regime. If a shock is symmetric, however, then it affects the foreign country and the home country in the same way, so they'll react in the same way, and the exchange rate will therefore not move much.

The level of integration is the other crucial dimension along which a fixed exchange rate is judged a good idea or not. If countries trade a lot, then a fixed exchange rate might facilitate that trade and increase efficiency because all of the calculations become more consistent, and furthermore there is less fear of exchange rate risk (like in the previous question); this was a large motivation for the Euro. If countries don't trade a lot, then the exchange rate between them is of little practical importance so there's not much motivation to fix it.

Anyway, declines in transaction costs (e.g. lower shipping costs) facilitates trade. All else equal, there will be more trade and therefore more integration among markets. So move the point to the right across the FIX line: now that the two countries are more integrated, a fixed exchange rate has bigger benefits (trade is easier and less risky when the relative values of currencies are reliable and predictable).

(b) From 1913 to 1939, world trade flows collapsed, falling in half relative to GDP. Many economic historians think this was driven by exogenous increases in transaction costs from rising transport costs and increases in tariffs and quotas. Depict this shift for a pair of countries that started off above the FIX line in 1913.

Solution. Alright, now the opposite occurs; just go back to the original point.

(c) Explain why an increase in country-specific shocks might have undermined commitment to the gold standard.

Solution. An increase in country-specific shocks mean less symmetry, which makes the loss of monetary autonomy more problematic, as shown earlier. So move the point downwards, past the FIX line and into float territory.

(d) Explain why an increase in democracy might have undermined commitment to the gold standard.

Solution. The loss of monetary autonomy that comes from a fixed exchange rate can mean sustained or exacerbated recessions. In a democracy, people might get fed up with a recession and therefore vote to break the peg, even if there is a lot of market integration and symmetry. In other words, the FIX line will shift to the right/up, making the floating area larger.

(e) Explain why growth of world output relative to the supply of gold might have undermined commitment to the gold standard.

Solution. The rationale behind a gold standard is that the growth rate of the gold supply is naturally kept at a low and stable level (in a long-run sense, anyway) as determined by the ability to mine new gold. Recall that $\pi = \mu - g$. An increase in world output relative to the supply of gold means g gets bigger while μ stays the same; in the Great Depression, this manifested as negative π, that is, deflation, which most economies try to avoid like the plague. So when fixing to the gold standard implied deflationary pressure, it didn't matter how symmetric or integrated markets were: the FIX line moved way right and floating was the way to go.

Problem 4

Many countries experiencing high and rising inflation, or even hyperinflation, will adopt a fixed exchange rate regime. The potential costs and benefits of a fixed exchange rate regime in this case include a(n) _____ in fiscal discipline, a _____ of seigniorage, and a _____ of expected future inflation.

(a) increase; gain; decrease

(b) increase; loss; decrease

(c) decrease; gain; decrease

(d) decrease; loss; decrease

Solution 4: b. We know from the policy trilemma that a country loses its monetary autonomy while in a fixed exchange rate regime. Because the government knows it won't be able to simply print money to pay for things (i.e. it can't do seigniorage), it might be more mindful of its budget, an increase in fiscal discipline. And because it can't simply print money, it can't create a high-inflation environment, so expected future inflation decreases.

Seigniorage is considered an *inflation tax*, as the following example illustrates. Suppose the money supply is $M_1 = \$100$, held entirely by households, and the price level is currently $P_1 = \$1$. That means the purchasing power of the households' money is $M_1/P_1 = 100$ units of goods. Now suppose the treasury prints \$1 and gives it to the government. The money supply increases by 1% to $M_2 = \$101$ and consequently there is inflation of 1% so that the price level is now $P_2 = 1.01$. This means the purchasing power of the households' money is now only $M_1/P_2 \approx 99$ units of goods; whereas the government can now buy $1/1.01 \approx 1$ unit of goods that it could not before. It is as if the government took one unit of consumption away from households, ergo the name inflation *tax*.

As a side note, research suggests that poorer individuals tend to hold more cash relative to interest-bearing assets, the implication being that inflation tax is a *regressive tax*: it disproportionately hurts the poor.[4] (That said, I am quite poor but the bout of inflation we are experiencing as I write this is eroding the value of my not-insignificant undergrad debt in real terms, by about 21% total since I started grad school, actually. Yours too, if your debt has a fixed nominal interest rate.) Okay, end of tangent that no one asked for.

Notice that every time the treasury prints a new dollar, the price level increases, so the purchasing power of new dollars gets smaller and smaller. In other words, there are diminishing returns to seigniorage. Suppose the treasury prints two dollars instead or just one. Then the price level goes to 1.02 and the government can purchase $2/1.02 = 1.96$ units of goods that it could not before; that's only 0.98 units of goods per dollar printed. If they print three dollars, it falls to $3/1.03 = 2.91$ units of goods, or 0.97 units of goods per dollar printed. Carry this logic out to its extreme: the treasury prints so much money that the price level – the denominator – becomes extraordinariily large, and therefore the purchasing power of printed dollars become extraordinarily small.

[4] https://www.jstor.org/stable/2673879