Problem 1

Part A. UIP says

$$i = i^* + \left(\frac{E^e_{H/F}}{E_{H/F}} - 1 \right).$$

Plug things in and rearrange to get

$$\left(\frac{E^e_{H/F}}{E_{H/F}} - 1 \right) = i - i^* = 6\% - 3\% = 3\%.$$

Part B. 50%. Just an arbitrarily chosen (but large) number.

Part C. The trilemma means that a country cannot simultaneously have:

- a fixed exchange rate,
- capital mobility,
- independent monetary policy.

In practice, capital controls are difficult to impose, so in this class we tend to assume high degrees of capital mobility. Therefore most of our focus has been on how a fixed exchange rate obviates monetary autonomy but a floating exchange rate allows monetary autonomy.

Part D. $GNE = C + I + G$, which accounts for all home expenditure. $GDP = C + I + G + TB$, which accounts only for domestic production. Exports are domestic production that is not consumed (i.e. not expenditure), so it is a plus for GDP; whereas imports are expenditure that is not domestically produced, so it is a minus for GDP.

Part E. GNI takes the value of domestic production, adds the value of production of home factors located in another country (EX_{FS}), and subtracts the value of production of foreign factors located in home country (IM_{FS}), so that $GNI = GDP + NFIA$. The idea here is to account for all productive value of home factors, and *only* home factors, regardless of where they are located.

Part F. Ideally a portfolio will hold a sizable fraction of assets from all over the world so that if something bad happens to one country, then only a portion of the portfolio will tank. Home bias means domestic residents like to hold a higher proportion of home assets than optimal diversification would imply, which means when the home country tanks, the portfolio takes a bigger hit than necessary.

Part G. A fiscal expansion means the IS curve shifts to the right. That means i goes up and therefore E goes down. So if the exchange rate is allowed to float, that means an appreciation.

Part H. A currency board is a fixed exchange rate regime such that the central bank has $B = 0$ so that the entire money supply is backed by reserves: $M = R$. In other words, the backing ratio $R/M = 100\%$. There are a bunch of rules and regulations to maintain the 100% backing ratio as well.

Part I. The Eurozone are the countries in the European Union that have replaced their currencies with the euro. Currently (as of 2020) there are 19 countries in the Eurozone:

Country	**Year Joined**
Austria	1999
Belgium	1999
Cyprus	2008
Estonia	2011
Finland	1999
France	1999
Germany	1999
Greece	2001
Ireland	1999
Italy	1999
Latvia	2014
Lithuania	2015
Luxembourg	1999
Malta	2008
the Netherlands	1999
Portugal	1999
Slovakia	2009
Slovenia	2007
Spain	1999

TABLE 1: Cyprus and Malta joined in 2008, and Slovakia did join in 2009. The most recent countries to join, however, are the Baltic states: Lithuania (2015), Latvia (2014), and Estonia (2011).

Part J. The UK seems unlikely to join the euro, especially since it just, you know, *left the European Union altogether*. Denmark and Sweden seem content maintaining their own currencies; the Danish krone is pegged to the euro, but the Swedish krona is floating.

Problem 2

Suppose that one year is considered the long run (i.e. PPP holds).

Part A. We are essentially told the shape of the money demand function, so we can conclude that when the money supply goes up by 10%, the interest rate will fall from 8% to 6%. In other words, shift MS_1 to the right by 10% and the new equilibrium is at $i = 6\%$.

Part B. UIP says

$$i = i^* + \left(\frac{E^e_{H/F}}{E_{H/F}} - 1\right).$$

Since i goes down by 2% and i^* hasn't done anything, it must be the case that $E^e/E - 1$ goes down by 2%. That means an expected appreciation of 2%.

Part C. The long-run (i.e. PPP) exchange rate is $E = 1$, which will remain true as long as the increase in the money supply is temporary (because then neither P_H nor P_F change in the long run.) Therefore $E^e = 1$. We just determined that $E^e/E - 1 = -0.02$, from which it follows that

$$1/E - 1 = -0.02 \quad \Longrightarrow \quad E = 1.02.$$

Part D. If the change is permanent, then an increase in the money supply by 10% implies a long-run increase in the price level by 10%, so $P^e = 1.10$. And because $E^e = P^e_H/P^e_F$ where $P_F = 1$ is always unchanged, it follows that $E^e = 1.10$ as well.

Part E. We have determined the long-run value $E^e = 1.10$. We know that the increase in money supply implies $E^e/E - 1 = -0.02$, from which it follows that

$$1.10/E - 1 = -0.02 \quad \Longrightarrow \quad E = 1.12.$$

Problem 3

Part A. There is a fall in Y during a recession. There is now less income to tax, therefore government tax revenue falls and the government budget moves closer to a deficit — government spending has not changed but its ability to pay for that spending has decreased.

Also note that consumption behavior will be different because Y goes down in a recession, but now T goes down as well, so disposable income $Y_d = Y - T$ goes down by *less* than it would were taxes constant, and therefore consumption goes down *less* than it would were taxes constant. In other words, C is less responsive to changes in Y; and therefore the demand function in the Keynesian Cross diagram is *flatter*. So when an increase in i shifts the demand function down through I, it implies a relatively small change in Y from the 45° line, and therefore a steeper IS curve than if taxes were constant.

Part B. Since tax revenue has fallen, the government has to respond to reducing its spending so that $\Delta G = \Delta T$. This shifts the IS curve to the left.

Part C. When IS shifts left, we have even lower Y, a lower interest rate, and a higher exchange rate. Consumption falls, investment increases, and the trade balance increases.

Part D. If there's a fixed exchange rate, then the central bank needs to shift the LM curve to the left to stabilize i and therefore stabilize E. This reduces Y even further (thereby making it the opposite of stabilization policy) and therefore consumption as well. Investment and the trade balance are back to their original levels since i and E are back to theirs.

Part E. The fixed exchange rate lead to large swings in Y because the central bank was forced to engage in contractionary policy in order to maintain the peg to gold. Perhaps gold standards have been abandoned for a good reason. Likewise, the obsession with a balanced budget lead exacerbated the recession as well since it required cuts to G.

Problem 4

Part A. 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 when the values of currency are known and consistent).

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

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

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, making the floating area larger.

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 5

Part a. Year 1 is just what we're told, so

Year	B	R	M	μ
1	8000	4500	12500	–

- Year 2: B grows at 25%, so in year 2 we know we'll have $B = 8000(1.25) = 10000$. To maintain the peg, the central bank must hold M constant so that $\mu = 0$, and they do this by reducing R by 2000.

Year	B	R	M	μ
1	8000	4500	12500	–
2	10000	2500	12500	0

- Year 3: B grows to $10000(1.25) = 12500$. This means R must shrink by 2500 to maintain constant M. Oh hey, now reserves are zero so the peg has been destroyed. Great job, Banania.

Year	B	R	M	μ
1	8000	4500	12500	–
2	10000	2500	12500	0
3	12500	0	12500	0

- Year 4: Okay, now when B increases by 25%, and so must M, so $\mu = 25\%$. Reserves remain at zero. Therefore $B = M = 12500(1.25) = 15625$.

Year	B	R	M	μ
1	8000	4500	12500	–
2	10000	2500	12500	0
3	12500	0	12500	0
4	15625	0	15625	25%

- Year 5: And repeat. B and M increase to $15625(1.25) = 19531.25$, so $\mu = 25\%$. Reserves remain at zero.

Year	B	R	M	μ
1	8000	4500	12500	–
2	10000	2500	12500	0
3	12500	0	12500	0
4	15625	0	15625	25%
5	19531.25	0	19531.25	25%

Part b. As seen above, reserves run out in year $T = 3$. Then the nominal money supply instantaneously begins growing at 25%, so inflation instantaneously jumps to 25% and the rate of depreciation instantaneously jumps to 25% too. Inflation was initially zero when $i = 5\%$, implying that $r = 5\%$. But now we have non-zero inflation, so the nominal interest rate instantaneously jumps to $i = r + \pi = 5\% + 25\% = 30\%$. The change in i will have implications in the money market graph, as seen in the next part.

Part c. Before time T, we have $M = 12500$ and $P = 1$ so $M/P = 12500$.

Then because $R = 0$ at time T, we must have $M = B = PL(i)Y$. Plugging in what we know and are told about $T = 3$, we have

$$\frac{M}{P} = \frac{12500}{P} = \frac{4}{5} \times 12500 = 10000.$$

Alright, so the new equilibrium i as determined by the Fisher equation tells us that equilibrium real money demand — and therefore supply — instantaneously changes to 10000.

Part d. Before time T, the price level stays at $P = 1$ because the nominal money supply is unchanged; this means inflation is zero and the interest rate remains at $i = 5\%$ as given. But immediately as T hits, we know $M/P = 10000$ and we know that $M = 12500$ from parts b and c, from which it follows that $P = 1.25$. Therefore the increase in the price level is 25%. Recall that the exchange rate under PPP is $E_{H/F} = P_H/P_F$. There has been no change to P_F, but P_H has jumped by 25%, therefore $E_{H/F}$ must also jump by 25% so $E_{H/F} = 1.25$.

Okay, that's a lot to take in. It might help here to draw the money market graph, which is on the next page. I'll repeat the steps in bullet points to hopefully make each logical increment easier to digest.

- At time T, $M = 12500$ and $R = 0$, which means $B = M = 12500$.
- Because B is growing at 25%, it follows that M now growing at 25%, and therefore inflation instantaneously jumps from 0% to 25%.
- The Fisher equation says $i = r + \pi$. We went from $i = 5\% + 0\%$ to an instantaneously jump of $i = 5\% + 25\% = 30\%$.
- When the instantaneous jump in the interest rate causes $L(i)$ to drop to $4/5$, it means we're moving *along* the money demand function (because i is on the vertical axis of the money market graph) from point A (12500) to point B (10000).
- So there must be an instantaneous shift left of the real money supply to get to that new equilibrium $i = 30\%$. Well, we know that M is still 12500, so the only way there can be an instantaneous decrease in M/P is if P instantaneously jumps from 1 to 1.25. (Note that this change in P is distinct from inflation — inflation is a rate of change over time, whereas here the increase in P is an instantaneous, one-off jump.)

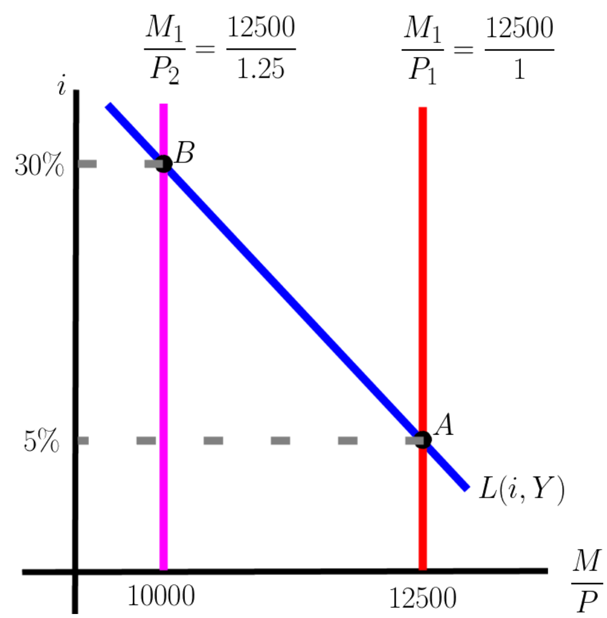

FIGURE 1: There is an increase in P to equilibrate real money supply with real money demand at the new (and sudden) interest rate of 30%.

This is unlikely to happen in practice, however. People who have pesos are likely to anticipate the expected depreciation and therefore will likely want to get rid of pesos in exchange for dollars before that happens. In this case, investors are forward-looking instead of myopic. Which leads to the next question...

Part e. The big problem with the previous problem is that there was a jump in the price level once reserves hit zero, which in turn caused the jump in the exchange rate. This jump in the price level was necessary because the real money supply M/P needed to fall to 10000 in order to equilibrate at $i = 30\%$, but M was fixed.

So what if speculators instead make M jump downwards via speculative attack? Then M/P can fall as needed with no jump in P and therefore no jump in E.

Let's look at year 2. The central bank has 2500 pesos worth of dollar reserves (which also happens to be 2500 dollars since the exchange rate is assumed to be $E = 1$). If speculators attack now and sell 2500 pesos to the central bank in exchange for 2500 dollars, then the peg is dead as $R = 0$.

- Then we have $M = B = 10000$ and $R = 0$.
- Because B is growing at 25%, it follows that M now growing at 25%, and therefore inflation instantaneously jumps from 0% to 25%.
- The Fisher equation says $i = r + \pi$. We went from $i = 5\% + 0\%$ to an instantaneously jump of $i = 5\% + 25\% = 30\%$.
- When the instantaneous jump in the interest rate causes $L(i)$ to drop to $4/5$, it means we're moving *along* the money demand function (because i is on the vertical axis of the money market graph) from point A (12500) to point B (10000).
- So there must be an instantaneous shift left of the real money supply to get to that new equilibrium $i = 30\%$. But wait, this time $M/P = 10000/1$ is already at the equilibrium level and therefore there is no need for P to change. Because P doesn't make a jump, it follows that E doesn't make a jump.

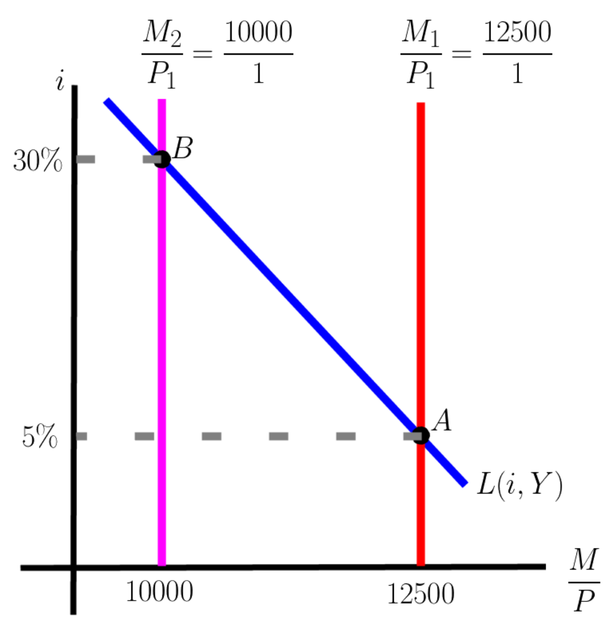

FIGURE 2: When the peg breaks, M/P will fall by 2500 no matter what. Peso holders can avoid a capital loss by draining the central bank's reserves exactly when $R = 2500$, which ensures that P and therefore E do not have to make any jumps.

In this case, *critical level* of reserves is $R_c = 2500$. The textbook gives a formula,

$$R_c = M(\phi \times \mu),$$

where ϕ is the responsiveness of money demand to changes in the interest rate: if i goes up by 1 percentage point, then M falls by ϕ percent. In other words, ϕ satisfies

$$\frac{\Delta M}{M} = -(\phi \times \Delta i).$$

Once reserves bottom out, we know that $\Delta i = \mu = 25\%$. And we are told that money demand falls from 1 to 4/5, so -20%. Ergo

$$-20\% = -(\phi \times 25\%) \quad \Longrightarrow \quad \phi = 0.80.$$

We also know that $M = 12500$. So plugging things in gives what we already know,

$$R_c = 12500(0.80 \times 0.25) = 2500.$$