a)

Equation 1 is the equilibrium for the money market. It is the states that the money demand equal the money supply. We get the equation by:

$$M^s = M^d$$

$$M^s = P * L(R, Y)$$

$$\frac{M^s}{P} = L(R, Y)$$

Let's look at the money supply. The money supply is decided by the central bank. In this model, they set the money supply at a given level. Also, we divide money supply by the nominal price level to find real money holdings. Since M^s is given, the money supply doesn't get affected by the interest rate. Money supply will be a vertical line.

The right side of the equal is the money demand. The money demand is a function of domestic interest rate and the real national income. Now let's see how these factors change the demand for money.

$$\frac{\partial M^d}{\partial R} < 0$$

Higher interest rate leads to less demand for money. People won't hold money since they can get a higher interest rate on their money in the bank.

$$\frac{dM^d}{dY} > 0:$$

Higher GNP leads to more demand for money. The intuition is that there will be more transactions in the economy. To be able to make these transactions, people will like to have more money.

$$\frac{dM^d}{dP} > 0$$

If prices raise, people will like to have more money. Goods and services becomes more expansive. To be able to buy the same basket of commodities, people will like to have more money to be able to have the same purchasing power.

Since interest rate gives lower demand for money, our curve will be sloping downwards for a given level of Y. The equilibrium in the money market can be show as. When the money demand equal the supply of money for a given level of Y, gives us interest rate R^0.

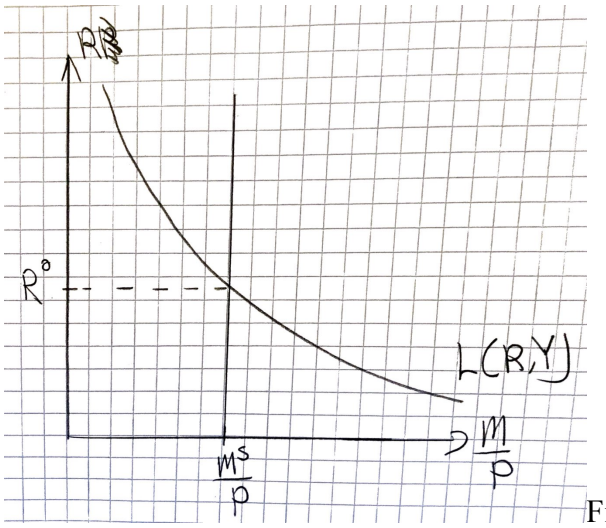


Figure 1

What happens if the interest rate isn't at the equilibrium, R^0 but at a lower or higher level?

- $R > R^0$

  When the interest rate is higher, money supply is higher than money demand. This results in excess supply of money. People will want to invest in bonds. Bonds has now a lower opportunity cost than holding cash. The demand for bonds raises the price of bonds. Bonds and its return has an inverse relationship, which means a higher price of bonds gives a lower return. This results that $R_\$$ gets lowered. $R_\$$ gets lower and lower until the we are back in equilibrium in the money market with interest at R^0.

- $R < R^0$

  When the interest rate is lower than the equilibrium, money demand is higher than money supply. This means there is excess demand of money. People will want to have money, so they will want to sell bonds. Less demand for bonds will lower its price. A lower price of bonds gives a higher return on the bond. The interest rate will increase, $R \uparrow$. R will continue to increase until we are back in equilibrium in the money market. R will go back to equilibrium interest rate R^0.

Equation 2 is the uncovered interest parity (UIP). It states that domestic interest rate should equal foreign interest rate plus expected depreciation of domestic currency from its level now. The intuition of the last part is that a domestic investor invests in euros. The person will exchange its domestic currency for euros and invests in euro deposits. When he reverts to domestic currency, the currency might have depreciated. Weakened against foreign. This means that he gets more domestic currency for one euro. The investor would have gotten return from the euro deposit interest rate and the depreciation of its domestic currency.

The left side of the equation is the domestic interest rate. The rate of return of domestic is equal to the interest rate you get on investing in domestic. $RR = R$. In our model, we will have exchange rate on the y-axis. So, rate of return on domestic won't get affected by exchange rate and therefore will be a vertical line in our figure.

The right side is the rate of return on foreign. $RR^* = R^* + \frac{E^e - E}{E}$. The intuition for this is mentioned earlier. To find the slope of the rate of return of foreign we derivate with the exchange rate.

$$\frac{\partial RR^*}{\partial E} = -\frac{E^e}{E^2} < 0$$

This means it is a falling curve.

$$\frac{\partial^2 RR^*}{\partial E^2} = \frac{2E^e}{E^3} > 0$$

This means it is a falling convex curve.

The equilibrium is when the uncovered interest parity holds. If we solve for the exchange rate, we find the exchange rate that makes the uncovered interest parity hold.

$$R = R^* + \frac{E^e - E}{E}$$

$$E = \frac{E^e}{1 + R - R^*}$$

where

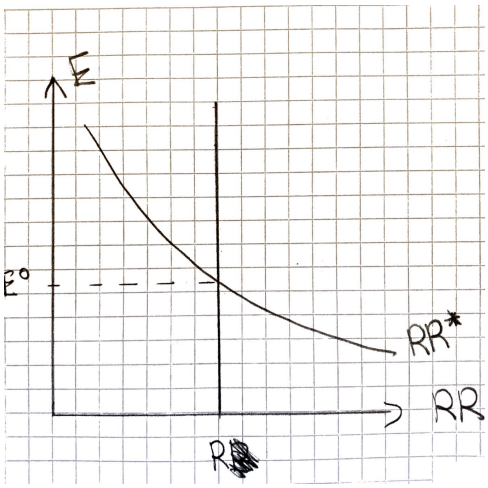
$$\frac{\partial E}{\partial R^*} = \frac{E^e}{(1 + R^* - R)^2} > 0$$

An increase in foreign interest rate leads to a depreciation of domestic currency.

$$\frac{\partial E}{\partial R} = -\frac{E^e}{(1 + R^* - R)^2} < 0$$

An increase in domestic interest rate leads to a appreciation of domestic currency.

Now we have found the equilibrium exchange rate. Let's show the equilibria graphically.



What happens if the exchange rate isn't at the equilibrium, E^0 but at a lower or higher level?

$$E < E^0$$

If the exchange rate is lower than the equilibrium, the rate of return of foreign is higher than domestic. UIP doesn't hold. Investors will use this opportunity to invest in foreign. This creates a lesser demand for domestic, making it weakened against foreign. Foreign investors won't give exchange at the given level. They want a better price. Domestic investors need to give a better price to exchange. This makes the domestic currency depreciate. This happens until the exchange rate has depreciated enough so UIP holds. The opposite will happen if exchange rate is higher than the equilibrium. Domestic rate of return is higher than foreign, so domestic currency will appreciate.

We can combine these two markets to see how a change in one market changes the other market. We will turn the money market 90 degrees to the right. The equilibrium between these two markets can be show as.

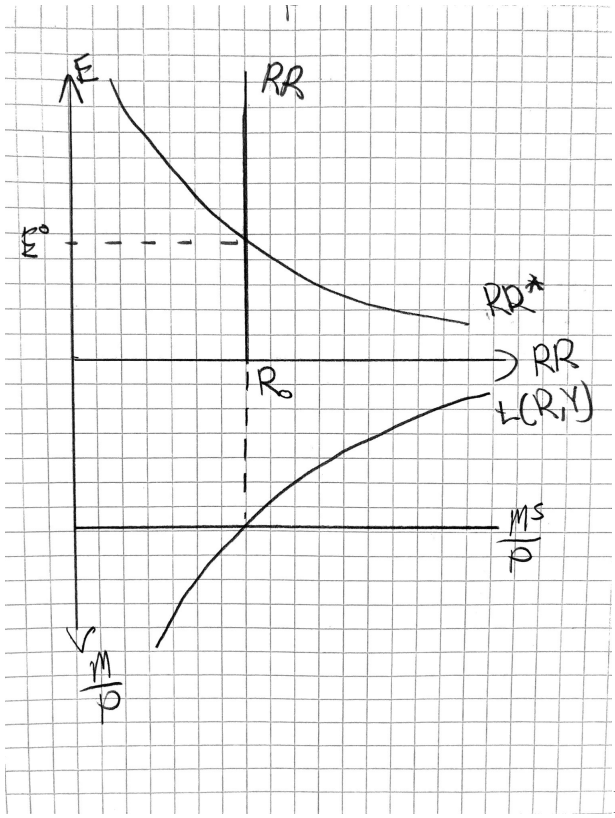


Figure 2

b)

For this task, I will use equation 2.

We use the different functions from previous task:

$$RR_{€} = R_{€} + \frac{E^{e}_{\$€} - E_{\$€}}{E_{\$€}}$$

Rate of return investing euros.

$$RR_{\$} = R_{\$}$$

Rate of return investing in dollars

I plot in the numbers to find the real rate of return for the deposits. Let´s start with dollar deposits.

$$RR_{\$} = R_{\$} = 2\% = 0.02$$

Buying a dollar deposit will give me 2% return in dollars.

$$RR_{€} = 0.02 + \frac{1.115 - 1.13}{1.13}$$

$$RR_{€} = 0.02 - 0.0132$$

$$RR_{€} = 0.0068 = 0.68\%$$

$$RR_{\$} > RR_{€}$$

The rate of return on dollars are 2% while in euros the rate of return is 0.68%. I should invest in dollars since my return is higher. In a year the dollars appreciate, which lowers my rate of return from investing in euros.

c)

- Relationship between money supply and inflation

  Money market equilibrium: $\frac{M^s}{P} = L(R, Y)$

  $$P = \frac{M^s}{L(R, Y)}$$

  In growth terms this can be written as:

  $$\frac{\Delta P}{P} = \frac{\Delta M^s}{M^s} - \frac{\Delta L}{L}$$

  $$The\ right\ side\ is\ the\ money\ demand\ growth$$

  Further we assume that R and Y are in their long run levels, which means that $\frac{\Delta L}{L} = 0$.

  This means the inflation growth rate is equal money supply growth.

  $$\frac{\Delta P}{P} = \frac{\Delta M^s}{M^s}$$

  If the money supply increases the inflation should increase the same amount. Over the long run, the real money supply should stay constant.

- Purchasing power parity, PPP holds

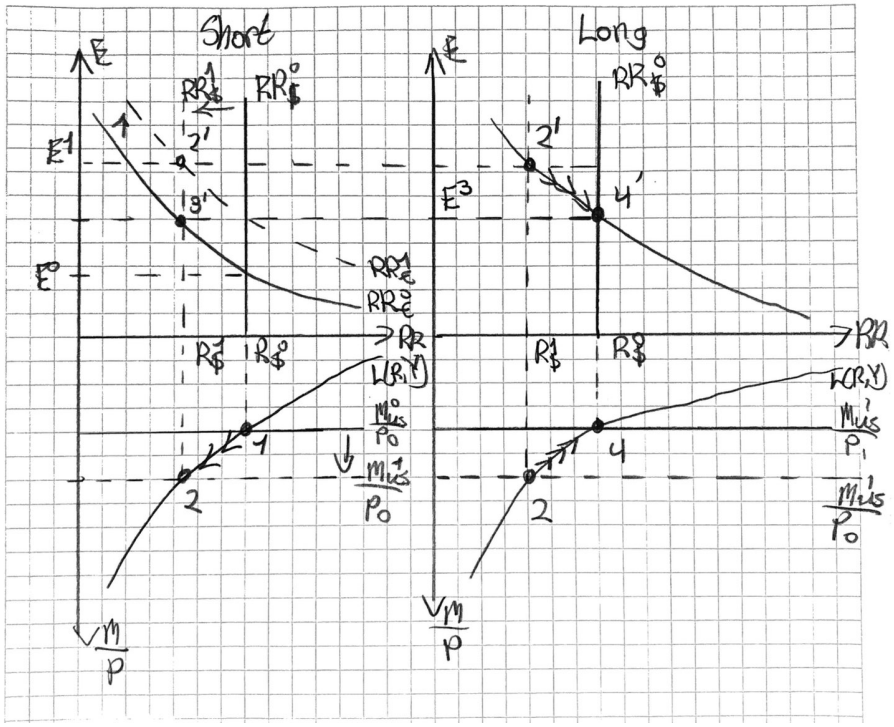
  Changes in a country's price levels should move the exchange rate between countries currencies.

  The equation for PPP is:

$$E_{\frac{\$}{€}}^{PPP} = \frac{P_{US}}{P_E}$$

This states that two equal consumers with two different currencies should have the same purchasing power. The consumers should be able to buy the same basket of commodities with the currencies. A higher price level in the US should result in higher expected exchange rate of dollars.

Before we start, I assume that domestic currency equal dollar and the foreign equal euros.



Money supply increases, from $M_{US}^{0}\ to\ M_{US}^{1}$

The money supply increases. There will now be more supply of money than it is demand for money. Excess supply of money.

$$\frac{M_{US}^{1}}{P^{0}} > \frac{M_{US}^{0}}{P^{0}}$$

Interest rate

Excess supply of money results in investors moving from money to bonds. The demand for bonds rises the price of it, but reduces its return. This is because of the inverse relationship.

Lower returns on bonds affects the interest rate. The interest rate gets reduced until it reestablishes the equilibrium in the money market, in point 2. The money demand equal the new money supply. Since the interest rate is lower in the US, the rate of return of dollar is now lower. Remember that the rate of return of dollar equal the interest rate in the US. Therefore $RR_{\$}^{0}$ shifts to $RR_{\$}^{1}$. In the forex equilibrium is in point 3'.

$$R_{\$}^{1} < R_{\$}^{0} \; and \; RR_{\$}^{1} < RR_{\$}^{0}$$

Increase in the rate of return of euros

We are looking at the long-run effect, so the PPP must hold. Prices in the US are expected to rise, since the money supply has been increased permanently. An expected increase in price level will result in that the market expects a depreciation of the dollar. A higher expected exchange rate, $E_{\$/€}^{e}$ shifts the $RR_{€}^{0} \; to \; RR_{€}^{1}$. The dollar depreciates to E^{1} where the new short run equilibrium is established.

$$RR_{€}^{0} < \; RR_{€}^{1}$$

The short-run equilibrium after increase in the money supply is in point 2 and 2' with money supply $\frac{M_{US}^{1}}{P_0}$, exchange rate E^{1} and interest rate $R_{\$}^{1}$.

Long term real money supply is reestablished.

Since the money supply has increased, prices will gradually increase. This is because inflation growth should equal money supply growth as mentioned in the beginning. The real money supply will shift back to its initial position, point 4.

$$\frac{M_{US}^{0}}{P_{US}^{0}} = \frac{M_{US}^{1}}{P_{US}^{1}}$$

Long term interest rate is back to initial position.

The real money supply moves back to its initial position, so the interest rate follows as well. Interest rate goes from $R_{\$}^{1} \; to \; R_{\$}^{0}$.

Exchange rate is not reestablished

The interest rate of dollar goes back to its initial position. This makes rate of return of dollar relatively higher than rate of return of euros given the new exchange rate, E^{1}. European investors will want to invest in dollars. This creates pressure on the dollar (demand for dollar), which appreciates the dollar against the euro. The dollar appreciates to where it

establishes the long run equilibrium in the foreign exchange market which is in point 4'. Note that the long run exchange rate E^3 is higher than the initial exchange rate. The difference is because that the expected deprecation of dollar has been increased. This phenomenon is called exchange rate overshooting.

Both money supply and price level increase permanently, but they it proportionally to each other, which means the real money supply is the same. Return of dollar goes down, but gets reinstated back to its initial positon by price changes. Exchange rate depreciates in the beginning, but over time it will appreciate, but to a higher level than its initial exchange rate. Meaning the exchange rate has been overshoot. This is because price changes are slower than the money supply and the expected depreciation of the dollar and therefore we differ a short-run and a long-run effect of a permanent increase in the money supply from each other.

d)

When the exchange rate is fixes then E is constant. From previous task we had:

$$R = R^* + \frac{E^e - E}{E}$$

Assume that the fixed exchange rae is credible. This means that the expected exchange rate equal the exchange rate. We will then get:

$$R = R^*$$

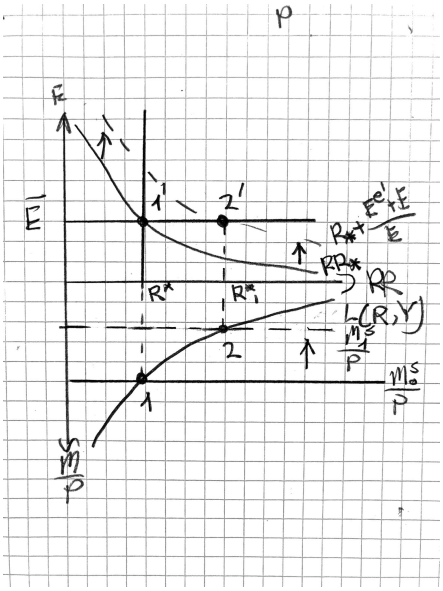
Domestic interest rate equal foreign interest rate. Under a fixed exchange rate regime, it gives up its monetary policy.

Let's look at a situation where there is expansionary monetary policy. This will result excess supply for money, which will lead to lower interest rate. A lower interest rate shifts the rate of return of domestic currency. This will lead to pressure for depreciation of domestic currency. The central can't allow it. To defend their currency, they must sell foreign assets. Selling will increase the relative demand for its own currency, since selling foreign assets decreased the money supply. Even though they do a expansionary monetary policy they have to counteract with an equally large contractionary monetary policy.

Let's look at fiscal policy.

If the government increase spending it will give a boost in the economy by increasing output. Increased output will increase transactions. Higher transactions equal higher demand for money. Excess demand for money will result in people selling bonds. Lower demand for bonds gives a higher return on them. Interest rate increases so domestic currency gets relative more attractive to invest in resulting in a pressure for appreciation of currency. The central bank can't allow this. To defend its currency, they must increase their money supply. They do this by buying foreign assets. Higher money supply will decrease the relative demand for domestic currency. We see that fiscal policy under fixed regime is more effective than with monetary policy.

How can a country defend the fixed exchange rate in a situation with strong expectations of devaluation?



The central bank doesn't want to devaluate its currency, but to keep its fixed currency. To defend its currency with an interest rate of $R_* + \frac{E^1-E}{E}$, the central bank must decrease its money supply ($from\ M_1^s\ to\ M_2^s$). To reduce its money supply, the country have to sell foreign assets and buy domestic bonds. Reduced money supply raises the interest rate to R_1^*, which is the equilibrium in the foreign exchange market. The new equilibrium with the initial exchange rate is at point (2,2'). The problem here is that the country might not have enough foreign assets to sell. If they run out, they might have to devaluate and therefore give up its fixed exchange rate.

e)

The AA-curve shows all combinations of output and the exchange rate where the domestic money market and the foreign exchange market is in equilibrium.

The money market is in equilibrium when money demand equal money supply.

$$M^s = M^d$$

$$M^s = P^*L(R,Y)$$

$$\frac{M^s}{P} = L(R,Y)$$

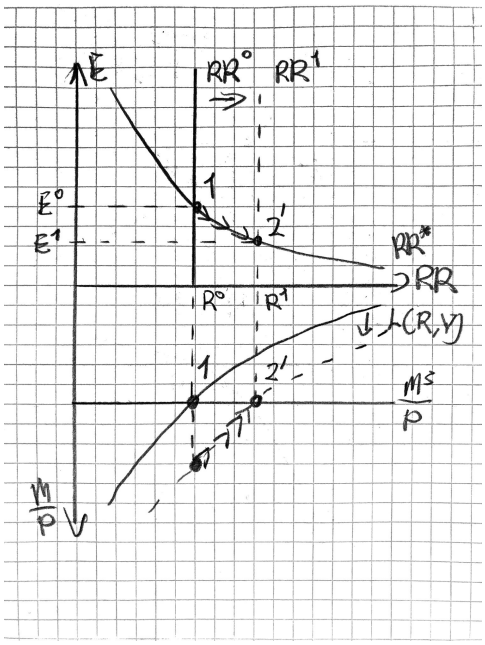
Real money supply equal the demand for money for a given level of Y.

The foreign exchange market is in equilibrium when the rate of return of domestic currency equal the rate of return of foreign currency in domestic currency.

$$RR = RR_*$$

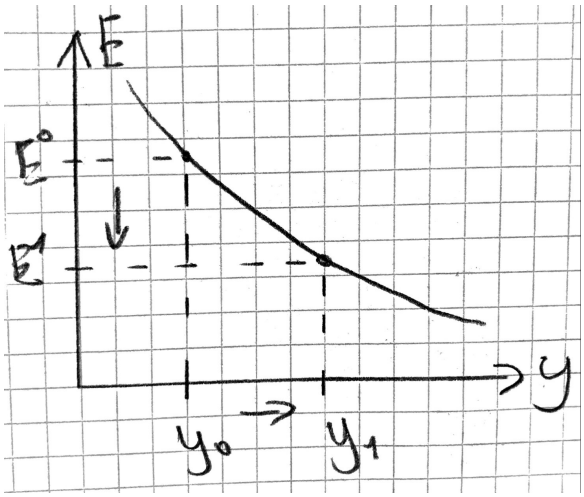
$$R = R_* + \frac{E^e\text{-}E}{E}$$

To find out how the AA-curve looks like, we can analyze how an increase in production affects the foreign and money market.



An increase in the production, $Y \uparrow$ shifts the money demand curve downwards. There is now more demand for money, $M^d \uparrow$. People will sell bonds. Less demand for bonds decreases its price which in return increases its return. This increases the domestic interest rate $R \uparrow$ because of higher return on bonds. $RR_\$$ shifts to the right. The exchange rate appreciates, $E \downarrow$, since dollars becomes relatively more attractive. You get a better return on dollars than euros. This causes higher demand for dollar, which makes the dollar appreciate. It appreciates until the exchange rate makes UIP hold. New equilibrium is with increased interest rate $R \uparrow$ and appreciated exchange rate $E \downarrow$.

From this we see a negative relationship of production and exchange rate. This gives us the AA-curve, a downward sloping curve.



AA-curve analytically

To find the slope of the AA-curve analytically, first we take the equation for money market equilibrium and differentiate it with respect to R an Y.

$$\frac{M^s}{P} = L(R, Y)$$

$$0 = L_R * \partial R + L_Y * \partial Y$$

$$\partial R = -\frac{L_Y}{L_R}\partial Y, \textit{higher production leads to higher interest rate}$$

where

$$L_R = \frac{\partial L}{\partial R} < 0$$

Higher interest rate reduces the demand for money.

$$and\ L_Y = \frac{\partial L}{\partial Y} > 0$$

Higher production leads to more transactions which leads to more demand for money to do these extra transactions.

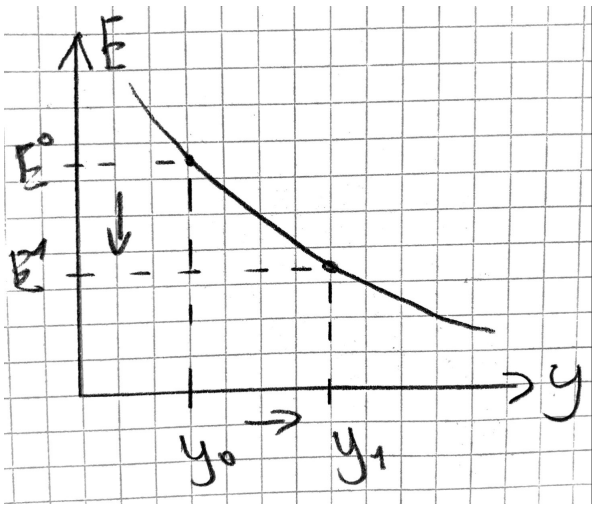
Now, we take the equation for exchange market equilibrium and differentiate it with respect to R and E. The result we get is

$$\partial R = -\frac{E^e}{E^2} * \partial E$$

Combining the two equations we find how an increase in production affects the exchange market and therefore gives the slope of the AA-curve:

$$\frac{\partial E}{\partial Y} = -\frac{L_Y}{L_R} * \frac{E^2}{E^e} < 0$$

A higher production leads to a depreciation of domestic currency. We can draw the AA-curve as such.



Higher production will lead to higher demand for money, which gives higher interest rate in the money and foreign exchange market. Dollars becomes more attractive. This results in an appreciation of domestic currency.

What causes the AA-curve to shift?

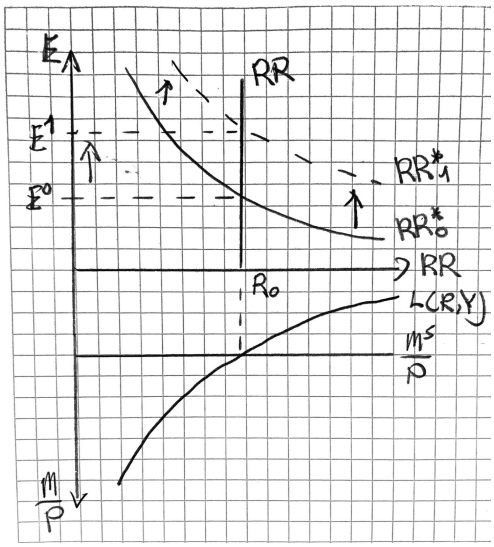
These are the factors that shift the AA-curve upwards:

- $M^s \uparrow$, Higher money supply shifts the real money supply downwards in the money market. Leads to lower interest rate and ultimately to a depreciation of domestic currency. Since production is the same, but the domestic currency has depreciated. To reflex this, the AA-curve shifts upwards.
- $P \downarrow$, Lower price level in the domestic country increases the real money supply. This results in the as increasing the nominal money supply.
- $R^* \uparrow$, Higher foreign interest rate shifts the rate of return of foreign currency outwards in the foreign exchange market. UIP doesn't hold, since there is difference in interest rate. This is an arbitrage opportunity. This leads to a depreciation of domestic currency, since investors wants to invest in foreign rather than in domestic currency. Production is the same, but exchange rate has moved. AA-curve shifts upwards.
- $E^e \uparrow$, Higher expected depreciation rate gives the same result as higher interest rate.

If these factors go in the opposite direction this will lead to the opposite result as mentioned.

f)

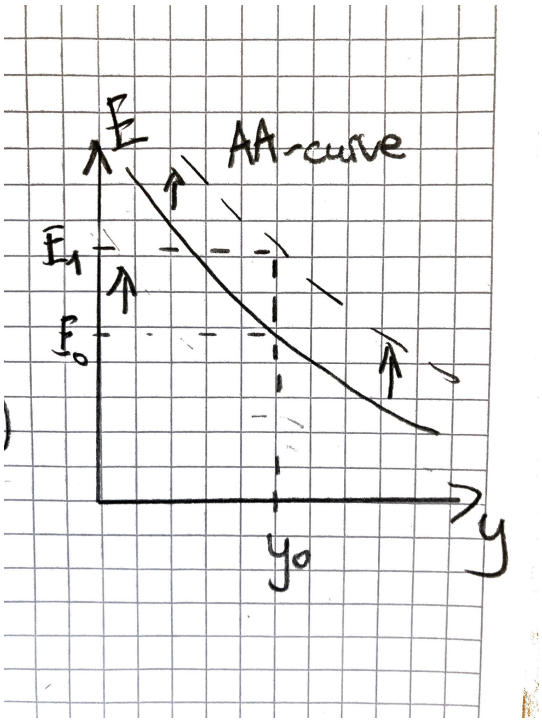
$E^e \uparrow$: Higher expected depreciation rate gives the same result as higher interest rate. We can illustrate the effect of an increase in the expected rate graphically in the foreign exchange market and money market. And then show how this affects the AA-curve.



A higher expected exchange rate shifts the rate of return of foreign currency from $RR_0^* \; to \; RR_1^*$. We can show this by:

$$\frac{\partial E}{\partial E^e} = \frac{1}{1 + R - R^*} > 0$$

At the given level of exchange rate, UIP doesn't hold, since there is a difference in interest rate. The rate of return on foreign is higher than domestic. This is an arbitrage opportunity for investors. Investors will want to invest in foreign rather than in domestic. Domestic investors will want to exchange to foreign. To be able to exchange they will have to give more domestic currency for a unit of foreign currency, since the counterpart wont exchange at the given level. Domestic currency will depreciate until the UIP holds. From the figure, we see that production is the same, but the currency has depreciated. To reflex this new equilibrium with the same interest rate and production but depreciated currency, the AA-curve shifts. It will shift upwards since currency has depreciated.



Question 2

a)

A monetary union is a union consisting of different countries were two of the countries at least must have the same currency. The countries in the union share the same central bank.

Take for example the Euro zone which have the ECB (European Central bank). By having a common central bank among themselves, the union have the same monetary policy. A single country can't make monetary policies for their own good, since the amount of national money is determined by the common central bank. This means that short-term interest rate can't be changed either. By being in a monetary union the countries will eliminate volatility in exchange rates and there will be better trade between the countries.

b)

A monetary union is when a group of countries, at least two countries have the same currency. The countries will have a common central bank that controls the monetary policy. A single country gives up its independent monetary policy. A fixed exchange rate regime is when a country will have their own currency, but it is pegged against another currency. The country will have an independent monetary policy, but must have control over capital. A country with this type of regime might be threatened by devaluation expectations as seen from task 1d. A floating exchange rate regime is a regime with its own currency and monetary policy. It allows its currency to float depending on the supply and demand on its currency. Higher demand will give an appreciation, while lower demand will give a depreciation. The central bank sets the amount of foreign assets.

c)

Economic advantage for countries in a monetary union is if the countries are well integrated with other countries in the monetary union. Then there will be more benefit to be in a union. Joining the monetary union can give lower transaction costs, since there might not be toll on imported goods. A monetary union opens for better trade. Sharing the same currency will reduce price volatility of foreign goods. There might be better mobility of labor between the countries in the union. People can move from one country to another to find work much easier, than if it wasn't in a monetary union.

Lets look at the Barro-Gordon model to see how a country like Italy might have an advantage joining a monetary union.

Expectations-augmented Phillips curve

$$U = U_N + a(\dot{p}^e - \dot{p})$$

This is the function for unemployment. Unemployment rate equals the natural rate of employment plus the difference between expected inflation and inflation.
We can rewrite the function to see how unemployment and expected inflation changes inflation.

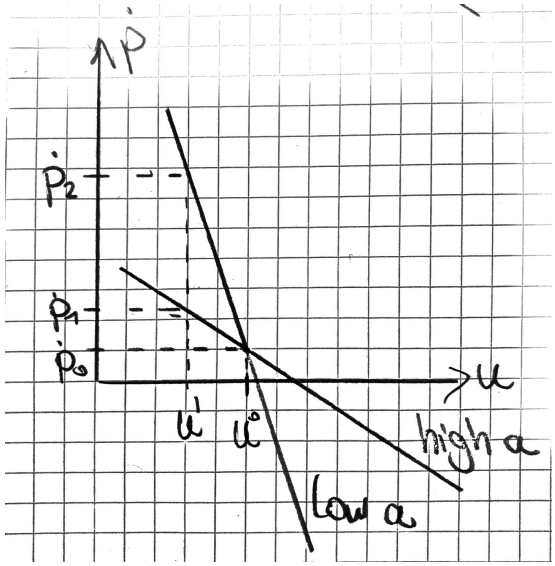
$$\dot{p} = \dot{p}^e - \frac{1}{a}(U - U_N)$$

U- Unemployment rate
U_N- The natural rate of employment. This is what the unemployment should be in the long run.
$\dot{p}$- Inflation
$\dot{p}^e$- Expected inflation
a- Parameter of how much the unemployment rate gets affected to a difference in expected inflation to inflation.

We can draw the Philips-curve in diagram with unemployment rate on the x-axis and inflation on the y-axis. To find the slope of the curve derivate inflation with unemployment.

$$\frac{\partial \dot{p}}{\partial U} = -\frac{1}{a} < 0$$

A higher a gives a flatter curve, while a low a gives a steeper curve. The intuition is that a high a is when the labor market is more rigid. A high unemployment rate doesn't give a big increase in inflation. A smaller a is when the labor market is flexible. A small change in unemployment gives a large increase in inflation.

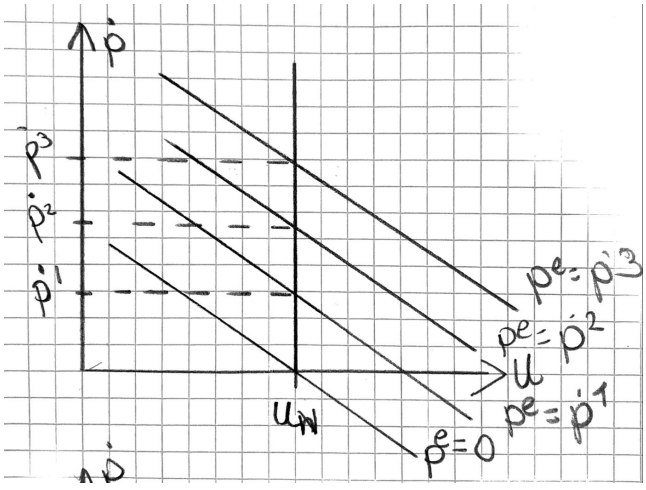


The trade-off between inflation and unemployment is that when the unemployment decreases this will create pressure on wage claims. When people have more money, the demand for goods raises will increases prices. Also, business/companies offset higher wages claims from lower unemployment by raising prices. Higher prices will result in higher inflation.

From the Philips-curve, we see that when unemployment equal the natural rate of unemployment then inflation equal expected inflation under rational expectations.

$$U = U_N \Rightarrow \dot{p} = \dot{p}^e$$

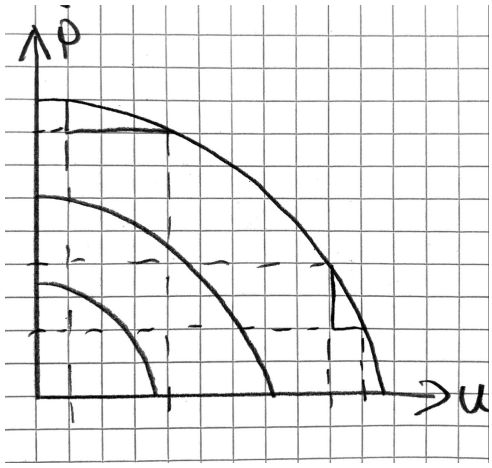
This gives us the long-term Phillips curve. U_N can be called the Nairu, Non-accelerating inflation rate of unemployment. From this a change in expected inflation will shift the Phillips-curve. Where the long-term Phillips curve crosses the Phillips curve, $\dot{p}^e = \dot{p}$.



We assume that the government has a function for their preference between unemployment rate and inflation. The welfare function of the government is given as:

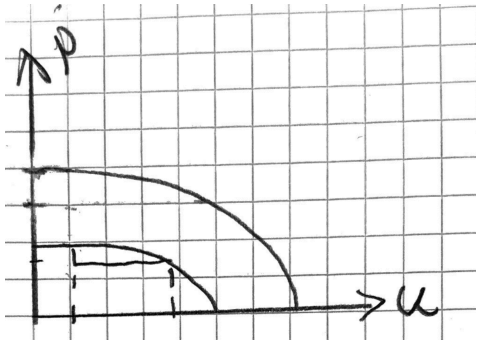
$$V = V(U, \dot{p})$$

This creates indifference curves for the government. The government wants to minimize their welfare loss. The government wants to be on a indifference curve that is closes to the origin. The closer to the origin, the lower will the loss in welfare. Further, the indifference curves are concave. What this means is that when inflation is already low the government is less willing to increase unemployment for lower inflation.

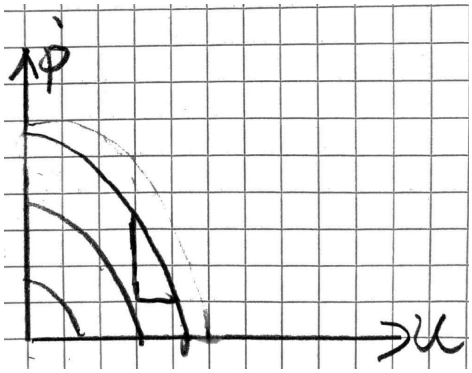


There might be differences in the slope of the indifference curves. Countries has difference preferences of inflation and unemployment rate. This can be showed in the slope of countries relative importance of these two factors.

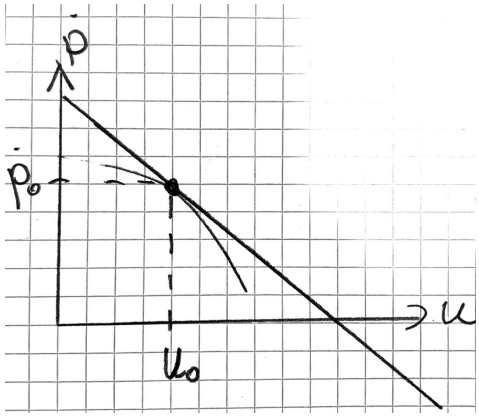
A 'hard-nosed government' is a government that cares more about inflation than unemployment rate. The government will reduce inflation by a percentage point by letting the unemployment rate increase.



A 'wet' government is the opposite of a hard-nosed government. They care relatively more about unemployment rate than inflation. They will let inflation increase a lot to reduce unemployment rate by a percentage point.

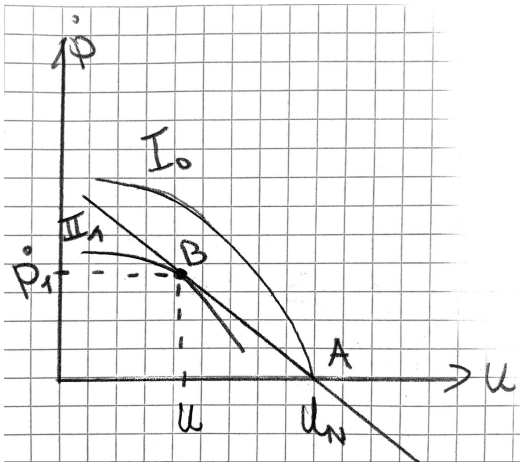


Model equilibrium:

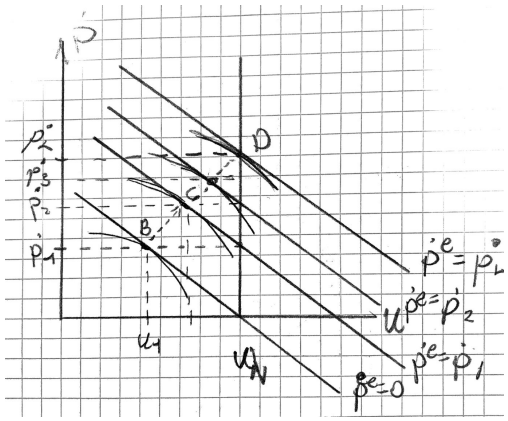


Given the Philips-curve, the lowest indifference curve of preference gives the government the short-run equilibrium. The government has found their preference, and will act accordingly. They will set the interest rate which affect inflation to $\dot{p}_0$. The inflation gives the government U_0 in unemployment rate.

Let's look at a situation where authorities announce that $p^* = 0$. This means central banks inflation target equal 0. Further, we assume that the monetary policy is credible, which means expected inflation equal 0 and that unemployment equal the natural rate of unemployment.



From the figure, we are in point A, with $\dot{p} = \dot{p}^e = 0$ and $U = U_N$ on indifference curve I_0. This is if the government does what they have said they would do. But point B is on a lower indifference curve while on the same Philips-curve making this point preferable than point A. This creates an incentive for the government by creating surprise inflation. The government can act on minimizing their welfare loss function by lowering interest rate. This will be led to inflation going to $\dot{p} = \dot{p}_1$. The short-run equilibrium is in point B. But over time expected inflation is adjusted upwards, since inflation is higher than expected. Expectations about expected inflation change to $\dot{p}^e = \dot{p}_1$. This shifts the Philips-curve upwards. The government will create a new inflation surprise to be on a lower indifference curve. The Philips-curve will keep on shifting upwards since the optimal point for the authorities' changes. Eventually we will be ending up in point E, which is the long-run equilibrium. In this point, inflation equal expected inflation which equal long-run equilibrium and unemployment rate equal the natural rate. Now the government has no incentive to create surprise inflation. If they did, they would be on a higher indifference curve. Point B to point D is something called stagflation, which high inflation within the economy.



Let's look at a situation when two countries are in a monetary union and not in a union.
Germany = 'hard-nosed' government and Italy = 'wet'

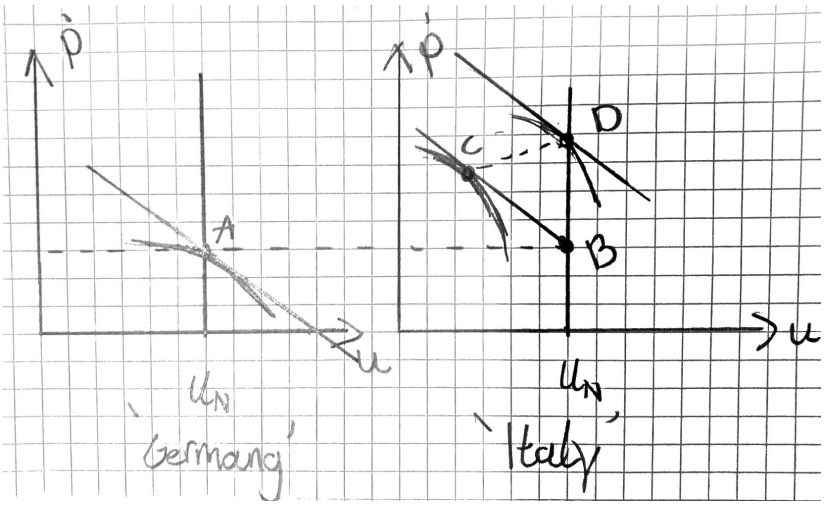
First look at Germany and Italy not in a monetary union. What will happen if inflation in Italy is higher than in Germany?

$$\dot{p}_I > \dot{p}_G$$

Following purchasing power parity, which says that the lira/mark exchange rate equals the ratio of price levels in Italy and Germany:

$$PPP: E^{PPP}_{lira/mark} = \frac{P_{italy}}{P_{germany}}$$

If PPP holds, then the price level in the two countries are equal, when measured in the same currency.
So, if Italy has a higher inflation, which means higher price level, then the lira will depreciate against the mark.



But what if Italy fixes its currency against the German mark or joining a monetary union? Italy would be in point B, but this isn't credible. Italy is better off if it devaluates its currency. This makes Italy's economy go to point C. It is now on a better indifference curve but has a higher inflation. Expectations of inflation will change over time. Italy will end up in point D, when expected inflation equal inflation which equal long-run inflation.

A solution to this problem is Italy joining a monetary union with the same currency as Germany. Then Italy won't be able to create surprise inflation by devaluation its currency against the mark. Italy would give up its monetary policy, so point B is now credible. By joining a monetary union Italy uses Germany´s credibility to be able to reduce its long-run inflation. This benefits Italy, but doesn't for Germany.

Let's explain the model to show how asymmetric demand shocks in a monetary union might be a challenge in a monetary union.

Notation:

$$Y\text{-}output$$

$$D\text{-}Aggregate\ demand$$

$$M\text{-}Nomial\ money\ amount$$

$$P\text{-}Domestic\ price\ level$$

$$G\text{-}Government\ spending$$

$$T\text{-}Taxes$$

$$E\text{-}Exchange\ rate$$

$$P^{*}\text{-}Foreign\ price\ level$$

$$\alpha\text{-}Demand\ shock\ parameter$$

Aggregate demand equal aggregate output.

$$Y = D$$

Aggregate demand curve is given as a function of these factors and have these properties on aggregate output.

$$Y = F\left(\frac{M}{P}, G, T, \frac{EP^{*}}{P}, \alpha\right)$$

$$\frac{\partial Y}{\frac{\partial M}{P}} > 0, \frac{\partial Y}{\partial G} > 0, \frac{\partial Y}{\partial T} < 0, \frac{\partial Y}{\frac{\partial EP^{*}}{P}} > 0, \frac{\partial Y}{\partial \alpha} > 0$$

Note that:

$$\frac{\partial Y}{\partial P} < 0$$

Higher domestic price level gives lower output level. This is because higher price level lowers real money holdings and net exports is lower.

Lower real money holdings give higher interest rate. This can be shown if we were to draw the foreign and money market and change domestic price level. A higher interest rate lowers investments. The result of this is lower output.

Foreign goods become relatively cheaper than domestic goods. Demand for domestic goods becomes lower which gives lower the current account. A weakened current account lowers output level.

Drawing the demand curve in a Y,P diagram gives us a falling curve as we have mentioned above.

What will shift the demand curve?

$$\frac{\partial Y}{\frac{\partial M}{P}} > 0, \frac{\partial Y}{\partial G} > 0, \frac{\partial Y}{\partial T} > 0, \frac{\partial Y}{\frac{\partial EP^*}{P}} > 0, \frac{\partial Y}{\partial \alpha} > 0$$

Looking at the properties of the factors that affect the output, we see the following changes gives positive shift (shift to the right) in the demand curve for a given level of P.

$$M \uparrow, G \uparrow, T \downarrow, E \uparrow, P^* \uparrow, \alpha \uparrow$$

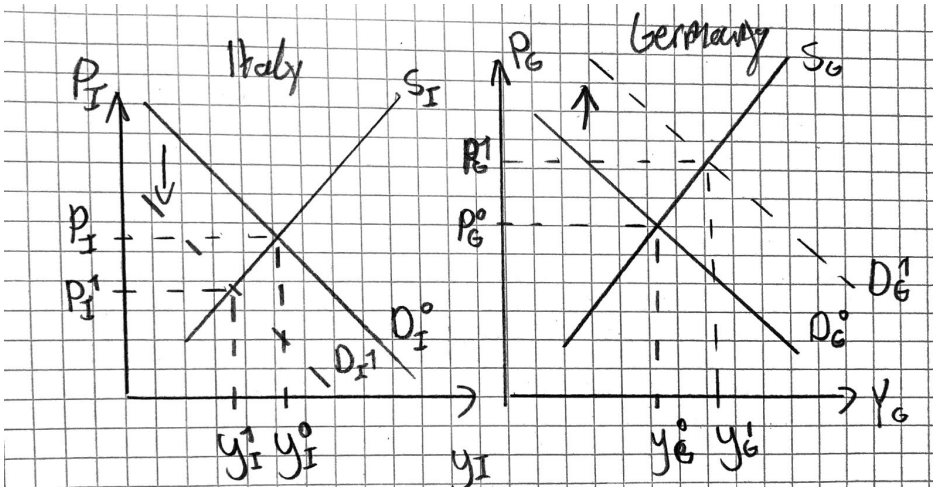
Supply curve

Aggregate supply is equal to aggregate output. The supply curve is given as a function of these factors:

$$Y = G(\frac{W}{P}, \beta)$$

$$\frac{\partial Y}{\partial W} < 0, \frac{\partial Y}{\partial P} > 0, \frac{\partial Y}{\partial \beta} > 0$$

Lets assume Italy and German experience asymmetric shock.



A negative shock for Italy will lead to a contraction in output, while Germany will get an expansion.

Italy can use expansionary fiscal policy to counteract the negative demand shock. Germany on the other hand will have to use a contractionary fiscal policy to counteract the positive the positive demand shock. A monetary policy won't work since Germany and Italy share the same monetary policy. If Italy weren't in a monetary union it could increase its money supply resulting in lower interest rate. Then the demand curve would shift back to its initial position. Germany would want to decrease its money supply, so the interest rate increases.

Rather than doing fiscal policy, the countries can rely on automatic adjustments.

Wage flexibility will bring the countries back to output equilibrium. For Italy the negative demand shock, lowers output, therefore increasing unemployment in the country. Lower employment makes Italian workers have power over wages. Wages claims will decline resulting in a positive shift in the supply curve. Italy will be back in its initial output equilibrium, but Italian works must see their real income decline.

For Germany, higher output give create pressure in the labour market. Now workers have more power over wages. Wages raises, which creates a negative shift in the supply. Germany will be back in equilibrium, but experience higher wages and prices.

Mobility of labour is another automatic adjustment the two countries can rely on. Unemployed workers in Italy can move to Germany. This lowers the labour pressure in

Germany, while there will be less competition for jobs in Italy. The equilibrium in the countries will be y_I^1 and y_G^1. Wage adjustments won't be needed since works will move from one country to another.

In theory, these automatic adjustments might work, but realistic they might not. If some countries in the union isn't well integrated with the rest then moving from one country to another isn't easy for people, both physically and psychically. You might have to get used to a new culture and learn a new language.

From this model, if two countries were to experience asymmetric shocks fiscal might be the best solution to counteract the shocks.

Overall, we conclude that there are advantages and challenges for an economy in a monetary union.