

The BB-NN Model

1. Real Exchange Rate Determination – Introduction

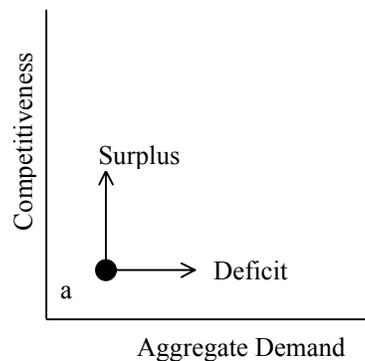
This model allows us to determine the real exchange rate for an economy. What is the real exchange rate? What is the nominal exchange rate? What are the differences and the similarities? The nominal exchange rate refers to the price at which two currencies are exchanged (1800 Italian Liras for 1 US dollar). On the other hand, the real exchange rate refers to the relative costs of similar goods in two different countries. In general, we are interested in the relative wages, since we almost always assume that capital has a high international mobility (e.g., we are assuming that capital is rewarded at the same risk-adjusted rate in all countries.) This simplifying assumption allows us to focus the model on the labor market. However, there are generalizations that include external capital, and the conclusions are practically the same.

The equilibrium real exchange rate is defined as the rate that results in equilibrium both in the labor market and in the balance of payments. It is important to understand that the real exchange rate refers to a certain extent to the degree of competitiveness of the economy. Therefore, it is a relative rather than a nominal price.

2. The Model

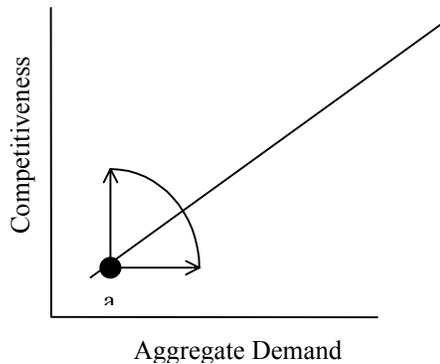
The BBNN will allow us to determine the real exchange rate by considering the equilibrium conditions in the balance of payments and in the labor market.

Let's suppose that we want to draw (in a graph) a curve that represents the equilibrium in the balance of payments (external equilibrium). On the "x" axis we plot the country's aggregate demand and on the "y" axis we plot a measure of competitiveness.



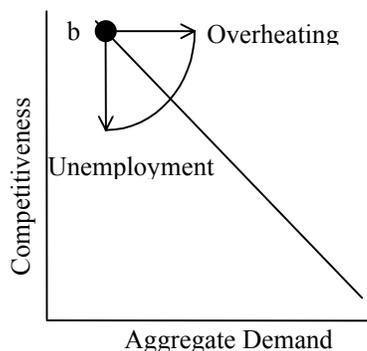
Let's suppose that point "a" is a point of equilibrium in the balance of payments. If at this point we increase competitiveness, keeping the same aggregate demand, we will obtain a surplus in the balance of payments. The external sector is more competitive and therefore exports increase. Moreover, import prices go up and demand falls, improving even more the external accounts. If at point "a" we increase aggregate demand, keeping the same level of competitiveness, we will consequently raise imports (consumption of imported goods) and reduce exports (more domestic goods are consumed and therefore less are available for export). This generates a deficit in the balance of payments.

Going up (north) we have a situation of surplus, while to the right (east) we have a situation of deficit. If we move between the point of surplus and the point of deficit, we must cross the zero (equilibrium in the balance of payments). In other words, the curve representing the equilibrium in the balance of payments has a positive slope.

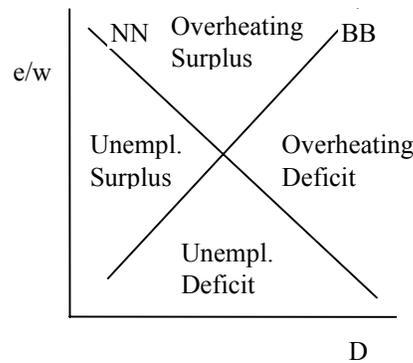


In the same way, we can derive a curve describing the equilibrium in the labor market. First, let's remember that equilibrium in the labor market means that the level of unemployment is such that there are no pressures to change wages. This rate of unemployment is known as the natural rate of unemployment. We say that we are in a situation of unemployment when there are pressures to reduce wages. Conversely, overheating means that there are pressures to raise wages.

Let's suppose that at point "b" there is equilibrium in the labor market. If we lower competitiveness keeping the same aggregate demand, some firms that used to export will go bankrupt, resulting in unemployment. On the other hand, if we keep the same level of competitiveness (and therefore of production) and increase aggregate demand, demand for domestic goods increases and therefore there are pressures in the labor market to hire more workers. Unemployment is reduced below the "natural rate of unemployment", causing overheating.



Going down (south) we have a situation of unemployment, while to the right (east) we have a situation of overheating. If we move between the point of unemployment and the point of overheating, we must encounter a point of equilibrium in the labor market. This means that the equilibrium curve is downward sloping. With the two curves, we can determine what is the real exchange rate consistent with equilibrium in the balance of payments (external equilibrium) and equilibrium in the labor market. We will call the labor market equilibrium curve "NN", and the external market equilibrium curve "BB".



These curves define the equilibrium and four regions. Economies can have unemployment or overheating in the labor market, and deficit or surplus in the external accounts. Notice that this will allow us to determine (diagnose) where economies lie on this map. For example, Venezuela in 1997 has high unemployment and a small surplus in the external accounts. This means that the economy is located below the NN and just above the BB curve.

2.1. Real exchange rate

We say that the real exchange rate is appreciated when the economy is located below the equilibrium exchange rate (i.e. the economy is not competitive), while we say that the real exchange rate is depreciated when the economy is above the equilibrium (i.e. it is competitive).

These reasons denote the disequilibria that economies can suffer. It is important that we always use disequilibria to **diagnose** where economies stand. Once diagnosed, we can decide what to do.

We will denote the real exchange rate “e/w” as a measure of competitiveness, where “e” is the nominal exchange rate and “w” is the nominal wage. (When we say that this is a measure of competitiveness, we are supposing that the only production factor is labor. This is another simplification that does not change the results.) The idea is that the real exchange rate is the inverse of the wage in dollars. It is logical to suppose that a country that has a higher dollar wage is less competitive. Therefore the inverse of the dollar wage is a measure of competitiveness.

3. What To Do as a Finance Minister?

Now, let’s suppose that we don’t like where the economy is located (for instance there is too much unemployment, etc.) What can we do? There are two alternatives: do something or do nothing. Let’s see the first.

Movements in aggregate demand (“x” axis) can be obtained by means of expansionary fiscal or monetary policies. Movements in competitiveness can be obtained by changing wages or the nominal exchange rate.

Let’s suppose that wages are relatively rigid in the short run. The question then becomes whether there exists any fiscal, monetary or foreign exchange policy that we can follow to cure the disequilibria of an economy. The answer is yes. If we implement an expansionary fiscal or monetary policy, aggregate demand will increase, at least in the short run. On the contrary, a contractionary policy will reduce aggregate demand. This conclusion comes from the IS-LM model.

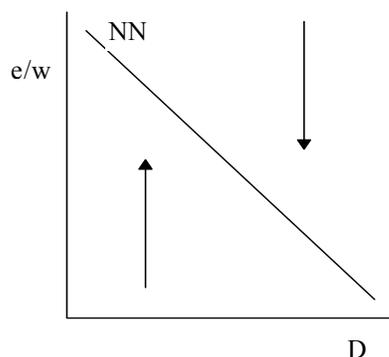
On the other hand, a nominal devaluation (“e” increases) translates into a real devaluation (“e/w” increases) if the wages are fixed. In other words, if an economy has unemployment and presents a deficit

in the balance of payments, the government must devalue the currency. If an economy is in a situation of unemployment and there is a surplus in the balance of payments, an expansionary fiscal policy is needed to return to equilibrium. We have two instruments: one allows us to move the economy horizontally from the right to the left, and the other allows us to move it vertically from the bottom to the top of the map.

Obviously, the world is much more complex than this description. Yet this basic model represents with good approximation what is happening to an economy. In the following pages, we will see that nominal devaluations are not necessarily effective in real terms and that controlling aggregate demand is not always easy. Nonetheless, the main aspects of an economy are summarized by the model variables.

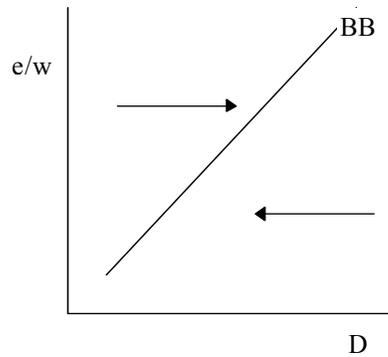
4. What Does the Economy Do by Itself? Dynamic Properties

Let's suppose that the government does not intervene. Is there any mechanism that leads the economy to equilibrium, or will it always stay in disequilibrium? The answer is an economy will autonomously move to equilibrium. Let's suppose that we have a fixed exchange rate system. If we are in a situation of unemployment, the wages tend to decrease. Therefore, we are experiencing a real depreciation (" e/w " increases.) On the contrary, if an economy is overheating, the wages tend to go up and, as a consequence, we obtain a real appreciation (" e/w " decreases.)

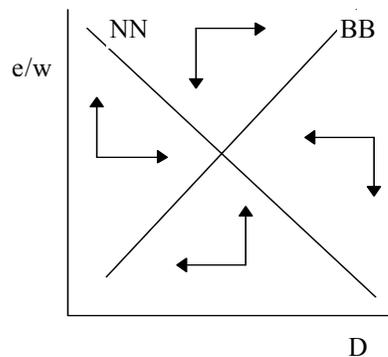


Notice that economic forces push the real exchange rate to the level corresponding to equilibrium in the labor market. In other words, the labor market has internal mechanisms that lead to the equilibrium.

On the other hand, if we have a deficit in the balance of payments, we will have a monetary mechanism (from the IS-LM) that will intervene on aggregate demand. When there is a deficit in the balance of payments, international reserves fall and therefore the monetary base falls. In the absence of fiscal policy changes, this is equivalent to a restrictive monetary policy. There is a monetary contraction, the interest rate increases and output and aggregate demand fall. (In other words, balance of payment deficits make the citizens of the country poorer, therefore consumption will decrease (and this will reduce aggregate demand).) The opposite happens when there is a surplus.



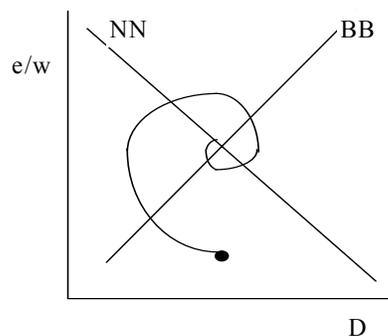
Putting the two dynamics together, we can see that the economy will approach equilibrium along a spiral path. An important question is how long it takes for an economy to trace the whole path. The answer is that normally it takes a long time (many years.)



In other words, if an economy has a problem of real exchange rate appreciation, with unemployment and balance of payments deficit, it will tend to go through a recession (more unemployment) for a long time. How can we fix this? With a devaluation!

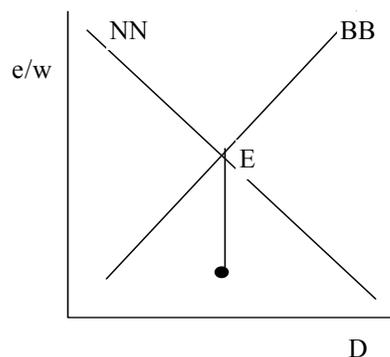
5. Devaluation

What happens when we have an appreciation and we devalue? If we don't devalue, the economy will approach equilibrium along a spiral path, according to the dynamics described above.



But if we devalue the economy will move directly from its initial point to the real exchange rate equilibrium. What shall we do? Obviously, the first alternative is longer, but does not require a devaluation, while the second path is shorter but requires a devaluation. As we will see later, there are

conditions under which nominal devaluations are not very effective, and therefore not so desirable. If that is the situation of a country, there is no solution other than following the longer path.



Analogously, if we have a problem of unemployment accompanied by surplus in the balance of payments, we can wait (and the economy will move along a spiral) or we can increase expenditures to increase aggregate demand (and in this way we move more rapidly towards the equilibrium.) You can do this graphically as an exercise.

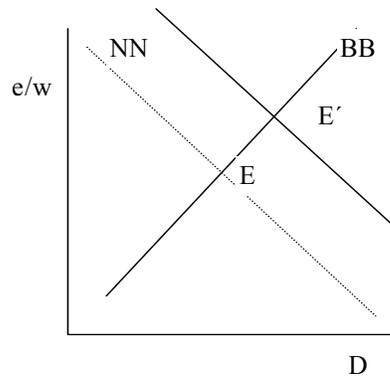
6. What Moves the Curves?

So far, we have seen what makes the **economy** move, but we always assumed in all these movements that the equilibrium is static (that the curves do not move). This is not always the case. In fact, the curves do change. For example, let's suppose that we are in a situation of equilibrium (point "E") and suddenly there is an epidemic and 50% of the workers die. The initial situation can not be an equilibrium any more. The labor market will be overheated, as there are many jobs available and few workers that can take them.

Another example is what happens if we are in equilibrium and there is a positive shock in an important export sector (for instance, if we are net exporters of oil, a positive shock would be a sudden positive jump in oil prices). Clearly the old situation is not an equilibrium anymore. Let's see these examples in more detail.

6.1. Changes in the Labor Force: Migrations

Let's suppose that we are in a situation of equilibrium and suddenly there is a migration into our country. Before, we were at full employment, but now we have a situation of unemployment. Notice that when the migration occurs, there are no immediate changes in wages, real exchange rate, or aggregate demand. This means (for now) that the economy has not moved. However, we are now in a situation of unemployment with external equilibrium. This means that the NN curve must have shifted upwards. In other words, for the same aggregate demand and the same real exchange rate, we have unemployment with external equilibrium, whereas before we had equilibrium in both markets.



To return to equilibrium we must have an increase in aggregate demand and a depreciation of the real exchange rate (a reduction of the real wage “ w/e ”). Notice that this is exactly what occurs in those countries that have a very high population growth. In these countries the real wages are low and nevertheless they are falling.

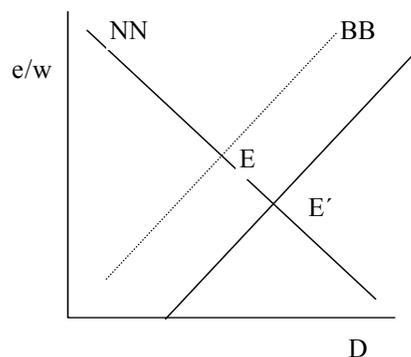
6.2. Changes in Labor Regulations

Similarly, if we change the labor regulations and it is now cheaper to lay off workers, then companies will be willing to increase employment keeping wages the same. This is a situation of overheating.

Notice that the conclusion depends crucially on our assumption about the impact of the reform. In this case we are assuming that the reform increases the demand for labor. However, there are other types of reforms that could very well reduce the demand for labor (e.g. restructuring of the public sector).

6.3. Positive Oil Shocks

If oil is one of the main exports of our country and the oil price goes up, then we have a situation of surplus with full employment. This means that the BB curve has shifted down. In other words, the new equilibrium results in an appreciation of the real exchange rate. This is what is known as the Dutch disease. Dutch disease occurs when an exporting sector experiences big productivity increases, causing an appreciation of the real exchange rate that damages other exporting sectors.



6.4. Productivity Increases

Analogously to the previous point, if we are in equilibrium and productivity increases in the exporting sector, then the economy will experience a surplus in the balance of payments so that the BB curve will shift down. Notice that in this case we also obtain an appreciation of the real exchange rate.

7. Sustainable and Unsustainable Appreciations

We have defined the real exchange rate “appreciated” when the economy is located below its external equilibrium. Is this good or bad? In principle, the workers are receiving a dollar wage that is higher than what they would receive in equilibrium. On the other hand, this situation is unsustainable and either unemployment or external accounts deficit will force a real depreciation. In other words, an appreciation of the real exchange rate, when not sustainable, makes little sense.

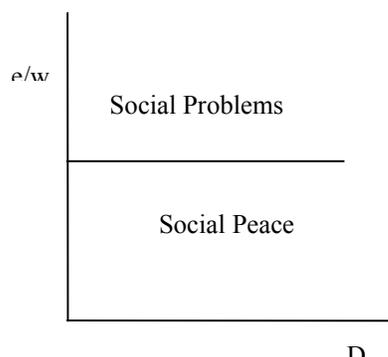
Now, let’s suppose that we observe an appreciation of the real dollar wages. Is this a sustainable or an unsustainable appreciation? As economists say, it depends!

If the appreciation is caused by shifts in the BB or the NN curves, it is due to a movement of the equilibrium point and is therefore sustainable. On the other hand, if the appreciation is occurring because there is internal inflation (and wages go up) but zero devaluation of the currency, then this real appreciation is unsustainable.

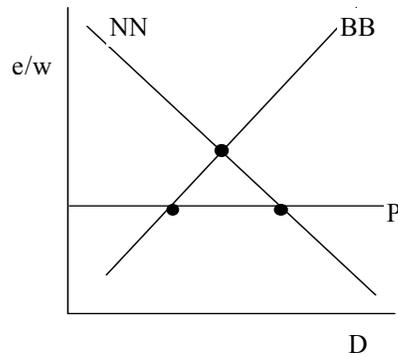
Moreover, if the appreciation is occurring because we are expecting that the BB will move in the future, then it might be sustainable in the short run. It is important to remember that it has to be sustainable at some point in time. We can run a deficit if we are expecting good news to come, but we can not run a deficit forever.

8. Social Peace Curve

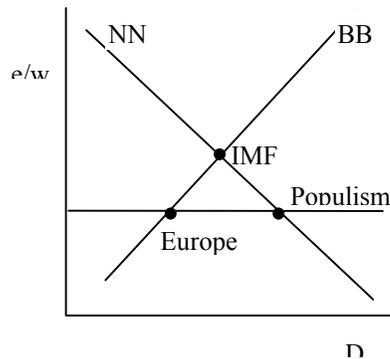
As we have seen, the real exchange rate is associated with the inverse of the real wage. The idea is that a lower real wage makes an economy more competitive abroad (and this is good in some social circles.) However, greater competitiveness implies a lower dollar wage and therefore a lower standard of living (and this does not sound so good in other social circles.) Let’s define the social peace curve “P” as the minimum standard of living below which we experience social problems.



If the real exchange rate is very depreciated (dollar wages are very low,) then the economy will have social problems. If, on the other hand, the exchange rate is very appreciated (dollar wages are high,) then we have social peace. We can put the three curves together.

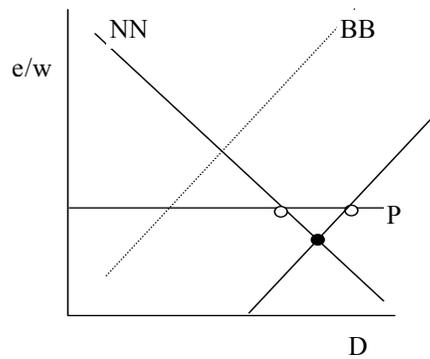


Nothing forces these curves to cross in the same point. Therefore, we have three intersections: one in which there is equilibrium in the balance of payments and in the labor market, but there are social problems (IMF.) Another one in which there is social peace and equilibrium in the balance of payments, but we have unemployment problems (Europe.) And finally, one in which there is full employment and social peace, but we have a deficit in the balance of payments (Populism.) The question is, which one shall we choose?



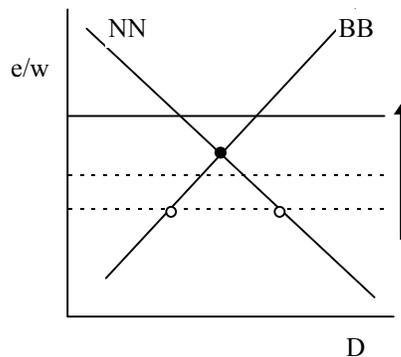
There is no simple answer. Moreover, none of these equilibria is sustainable in the long run. What happens in reality is that economies cycle among these equilibria. They start with populism: people are happy but the deficit forces the government to implement an adjustment program. This adjustment program fixes the disequilibria, but wages in dollars are so low that social problems start to appear. Pressures from some sectors force the government to allow an appreciation of the exchange rate, but as the external equilibrium must be kept, expenditures are cut. The exchange rate starts to appreciate and demand falls. These two effects guarantee to a certain extent the equilibrium in the balance of payments, but the employment situation deteriorates. The year before the elections, the government decides that it is necessary to expand the economy. Expansionary fiscal and monetary measures are used to reduce the unemployment problem, but they cause disequilibrium in the balance of payments. So we move back to the populist equilibrium, where the government remains until it runs out of reserves. The new government comes and the cycle starts again.

How can we solve the problem and exit from the cycle? Well, there are no solutions! The only thing that the economy can do is to take time and try to move the IMF equilibrium down. The other option is to move the social peace curve up, as shown in the graph below. Let's see each alternative separately.



We can generate a productivity increase that guarantees that the labor market and the external equilibria occur in the region of social peace. In this case, we have an equilibrium that is obviously preferable. Clearly, we need a sufficiently big increase in productivity. Another alternative is to move the NN curve downwards. This can be obtained with migrations. We could make the social situation of the country so bad that it would cause emigration. This is obviously not the best solution, because generally the best human resources are the first to leave. But, from a theoretical point of view, this would shift the NN curve down, moving the equilibrium into the social peace area.

On the other hand, we can maintain the economy with a certain level of dissatisfaction in order to get it accustomed to a reduction in the standard of living. Obviously, this takes years, so these adjustment processes are painful to the economy. In this case, the social peace curve will slowly shift up, eventually allowing a sustainable equilibrium.



It is critical to understand that the problem can not be solved with any macroeconomic cosmetics. For example, if we move to a flexible exchange rate, the sustainability of the equilibrium does not change. The real exchange rate is a relative price and therefore does not depend on the nominal regime (for instance, the real equilibrium exchange rate would be the same under a fixed or a flexible exchange rate system). Monetary, fiscal, or exchange rate policies will have no impact on the real equilibrium exchange rate. Only structural measures can modify the situation. In other words, the IMF equilibrium is desirable from the point of view of economic equilibria, however it is not sustainable from the social point of view, **regardless** of the economic policy. When society is not ready to sustain the IMF equilibrium, only by making structural changes (moving the BB, NN and P curves) can we reach a permanently sustainable real exchange rate.

In summary, when we include the social aspects in our model, we find an indeterminacy of the equilibrium, which makes the analysis of adjustment programs quite interesting. In this case, we are talking about social peace, but many other considerations could be included. Keep in mind that the world is a complex place and simple solutions are not always available. The inclusion of the social peace curve

in this model gives a quite interesting slant to the discussion and the explanation of historical events. Moreover, it allows us to rationalize past decisions without having to blame ignorance or stupidity. This is fundamental for the study of economic history.

References: There is an infinite amount of papers in the subject. It all started with the papers by Salter (1960) and Swan (1961) when they proposed the original model. Later Dornbusch (1980) formalized the model calling it the dependent economy. Unfortunately, one of the problems of this model is that easily readable versions are not available. They are usually very technical and the intuitions are hard to get. However, a relatively easy version is found in chapter 7 of Rudi's Open Economy Macroeconomics book, although it still is quite technical. For the Latin Triangle, see Rudi's paper (The Latin Triangle) (1997).