Equilibrium exchange rate theories under flexible exchange rate regimes

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EQUILIBRIUM EXCHANGE RATE THEORIES IN A FLEXIBLE EXCHANGE RATE REGIME

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Abstract: Economic theory refers to several notions of the exchange rate equilibrium value in a flexible exchange rate regime. It has been defined as that consistent with : a) the equilibrium of trade balance; b)the equilibrium of current account; c) the overall equilibrium of the balance of payments; d) the absence of speculative attacks on foreign exchange markets; e) the absence of a *beggar thy neighbour*" dispute at an international level; f) the achievement of price stability; g) the pursuit of a monetary policy rule. Through a literature survey we have seen that different exchange rates have effects on output and employment both in the short and in the long run. However the major conclusion was reached by an extension of recent studies, according to which, even if the central bank strictly controls the inflation rate, the absence of a precise objective in terms of price level makes the exchange rate indeterminate.

Keywords: exchange rate, equilibrium, real misalignment

1. Introduction

Economic theory refers to several notions of the exchange rate equilibrium value, examining the conditions of disequilibrium from different perspectives. A quick literature survey helps us to distinguish at least six ways of explain real misalignment, and correspondingly, six ways to settle the equilibrium exchange rate.

It can be defined as that consistent with:

a) the equilibrium of trade balance;

b) the equilibrium of current account;

c) the overall equilibrium of the balance of payments;

d) the absence of speculative attacks on foreign exchange markets;

e) the absence of a "beggar thy neighbour" dispute with other major currencies at an international level;

f) the achievement of price stability;

g) the pursuit of a monetary policy rule.

The first notion refers to the one-price-law and the purchasing power parity law

(PPP) according to which, in the long run, price movements, influencing imports and exports of goods, determine the equilibrium value of the exchange rate. In fact, according to these laws, home prices in the long run become equal to external ones when expressed in the same unit of measure (strong version) or – in the weak version - the variation of the exchange rate has to be proportional to the relative variation of prices. In the short run, it is the Marshall-Lerner condition - i.e. the elasticity of imports and exports to the exchange rate - that explains the convergence toward PPP and trade balance disequilibrium at least until price movements haven't had the time of carrying out their effects.

The second and third notions of equilibrium exchange rate have been developed by economists of the monetary approach to the balance of payments and focus on the importance of money growth in conditions of disequilibrium in the short run. This approach has its roots in the Mundell-Fleming model and can be further divided into two approaches:

1) The Current Account Monetarist' approach (CAM) that establishes the equilibrium exchange rate as that granting the current account equilibrium through movements caused by the *real balance effect* and

2) The Capital Account Monetarist approach (KAM) that focuses on both capital account and current account – i.e. the overall equilibrium of the balance of payments - considering not only (rapid or slow) price movements, but also the interest rate relative movements determined by uncovered interest parity (Uip).

The Portfolio Balance Approach refers to the third notion of the equilibrium exchange rate – i.e. the overall equilibrium of the balance of payments. It examines, similarly to the KAM approach, current account movements and capital account movements; but instead of using the Uip condition, the model assumes that internal and external bonds are not perfect substitutes. This hypothesis leads to the introduction of the risk premia into the models and to the use of the covered interest parity (Cip) instead of the Uip. The presence of risk in the models explains why operators speculate on the foreign exchange market and induce movements of the equilibrium exchange rate, even if there is price stability and perfect foresight.

The forth notion of the equilibrium value of the exchange rate refers to the behaviour of monetary policy: to explain speculative attacks it is necessary to add the hypothesis that policy authority credibility and the cost of continuing in that kind of intervention influence the expected exchange rate value. The absence of the first condition and the presence of high costs can induce operators to make speculative attacks on currency in order to receive capital gains on its future value.

The fifth notion of the equilibrium exchange rate also refers to the behaviour of monetary policy too. In a flexible exchange rate regime it is not possible to use competitive devaluation, but it is possible to increase the growth of the quantity of money to a greater degree than the average of the rest of the world. Following the quantity theory of money, this operation increases prices to a level higher than in the rest of the world and the exchange rate increases as well, spreading abroad the problem of unemployment. The exchange rate that is consistent with the absence of a *beggar thy neighbour* policy is that resulting from a "sound" monetary policy.

Regarding finally the last notion of the equilibrium value of exchange rate, authors are convinced that a sound, credible and internationally co-ordinated monetary policy allows agents to correctly formulate expectations so that the inflation rate is constant.

However, unfortunately, the inflation rate can be caused not only by an "wrong" monetary policy but also by an "imported inflation". In fact, if international demand is inelastic to prices, a currency depreciation or appreciation increases or decreases inflation respectively. This kind of disequilibrium is explained by the fact that the Marshall- Lerner condition is not verified.

Recent theories have shown, that independently from the approach to an equilibrium exchange rate, monetary policy objectives, even if perfectly predicted by agents might have uncertain effects on future price level and consequently on the exchange rate value.

The aim of the paper is to show that there is no single, correct way to establish an optimal value of the equilibrium exchange rate. This problem is so important because, at present, economic policy authorities are looking for an optimal value of

Euro/Dollar exchange rate. The European Central Bank sometimes intervenes to defend the value of the Euro, but other times leaves the market to work without modifying monetary policy. There is not the intention to answer the question "Which is the optimal equilibrium exchange rate?", but to clarify the necessity to define the objective, i.e. to specify the model policy authorities refer to. This derives from the circumstance that a certain value of the exchange rate is consistent with a kind of equilibrium, but inconsistent with another one.

The paper is organized as follows: after having examined the PPP and the normal working of the Marshall-Lerner condition (section 2), we examine the theories of the short period disequilibrium. In section 3 the monetary approach to the balance of payments is examined, which is in turn divided into section 3.1 where the CAM approach is presented in its essential lines and in section 3.2 where the KAM approach is shown. The PB approach is examined in section 3.3. Section 4 analyses the equilibrium exchange rate consistent with the absence of speculative attacks. In section 5 the presence of *beggar-thy- neighbour* policies is examined. In section 6 the Marshall Lerner condition is used to explain prices instability through the exchange rate movements. A quick survey of the balance of payments theories is concluded with a policy model (section 7) that shows how a monetary policy rule can lead to an indeterminate exchange rate. Some conclusions are drawn in section 8.

2. The trade balance, the purchasing power parity law and the equilibrium level of the exchange rate in the long run

This law explains how automatic trade mechanisms contribute to the equilibrium exchange rate. The assumptions of the model that simplify understanding the relationship are: 1) output is at full employment level; 2) home prices are not influenced by the increase or decrease of external price level and 3) the amounts of imports and exports are determined by real competitiveness. In a condition of equilibrium it has to be that a good bought in a country must cost the same, if expressed in the same unit of measure, as the same good bought abroad (costs of transport, obviously, are not considered).

This condition is known as the strong version of the PPP or one price law:

(1) $$P = P^* S$$

where P is the home price, P* is the foreign price and S is the exchange rate and can be expressed also in terms of the real exchange rate:

$$R = SP^*/P = 1$$

Authors generally, convinced that this law (1) is based on a too strong hypothesis, use a weak version of the PPP:

(2) $$\delta P = \delta S + \delta P^*$$

It states that the variation of home prices is equal to the variation of the exchange rate plus the variation of external prices.

These are long term equilibrium conditions and, if verified, the value of exports is exactly equal to the value of imports and the trade balance is at the equilibrium level. This happens because consumers prefer to buy goods sold at the lowest price. Thus if the exchange rate decreases (increases), home demand moves toward cheaper external (internal) goods. As consequence the external (home) prices increases. This movement continues until the two equations above are verified again.

The automatic equilibrium of trade balance is granted by the Marshall-Lerner condition, according to which:

$$|\eta_x| + |\eta_m| > 1$$

If the sum, in terms of absolute value, of the elasticity of exports (η_x) and imports (η_m) to the exchange rate is greater then one, then an appreciation (depreciation) causes a worsening (improving) of the commercial balance.

It is possible to conclude that the equilibrium exchange rate consistent with the trade balance equilibrium, is that granting a real exchange rate equal to one.

However, there are, as data clearly show, long fluctuations in real exchange rates, that would seem to indicate the failure of the one price law (Engel 1999).

Orthodox literature explains these movements through shocks originating in the real sector. The first explanation can be found in the proportion of tradable vs. non-tradable goods. Fluctuations in the prices of non-tradable goods causes a higher inflation that cannot determine a demand reallocation across countries. This explains the long run

exchange movement with changes in productive structures.

The second explanation is the relative growth of productivity. If one country experiences a permanent increase in the rate of productivity, prices become permanently lower and there will be a permanent increase of the real exchange rate.

A third explanation can be found in a change in international consumer preferences. If one country experiences an increase in demand for its goods, then its equilibrium price has to be higher, causing a permanent decrease of the real exchange rate.

Every shock of a real nature causes a permanent change in the natural income and, *ceteris paribus*, in the real exchange rate.

However, according to these models, the law of competition in the *very* long run would cause a reallocation of resources until the real exchange rate was again equal to one. These conclusions pertaining to the long term are taken for granted by all economists, but they are not enough to explain the reasons of positions of disequilibrium in the short period and the mechanisms of adjustments if the Marshall-Lerner condition is verified. As summarised in the introduction, various authors have given different explanations for the balance of payments disequilibrium which will now be considered.

3. The roots of monetary approach: the Mundell-Fleming model

The monetary approach has a long history, going back to David Hume. It was resurrected by Polack (1957) and Hahn (1959), but owes much of its influence to Mundell (1963) and Fleming (1962). The core of this approach is that the equilibrium exchange rate, in a flexible exchange rate regime, is determined by the quantity of money growth.

The Mundell-Fleming model extended the conclusions of the IS-LM model to an open economy. In these pages, just the contribution regarding the flexible exchange rate regime is examined. The starting point is the IS-LM model in which prices are fixed; this represent the greatest limit of the model which successive authors tried to overcome.

Equations regarding the commercial balance and capital movements must be added the to the usual IS-LM model in a closed economy:

$$N/P = N' = \delta(s+p^{*}-p) - \gamma y + q$$

$$\Delta K = \alpha(i - i^{*})$$

Added together, they represent the balance of payments.

The first expresses the trade balance in terms of the real exchange rate, imports (γy) and exogenous factors (q). If prices are fixed the movements of nominal exchange rates determine corresponding movements of the real exchange rate and, if the Marshall-Lerner condition is verified, an improvement (in case of depreciation) or a worsening (in case of appreciation) of the trade balance. The second expresses capital movements in terms of interest rate differentials. The parameter α indicates the degree of capital mobility and if it is equal to zero, capital does not affect the balance of payments; on the contrary, if it is equal to one, there is perfect capital mobility and interest rate movements cause changes in the exchange rate. The additional hypothesis is that an increase in home interest rates causes an appreciation of currency and *vice versa*, so that $\delta s/\delta i < 0$.

Suppose that an equilibrium condition exists, in which there is internal and external equilibrium with fixed prices. If in a flexible exchange rate regime with perfect capital mobility, there is a monetary expansion, internal interest rates are pushed downward. Capital goes abroad and both the nominal and the real exchange rate (because of fixed prices) are pushed upward because of the increased purchasing of foreign currency. Trade balance improves and the capital account deficit is financed through an increase of exports. The adjustment mechanism stops when the increased demand for goods (expressed by the IS) has raised the rate of interest to its international level. As a final result, income has increased and the monetary expansion, under flexible exchange rates regime, can be defined as perfectly effective. On the contrary, a fiscal expansion is ineffective because it causes an increase in interest rates, an appreciation of the exchange rate and a decrease of exports.

The equilibrium exchange rate can be defined as that consistent with the overall equilibrium of the balance of payments. The greatest limit of this analysis is represented

by the fact that prices are fixed, and that the movements of the nominal exchange rate cause corresponding movements of the real exchange rate.

The approaches which follow have tried to overcome this limit even if they focus on monetary effects of the balance of payments as well.

3.1 The equilibrium exchange rate and current account movements: the CAM approach

At the beginning of the '70s, Mundell himself (1968 and 1971), and Johnson (1972) connected their conclusions with the monetarists models of the closed economy developed by Friedman (1956), and Patinkin (1956), and led the way to the development of the CAM approach.

It concentrates on an analysis of current account movements and the following hypotheses simplify understanding the mechanism: 1) arbitrage conditions on prices grant that, in the long run, the PPP condition is verified; 2) the real demand for money is a stable function of income (Y) and interest rate (i); 3) income is at its full employment level and 4) the real rate of interest is determined by the marginal productivity of capital while the nominal rate is determined by the Fisher equation. The CAM models explain the disequilibrium in terms of the relative growth rate of money because: a) the home price growth rate depends on the money growth rate and b) the equilibrium exchange rate is determined by the previous condition plus the foreign money growth rate.

A simple version of the model can be expressed as follows:

(3) $$m^s = p + \phi y - \lambda i$$

where m^s is the supply of money of the country considered, p the level of prices, y income and r the nominal rate of interest, all expressed in terms of natural logs.

The foreign money market equilibrium is expressed by the following equation.

(4) $$m^{s*} = p^* + \phi^* y^* - \lambda^* i^*$$

where * indicates the foreign country.

The purchasing power parity condition in terms of logs can be expressed by the equation:

(5) $$s = p - p^*$$

Solving equations (3) and (4) for p and p* with due substitutions, it is possible to find the equilibrium value of the exchange rate:

(6) $$s = (m - m^*) - \phi y + \phi^* y^* + \lambda i - \lambda^* i^*$$

Equation (6) states that, given y, y^*, i and i^* and the relative parameters which they depend on, the equilibrium value of the exchange rate is given by the *relative growth* of the supply of money. The adjustment mechanism can be described through the *real-balance-effect* on international markets: an increased home money supply induces consumers to buy both foreign and home goods. By buying foreign goods, they directly cause an appreciation of the foreign currency and a depreciation of the national one. By buying home goods, if the output is given, they increase home prices. The internal goods become expensive and external goods are preferred for consumption.

If to equation (6) we add the Fisher equation:

(7) $$r = i + \pi$$

we can also have an explanation for the fact that an increase of the internal rate of interest causes a depreciation of the exchange rate, i.e. $\delta s/\delta i > 0$ (this result is the opposite to the results of the Mundell-Fleming model of the '60s, where $\delta s/\delta i < 0$). In fact, if the increase in home interest rates is determined by a higher expected inflation rate, it causes an increase, given the relative money growth, of the demand for foreign currency. This result, explained by the CAM approach through the movements of current account can be extended to capital movements, considered in the KAM approach.

3.2 The equilibrium exchange rate and the balance of payments: the KAM approach.

The KAM approach (Dornbush 1976, Frenkel, 1976 Bilson 1978), as well as the CAM approach, defines the equilibrium exchange rate as that resulting from the *relative* growth of the money supply. However, rather than considering exclusively current account movements, also considers capital movements under the uncovered interest parity (Uip) condition. Two KAM approaches can be distinguished: one flexible prices

and the other with sticky prices; this second approach can be reconciled with the first, in the long run, adding the *overshooting* of the exchange rate (Dornbush).

The KAM approach uses the CAM hypotheses plus the Uip condition which can be expressed as follows:

$E_tS_{t+1}(1+i_t^*) = S_t\,(1+i_t)$

The value of the expected nominal exchange rate (E_tS_{t+1}), plus a certain rate of interest gained on foreign markets ($1+i^*$), must be equal to the spot exchange rate (S_t), plus the rate of interest earned in home markets.

It can also be expressed approximately in terms of logs as follows:

$E_ts_{t+1} - s_t \approx i_t - i_t^*$

known as the uncovered interest parity condition of arbitrage, because operators do not take risks into account and reallocate their bond investments any time there is a possibility of gaining on interest rates or on future value of currencies. In addition no wealth effect is considered.

It is useful to add to the above equation, the aggregate demand and supply relations. Demand is:

(8) $$AD = \delta\,(s-p+p^*) - \sigma i + \gamma y + \gamma'$$

where $\delta\,(s-p+p^*)$ is the real exchange rate effect on net exports, $-\sigma r$ is the response of demand for consumption and investment to the rate of interest, γy imports of consumption goods, γ' exogenous factors.

Supply is:

(9) $$\pi = h(AD - y_f) = h[\delta\,(s-p+p^*) - \sigma i + \gamma y + \gamma' - y_f]$$

formulated following the Phillips curve according to which the inflation rate (π) varies if the value of current income diverges from the long run full employment equilibrium (y_f).

Under this model we can describe the above two cases: the first and simpler one is the case of perfectly flexible prices: if the quantity of money decreases, prices decrease also by the same value, because of the rational expectation hypothesis. If the nominal exchange rate immediately decreases too the real exchange rate remains

unchanged. Demand remains equal to supply; relative interest rates do not vary and there is no modification of the capital account financed by a variation of the current account.

The second case is that of sticky prices, when the phenomenon of overshooting occurs: the variation of the exchange rate is more than that necessary in response to the initial variation of money. Suppose there is an increase of the quantity of money that induces depreciation of the exchange rate which verifies the Uip: $E_t s_{t+1} - s_t \approx i_t - i_t^*$. Immediately capital moves toward foreign countries in order to gain on interest rate differentials and the exchange rate goes up more than in proportion to the quantity of money. Because of sticky prices exports increase (in fact given p^*, $s-p^* > p$) as expressed by the AD equation, causing a current account surplus. When prices adjust to the increase of money, through the slow movement granted by the *real-balance–effect* analysed by the CAM approach and the mechanism granted by the Phillips curve expressed by AS, the current account surplus decreases, and the exchange rate appreciates to its long run equilibrium level. Initial overshooting ($\Delta s_t > 0$) is caused by appreciation expectation ($\Delta E s_t < 0$) generated by the increase of exports ($\Delta s_t > - \Delta E s_t$).

This model defines the real misalignment as that happening during the overshooting phenomenon, but when monetary variables have had time to adjust, money is neutral and the economic system is dichotomic. This has, however, many advantages:

1. It introduces expectations
2. It allows the study of the fluctuations of output around its long run equilibrium level due to appreciation or depreciation of the exchange rate.
3. It analyses relations between capital account movements and current account movements.

The results reached by KAM and CAM models can be conciliated by the Frankel analysis (Frankel, 1979) which examines the impact of interest rate differentials on the exchange rate. CAM models argue that $\delta s/\delta i > 0$, while KAM models, such as the first Mundell-Fleming model, argue the contrary, i.e. $\delta s/\delta r < 0$. The Frankel's model conciliates these two different conclusions stating that $\delta s/\delta i > 0$ is true when inflation is perfectly predicted, while $\delta s/\delta i < 0$ when expectations are not correctly formulated.

These conclusions underline the importance of monetary policy and expected and unexpected variations of the supply of money on the determination of the exchange rate.

3.3 The equilibrium exchange rate and the balance of payments: the PB approach

CAM and KAM models contain the simplifying assumptions that wealth-effects do not exist and that national and foreign assets are perfect substitutes, i.e. there is no risk premium. The portfolio balance approach includes these hypotheses and furnishes another perspective to examine the equilibrium exchange rate(Branson 1977, Isard 1978, Dornbush and Fisher 1980, Taylor 1988).

The Uip condition in the presence of risk premia becomes:

$$F_t(1+i_t^*) = S_t\,(1+i_t)$$

Where F_t is the present forward exchange rate. It can be rewritten in terms of logs:

(10) $$f_t - s_t \approx r_t - r_t$$

The covered interest parity suggests that, if operators consider risks in estimating the future value of the exchange rate, they take into account a different condition of arbitrage according to which the interest rate differentials must be equal to the difference between the present forward exchange rate and thepresent spot exchange rate.

Other equations of the model are:

$W = M + B + SF$

$M = M\,(i, i^*)\,W \qquad M_i < 0,\ M_{i^*} < 0$

$B = B\,(i, i^*)\,W \qquad B_i > 0,\ B_{i^*} < 0$

$SF = F\,(i, i^*)\,W \qquad F_i < 0,\ F_{i^*} > 0$

$CC = N(SP^*/P) + i^*F$

All equations are expressed in nominal terms. W is nominal wealth, B internal bonds, F foreign bonds, S the nominal exchange rate, i and i^* the interest rates of national and foreign countries respectively. The derivatives indicate how dependent variables react to independent ones. The last equation shows current account flows in terms of net commercial balance and interests on foreign bonds.

Suppose an initial situation in which the current account balance is in condition of equilibrium (with the net commercial balance equal to zero and interest on foreign

bonds also equal to zero) and that there is an increase of the quantity of money. When M increases, agents try to adjust their portfolios by buying both domestic and foreign bonds. This adjustment mechanism stems from the fact that the increase of money has no direct effects on the goods market, but an indirect one through the bonds market. The portfolio reallocation is based not only on the variation expectation of the exchange rate, but also on the internal substitutability of the different parts. If there is substitutability between money and national bonds and between money and foreign bonds, the increase in the means of payment pushes the exchange rate upward (depreciation, because agents need foreign currency to buy foreign goods) and the internal interest rate downward (because prices of national bonds go up). These variations are so much greater as greater is the substitutability among different portfolio quotas. Foreign prices remain unchanged, thus there is an increase of exports and an increase of net income gained on foreign bonds. The current account now registers a surplus with which the domestic residents accumulate foreign bonds. The internal supply of foreign bonds increases, the exchange rate begins to appreciate and commercial balance begins to worsen. Internal prices now begin to rise because of the wealth effect of the greater quantity of bonds held by agents. This process goes on until the net income on the greater quantity of foreign bonds equals the deficit of commercial balance, that is:

$- N(SP^*/P) = r^*F$

and the current account is again at its equilibrium level. The final result – as in KAM models - is that the initial increase of money has been offset by an increase of prices, but it should be noted that:

1) the components of the current account are no longer equal to zero;

2) there has been overshooting beyond its long term equilibrium level, and only after some time the real variables have had the time to adjust;

3) differently from the first Dornbush model, overshooting occurs even if home prices adjust immediately (perfectly predicted monetary policy) because of the wealth effect generated by the international flux of money.

The equilibrium exchange rate can be defined as that granting the overall equilibrium of the balance of payments consistent with the absence of flows between

different portfolio quotas. It is clear that portfolio reallocation can be the result, not only of the variation of exogenous factors, but also, and more often of changes in endogenous factors, i.e. operators preferences in money demand, which monetary policy cannot perfectly control.

In the PB balance approach, there are new studies regarding the intertemporal approach to the current account (Obstfeld and Rogoff 1995 and 1996) according to which agents reallocate their income and their spending over time. This hypothesis makes it possible to control the endogenous factor of changes in agents preferences, making them dependent only on real income.

In fact, if we suppose that the wealth effect operates immediately, and that consumption immediately smoothes out to its long run equilibrium level (i.e. that depending on permanent income), overshooting does not occur. The rational expectation hypothesis confirms, according to these new versions of PB models, the neutrality of money and the real and monetary sectors dichotomy.

4. The equilibrium exchange rate and speculative attacks.

As we have seen monetary policy in a flexible exchange rate regime has a central role in determining the exchange rate equilibrium value. It is linked, however, not only to monetary policy rules, but also to monetary authority credibility and the costs of maintaining the rules. We can refer to many models, but they can all have their origins in Kydland and Prescott (1977) and Barro and Gordon (1983), according to which a monetary policy rule is sustainable if there is an equilibrium between the reputation of the monetary policy authority and the costs of maintaining the policy rule.

According to the Cam models the equilibrium exchange rate is given by the equation (6)

$$s = (m - m^*) - \phi y + \phi^* y^* + \lambda i - \lambda^* i^*$$

If the policy authority wants to appreciate the exchange rate the quantity of money has to reduce. In the short run, reduction of the means of payments causes a reduction of output as stated by the aggregate demand and supply equations (8) and (9):

$AD = \delta\,(s\text{-}p+ p^{*}) - \sigma i + \gamma y + \gamma'$

$\pi = h[\delta\,(s\text{-}p+ p^{*}) - \sigma i + \gamma y + \gamma' - y_f]$

If agents do not think that the monetary authorities are reliable; i.e. if they think that the cost of an unmodified monetary policy rule is too high (there is too much unemployment), they continue to buy foreign currency and sell the national, waiting for a change in monetary policy orientation. This behaviour causes an excess supply and a depreciation of home currency and brings about a new intervention by monetary authorities which causes another reduction of output before the aggregate supply has had the time to adjust.

The agents speculative behaviour, in other words, causes a tighter and tighter monetary policy that, considering costs in output and unemployment, finally has to be abandoned in order to reduce its effects on welfare.

The equilibrium exchange rate is defined, according to these models, as that consistent with the equilibrium between the costs and benefits of a monetary policy, i.e. the credibility. In fact, if agents believe that the costs of intervention are sustainable, they do not expect a future depreciation of the currency and do not contrast the monetary policy intervention.

From this kind of analysis, the traditional argument in favour of floating exchange rates - i.e., that they insulate economies from foreign disturbances and provide autonomy to policy makers - becomes very weak (Milani 1998). To the extent that policy authorities are not credible the flexible exchange rate regime is destabilising, instead of stabilising as suggested by previous analyses.

5. The equilibrium exchange rate and *beggar-thy-neighbour* policies

Monetary policy, as stated many times, has a central importance in determining the equilibrium exchange rate. It can be, however, an instrument which increases output and employment and moves abroad the problems of reaching a full employment equilibrium. In fact, a continuous increase in the means of payment causes, *ceteris paribus*, a continuous depreciation of the exchange rate and an increase of exports. Aggregate demand increase and output and employment increase also. Problems arise

from the fact that the output and employment of other countries, on the contrary, decrease, i.e. the monetary policy is a b*eggar-thy-neighbour* policy. The equilibrium exchange rate, following this analysis, is that which does not artificially increase foreign demand, i.e. that consistent with the trade balance equilibrium when other factors influencing competitiveness are equal in both countries.

These analyses have been completely invalidated by the rational expectation hypothesis, according to which agents perfectly predict the behaviour of monetary policy. They are, in other words, able to offset an increase of money and avoid a continuous depreciation of the means of payment.

Further analyses of the same models (Obstfeld e Rogoff 1996), lead, however, to some interesting conclusions. Supposing that monetary expansions are not anticipated by agents and prices are pre-set under monopolistic competition, where output is in equilibrium below the level of full employment, then policy interventions have real effects on output and welfare.

This occurs because the output effects of a monetary surprise alter the current account, altering as consequence the quantity of assets held by agents and the permanent consumption level. In short a monetary expansion in the home country produces a currency depreciation, a temporary increase in output, partly consumed and partly exported, and an increase in net asset position. Even if the increase in output lasts just one period, income increases because of the increase of interest on foreign bonds, i.e. the annuity value of claims on future foreign output. These conclusions show that policy authorities have incentives of increasing welfare in the country, even if the burden is borne by foreign countries; however equal results can be reached by two countries that co-ordinate their policies if the hypotheses of the model are verified for both of them and if there is monopolistic competition that stops output at an inefficient level (Walsh 1998).

6. The equilibrium exchange rate and the inflation rate.

According to the theories examined, although following different hypotheses on operators behaviour, price movements and exchange rate equilibrium conditions

depend, as the quantity theory states, on monetary policy. However this is not the final word, because many causes of inflation do not come from an increase in the means of payment.

If, then, we want to establish the equilibrium exchange rate as that consistent with price stability, we have to deepen our analysis and remove the assumption, made in the second paragraph, that home prices do not vary with the movements of external ones. In fact domestic residents buy both home and foreign goods and many producers use raw materials from abroad. This leads us to conclude that when foreign prices (expressed in terms of home currency) increase, internal prices increase also.

Under normal conditions, the trade balance equilibrium is represented by the following equation:

$P_dY = P_aA$

where P_d is the average price level of home goods, Y the internal output, P_a is an average of home good prices and imported good prices (expressed in the same unit of measure) and A the internal absorption. The price of home goods can be written as follows:

(11) $$P_d = (P_aA)/Y$$

i.e., in order to have a trade balance equilibrium in terms of value, if A and Y do not vary, home prices have to vary with foreign ones, expressed in terms of national currency (De Grauwe 1997).

Supposing that the home monetary policy has the objective of price stability and that the means of payment have not varied in order to maintain the target. Suppose, in addition, that foreign monetary policy causes an appreciation of foreign and a depreciation of the national currency.

The general effect on trade balance depends on the dimension of imports and exports of the country and on the value assumed by the elasticity of imports and exports to the exchange rate. It is easy to deduce that if the country does not export at all, but imports, for example, raw materials, the depreciation causes a worsening of trade balance. In fact, now, as shown in the equation (11) a grater home output is necessary to have a new equilibrium condition. However if the country has a certain amount of

exports, the improving of trade balance is submitted to the constraint of the Marshall-Lerner condition:

$$|\eta_x| + |\eta_m| > 1$$

according to which a depreciation of currency causes an improvement of trade balance if, in terms of absolute value, the sum, of the elasticity of export (η_x) and imports (η_m) to the exchange rate is greater then one. If the Marshall-Lerner condition is not verified, then a depreciation causes a worsening of commercial balance.

The effect of a depreciation of currency on trade balance is not the only one; in fact, it is possible to observe as great an increase of home inflation rate as grater is the incidence of foreign prices in determining the average level of domestic prices.

In fact a decrease of the exchange rate does not cause a demand shift but an increase of the internal inflation rate. This is the case of imported inflation; because of the inelasticity of imports to the exchange rate, a depreciation of currency does not cause a decrease of the demand for foreign goods. The increase in inflation is as great as the effect on production costs of the increase of foreign prices (the supply curve shifts leftward) and the worsening of the commercial balance and internal output is as great as the effect of exports on aggregate demand is small.

The equilibrium exchange rate consistent with price stability, leaving the money supply unchanged, can be defined as which does not cause imported inflation. In other words if the exchange rate depreciates because of exogenous factors and the country is a great importer of foreign goods, monetary policy authorities would have to intervene in order to adjust it to its previous value.

7. Monetary policy rules and the exchange rate.

We have already seen the importance of monetary policy in the exchange rate determination in a flexible exchange rate regime. We have concluded that if there is perfect competition and monetary expansions are perfectly predicted there is no effect on the real exchange rate in the long run. There can be overshooting in the short run if prices are sticky and/or if there are wealth effects, but even if at times the initial position of the current account is different from the final one, it is confirmed, in the rational

expectation hypothesis, that money is neutral and that the system is dichotomic.

Recent analyses have shown, however, that some monetary policy rules, even in the REH do affect the equilibrium exchange rate. In particular, if authorities have an inflation target to be reached by an interest targeting, rule the solution of the model is consistent with multiple equilibria and, therefore, inflation is indeterminate. If inflation is indeterminate, the exchange rate is also indeterminate.

To better explain these conclusions, suppose the following model:

$y_t = y^e + a(p_t - E_{t-1}p_t) + e_t$

$y_t = \alpha_0 - \alpha_1 r_t + u_t$

$m_t - p_t = -ci_t + y_t + v_t$

$i_t = r_t + (E_t p_{t+1} - p_t)$

The first is the supply equation and expresses the current output, in terms of the expected output and errors in expected inflation. The second is the demand equation, relating current demand to autonomous factors and the real rate of interest. The third is the money market equilibrium, in which the real supply equals the demand for money. The fourth is the Fisher equation expressed in terms of expected inflation.

Suppose that policy authorities control the nominal rate of interest i; the first consequence is that the money market equilibrium is no longer relevant because the nominal supply of money adjusts endogenously to the demand determined by the output and price level. Although central banks control the nominal rate of interest, according to this model it is the real interest rate that influences the aggregate demand.

Taken for granted these considerations and expressing the model in terms of inflation rates (π), it becomes:

$y_t = y^e + a(\pi_t - E_{t-1}\pi_t) + e_t$

$y_t = \alpha_0 - \alpha_1 r_t + u_t$

$i^T = r_t + E_t \pi_{t+1}$

This structure implies that the price level is indeterminate. That is, the solution of the model is consistent with many values of the current and future price level; it is only necessary that the difference between current and future inflation is equal to a constant value.

If, to the equations above, we add the real exchange rate and the Uip :

$Es_{t+1} - s_t = i^T - i^* = r_t + E_t\pi_{t+1} - \pi_{\tau+1}^*$

It must be concluded that the exchange rate is also indeterminate and subject to continuous variation in relation to the inflation expectations of the central bank. This constitutes an apparent irrationality of agents because they do not have enough information to formulate expectations on prices and exchange rates.

If the central bank were to fix an inflation target, the problem would be solved because the value of $E\pi_{t+1}$ would be equal to a constant and the model would no longer be indeterminate (Svenson 1998).

8. Conclusions

The common root of these literature contributions is that, because the exchange rate is a monetary variable, correct management of monetary policies allows the establishment of an equilibrium exchange rate.

Problems arise from the fact that we have examined, even if there is this common denominator, many ways of defining the equilibrium exchange rate, looking at it from at least seven perspectives: that one of a) the trade balance; b) the current account; c) the balance of payments; d) the absence of speculative attacks on foreign exchange markets; e) the absence of a "beggar thy neighbour" dispute with other major currencies; f) the achievement of price stability; g) the pursuit of a monetary policy rule.

Through this literature survey, we have seen that different exchange rates have effects on output and employment both in the short – as theory has asserted since long time- (the Cam, Kam and Portfolio balance approach models) and in the long run (e.g. intertemporal approach to the balance of payments Obstfeld and Rogoff 1995 and 1996). According to many authors, therefore, money is not neutral even in the long run and monetary policy interventions could have effects on the international distribution of output and employment.

In any case the major conclusion has been reached by an extension of recent studies (Svensonn 1998), according to which, even if the central bank strictly controls the inflation rate, the absence of a precise objective in terms of price levels makes the

exchange rate indeterminate. This situation, obviously, has many implications – as other models have clearly shown – for the wealth and welfare of each country.

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