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Rapetti, Martin

CEDES, CONICET

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Martín Rapetti
CEDES, CONICET

1. Introduction

Recent years have witnessed an increasing interest in the macroeconomic strategy followed by some developing countries, most notably China, consistent in preserving a stable and competitive real exchange rate (SCRER). These countries have shown impressive output and employment growth records. The academic interest focused on diverse related aspects of the SCRER strategy. Some scholars following an aggregate approach focused on the implications at global scale of such a strategy. These efforts derived in the so-called "global imbalances" literature.[1] Others following a small country perspective were interested in the potential developmental benefits of the SCRER. Different rationales were offered to explain the favorable effects of a SCRER on economic growth.[2] Notwithstanding which the actual channels linking the SCRER and economic growth are, research in this area has contributed to document the positive correlation between them.[3]

It is worth noticing that the research followed by these two groups implicitly assume that (at least some) countries have the ability to set their real exchange rates (RER) at competitive levels. Certainly, the global imbalances debate points to the potential aggregate costs of such strategy, but the fact that governments manage their RER is taken for granted in that literature. This should not be surprising: casual observation confirms that certain countries actually manage their RER.

In contradiction with this view, conventional economic theory predicts *equilibrium* values for RER. By equilibrium it should be understood *point of attraction*: certain level toward which the RER is conducted by autonomous economic forces. Under this traditional vision, the RER can hardly be interpreted as a policy variable. At most public intervention may affect it transitorily, but the RER will ultimately converge toward equilibrium.

Hardly an exception within Economics, there seems to exist conflicting views between policy-oriented research and theoretical-abstract analysis regarding the behavior of exchange rates. On the one hand, the RER is

[1] See, for instance, Dooley, Folkerts-Landau and Garber (2003 and 2004) and Eichengreen (2004).
[2] See Williamson (2003), Rodrik (2005), Frenkel (2004) and Frenkel and Taylor (2005).
[3]See Polterovich and Popov (2002), Hausman, Prichet and Rodrik (2005), Prasad, Rajan and Subramanian (2007) and Sturzenegger and Yeyati (2007).

typically seen as an equilibrium variable, but on the other, as a policy variable. These two contradictory visions regarding the nature of the RER became apparent to me in recent years when studying the macroeconomic performance of Argentina after the 2001-02 crisis (Frenkel and Rapetti, 2008). During the post-crisis period, Argentine authorities successfully followed a SCRER strategy, which was criticized by some analysts under the basis of conventional theory of the RER determination. I found that these contradictory views call for an answer and decide to orient my PhD. dissertation to deal with these issues.

The present paper is a first step toward that goal. It critically reviews the set of what it could be termed "the most popular theories of RER determination". It is critical in the sense that the review *tries* to go beyond a mere exposition or description of theories. Given the time constraint and the immense amount of literature dealing with the economics of exchange rate, the review is eminently partial. The review does not include the empirical tests of these theories. The relevant excluded theories and the empirical work will be added in future versions.

The paper is organized as follows. I present the basic concepts and definitions in the next section. The popular purchasing power parity and Harrod-Balassa-Samuelson hypothesis appear in section 3. The determination of the RER under models dealing with economies in financial autarky is analyzed in section 4. Among the "models for current account" appear the tradable and non-tradable model and a simple Keynesian model. Section 5 reviews models analyzing economies integrated to the international capital markets, mainly focusing on the Mundell-Fleming model and the portfolio balance approach. The monetary approach to balance of payment and the intertemporal approach to the current account are briefly discussed in this part. Section 6 presents some conclusions.

Before moving to the next section, it is worth emphasizing that all models presented here are analyzed under the small economy assumption and, since the objective of the paper is RER determination, the attention tends to focus on flexible exchange rate regimes, which facilitates the exposition.

2. Definitions and concepts

Hinkle and Montiel (1999) define RER in two different ways. The *external RER* is the relative price between baskets of goods produced or consumed in different countries. To make the comparison feasible the prices of the baskets should be expressed in the same currency. Therefore, the external RER, e, is expressed as the ratio of these two prices in a common numeraire:

$$e = EP^* / P \tag{2.1}$$

E is the nominal exchange rate, which expresses the domestic price of foreign currency (i.e units of domestic currency per units of foreign currency). A rise (fall) in E implies a depreciation (appreciation) of local currency. $P^*$and $P$are foreign and domestic price indexes, respectively. These could be consumer price indexes (CPI), wholesale price indexes (WPI), GDP deflator or some other index, depending on what the RER is intended to measure. For instance, if the intention is to compare purchasing power between countries, CPI would be an appropriate index. On the contrary, if the comparison points to relative competitiveness between countries, GDP deflators or WPI would be better.

External RER can also be distinguished by whether it compares relative prices between two or more countries. The first case corresponds to the bilateral RER, which is represented by equation (1). When the comparison is between the home country and a set of its trading partners, the relevant measurement is the multilateral or effective RER.[4] In this case, the RER is calculated as a weighted average:

$$e_m = \prod_{i=1}^{n} (E_i P_i^*)^{\alpha_i} \frac{1}{P} \tag{2.2}$$

Where n is the number of trading partners or competitors of the home country, and α_i the weigh of country i in the geometric average, $\sum_{i=1}^{n} \alpha_i = 1$.

While the external RER is a relative price between countries, the *internal RER* measures the relative price between two different categories of domestic goods: tradables and non-tradables. It is formally expressed as the ratio of a price index of traded goods (P_T) over a price index of non-traded goods (P_N).

$$e_i = \frac{P_T}{P_N} \tag{2.3}$$

The relative domestic price of traded and non-traded goods is an indicator of the incentives for both producing and consuming these two categories of goods. As the external RER, it is a key relative price in determining the trade balance of an open economy. If the internal RER rises it would be expected that the production of traded goods will increase while its consumption will decrease. These forces would tend to improve the trade balance. From this expected result, the internal RER is also interpreted as an indicator of international competitiveness.

[4] The term "effective" has also another meaning in the exchange rate literature. Effective RER may refer to the one that includes the effects of tariffs, subsides and other charges on the domestic prices of imports and exports.

Notice that both the external and internal RER appear as indicators of international competitiveness, affecting the behavior of the trade balance. In both cases, it is expected that a rise in their values would result in a greater international competitiveness of local production and therefore an improvement in the trade balance. It is because of this similarity that open economy macroeconomic models are build considering both types of RER. As discuss in the next sections, some models use the external RER as indicator of international competitiveness and some others the internal RER. Before analyzing these models, it is interesting to investigate the relationship between both indicators.

Assume that the domestic and foreign aggregate price indexes are geometric weighted average of tradable and non-tradable prices, with weights α and β for non-tradables, as in equations 2.4 and 2.5.

$$P = P_N^{\alpha} P_T^{1-\alpha} \tag{2.4}$$

$$P^* = P_N^{*\beta} P_T^{*1-\beta} \tag{2.5}$$

Plugging 2.4 and 2.5 into 2.1 and doing simple algebra, we get equation 2.6:

$$e = \frac{EP_T^*}{P_T} \frac{e_i^{\alpha}}{e_i^{*\beta}} \tag{2.6}$$

This equation shows the relationship between external and internal RER. The former depends positively on the latter, but also on the external RER for traded goods ($e_T = \frac{EP_T^*}{P_T}$) and negatively on the foreign country internal RER (e_i^*). By log-differentiating 2.6, we get the rate of variation of home external RER:

$$\hat{e} = \hat{e}_T + \alpha \hat{e}_i - \beta \hat{e}_i^* \tag{2.7}$$

Equations 2.6 and 2.7 make clear that the external and internal RER are not the same, nor necessarily move in the same direction. The similarity between both indicators arises when some assumptions regarding the behavior of prices are made.

A popular version of the purchasing power parity hypothesis (PPP) –which is discussed in detail in section 3.1- establishes that the prices of homogenous traded goods in different countries should be equal when expressed in the same currency. When transaction costs are considered, PPP implies that the ratio of these prices should be equal to some constant k. This is the relative PPP and it is shown in equation 2.8.

$$\frac{EP_T^*}{P_T} = k \qquad (2.8)$$

When the home country is a small economy, relative prices in the foreign country can be considered as given. Making the small country assumption and additionally assuming that relative PPP holds for traded goods, we know for sure that the external RER moves in the same direction as the internal RER.

$$\hat{e} = \alpha \hat{e}_i \qquad (2.9)$$

Given that $0 < \alpha < 1$, it is clear that the external is less volatile than the internal RER. The greater the proportion of non-traded goods in the aggregate price index, the more similar the both indicators would tend to move. It follows from this characteristics that –given the assumptions- a nominal devaluation would have a greater impact in the internal than in the external RER.

However, the external and the internal RER may move in opposite direction. Take, for instance, the following case in which PPP holds for traded goods. The Harrod-Balassa-Samuelson effect –which is analyzed in section 3.2- states that countries´ internal RER tend to appreciate as a consequence of faster productivity growth in their tradable than in their non-tradable sector. If the foreign country's internal RER appreciates at sufficiently high rate, home external RER could depreciate while internal RER appreciates. This would happen when equation 2.10 holds.

$$\alpha \hat{e}_i < \beta \hat{e}_i^* \qquad (2.10)$$

The likelihood of these opposite movements would be greater, the faster productivity growth in foreign tradable sector and the higher the share of non-tradable prices in the aggregate price index. However, if condition 2.10 does not hold, external RER would appreciate with internal RER although at lower rate, because of the effects of foreign country's internal RER appreciation.

If PPP does not hold the relationship between the external and internal RER could also be affected. In an extreme example where the pass-through from exchange rate to tradable prices is nil, a nominal depreciation would make the external RER depreciate while maintaining the internal RER unchanged. The failing of PPP typically occurs under situation of pricing to market and other strategic behaviors. Finally, it should be considered that current considerations implicitly assume that tradable goods prices are given (terms of trade are exogenous). The analysis would be more complicated if terms of trade are considered endogenous. We are not going to consider that possibility in this study.

3. RER determination in non-General Equilibrium macro-models

This section focuses on theories in which the determination of the RER does not consider the macroeconomic system. In other words, nothing is explicitly said about output and employment levels or the external accounts. First, it is presented the purchasing power parity and then the Harrod-Balassa-Samuelson hypothesis about the evolution of the RER.

3.1. The Purchasing Power Parity Theory

Standard presentations of the purchasing power parity (PPP) theory state that its basic building block is the law of one price (LOP). [5] This "law" states that two homogenous traded goods produced in different countries should have the same price when expressed in the same currency. Equation 3.1 formalizes the LOP, in which the subscript refers to the good *i*.

$$P_i = EP_i^* \tag{3.1}$$

The mechanism enforcing the LOP is international commodity arbitrage. Prices should be equal otherwise there would exist unexploited risk-free arbitrage opportunities, which would be difficult to explain if traders are assumed to be rational. However, arbitrage could fail to operate because of transaction cost, such as transportation costs or legal barriers on international trade (i.e. taxes, tariffs, quotas, etc). Assuming the existence of proportional transaction costs (t), the modified or relative LOP is typically expressed as in equation 3.2.

$$P_i = EP_i^*(1+t_i) \tag{3.2}$$

In turn, equation 3.2 implies that the rate of variation of the domestic price of good *i* must be equal to the sum of the rates of variation of the nominal exchange rate and the foreign price of good *i*. This results from log-differentiating equation 3.2, as in the following expression in which "^" means proportionate rate of variation.

$$\hat{P}_i = \hat{E} + \hat{P}_i^* \tag{3.3}$$

Instead of considering only one good, the analysis can be extended to a set of goods with similar logic. When considering an aggregate bundle of goods, equations 3.1 and 3.3 turn into the *absolute* and *relative* versions of the PPP

[5] As a representative sample of this way of presenting the PPP theory, see Obsfeldt and Roggof (1996), Hallwood and MacDonald (2000) and Sarno and Taylor (2002).

theory. The following expressions represent these two versions, where the absence of subscripts indicates that prices are aggregate indexes.

$$P = EP^{*} \tag{3.4}$$

$$\hat{P} = \hat{E} + \hat{P}^{*} \tag{3.5}$$

PPP theory represented in the equations above has been typically used as a theory of RER determination. The absolute version predicts that the (external) RER would be equal to 1, while the relative PPP[6] to some constant (recall equation 2.8 in section 2). Whether it is 1 or a constant, both versions predict an equilibrium level to which the RER should return if some shock takes it away from it.

A few observations regarding this standard presentation of the PPP theory are in order. To begin with, it is important to recall that the driving force toward the equilibrium RER is international trade arbitrage. Arbitrage forces would get into motion once there are unexploited risk-free opportunities from international trade. This would make prices converge to the parity. Notice that the elimination of price differentials through arbitrage is guaranteed only under certain conditions. First, by its own definition arbitrage is applicable to a restrictive set of goods: homogenous traded goods. A priori, PPP theory leaves aside the majority of goods produced in modern economies, namely non-homogeneous traded goods and non-traded goods. There is no reason why international price differential among these goods should be corrected by arbitrage. Therefore, PPP can only be interpreted as a complete theory of RER determination if some additional assumptions are made. In particular, it should be assumed a constant ratio, within each country, between the prices of homogenous traded goods and the other goods. Sometimes, it has been rationalized that changes in traded goods prices generate proportional changes in non-traded goods prices through substitution effects in both the demand and supply functions of these goods.[7] Even casual observation provides evidence that makes hard to adhere to the assumption of constant price ratios. On the other hand, there is substantial evidence and theoretical arguments explaining international price differential even for quasi-homogenous traded good. An eloquent example derives from firms that can discriminate prices of certain goods across country, such as automobiles. These “pricing to market” behaviours can explain from a theoretical view not only short-term but also longer-term departures from PPP (Obstfeld and Rogoff, 1996).

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[6] The passage from relative LOP to relative PPP is not completely symmetric. Relative PPP may be due to transaction costs –as in the relative LOP- but also due to different price weighting schemes between home and foreign countries.

[7] For instance, Rodriguez (1982) offers a rationale for stabilization program based on the so-called “tablita” in Argentina during the late seventies based on this idea.

International trade arbitrage also implies certain requirements on the arbitrageurs' information set: price differential has to be detected in order to start arbitraging. If information is not complete, it is costly and takes time to gather. Certainly, information costs can be considered as one of the many possible transaction costs included in the relative version of PPP. However, the time required to detect arbitrage opportunities would imply that the adjustment toward PPP is not instantaneous. This would turn PPP into a theory only for long-run determination of the RER. This is in line with the current consensus among scholars (Taylor and Taylor, 2004). However, the consensus regarding that PPP holds only in the long-run seems to rely mostly on empirical rather than theoretical grounds. Furthermore, it is not always clearly expressed the rationale backing the statement that PPP applies for the long-run.

There is an important qualification to be made regarding the logical implication of transaction costs on arbitrage. Theory states that there is room for arbitrage when price differentials are higher than transaction costs. Price differentials lower than transaction costs would not put into motion market forces toward parity. It is important to notice that transaction costs establish upper and lower limits to arbitrage. Since PPP does not explicitly establish any causality between the variables involved, to illustrate this point assume a small open economy with fixed nominal exchange rate. In such a setting, relative PPP would predict that domestic prices of homogeneous traded goods cannot be lower than foreign prices discounted by the transaction costs ($P^*E/(1+t)$). Otherwise, there would be an excess demand for domestic goods exactly matched with an excess supply of foreign goods that would make prices converge. On the contrary, domestic prices cannot be higher than foreign prices plus transaction costs ($P^*E(1+t)$), because the excess supply of domestic goods (excess demand for foreign goods) would make prices converge. Thus, without any additional assumption, transaction costs would establish an *inaction or neutral band* for arbitrage:

$$P^*E/(1+t) < P < EP^*(1+t) \qquad (3.6)$$

Within this band, prices would not be determined by international trade arbitrage, but by local markets characteristics. Notice that if there is high degree of competition, domestic traded goods prices would tend to converge to the lower limit. On the contrary, in more concentrated market structures prices would tend to be set near the upper limit, as in the standard presentation of the relative PPP of equation 3.2. It is also worth noticing that the existence of transaction costs does not imply the predictions by equations 3.3 and 3.5. For instance, a nominal depreciation in the home country would not necessarily generate a proportional increase in domestic prices. Since the existence of inaction bands introduces some degree of indeterminacy, a complete pass-through from variations in the nominal exchange rate to domestic traded goods prices is not necessarily guaranteed.

Notice that the existence of inaction bands predicted by the relative PPP establishes an interval of RER indeterminacy. In other words, PPP theory cannot predict the level of RER inside the interval. From equation (3.6), it is straightforward to get this interval:

$$\underline{e} = \frac{EP^*}{P(1+t)} < e^{PPP} < \frac{EP^*(1+t)}{P} = \overline{e} \qquad (3.7)$$

Considering all these qualifications and implicit assumptions, PPP theory would predict that the RER should show a long-run tendency toward the interval established by equation 3.7 and would remain undetermined within it. Furthermore, since transaction costs are not necessarily homogenously proportional for all goods (i.e. the t_i in equation 3.2 are the same for all goods *i*), it is natural to expect that more arbitrage operations would tend to appear as the RER moves away from equilibrium. In other words, arbitraging forces toward PPP would become more powerful as the RER diverge from equilibrium. Therefore, one should expect to observe a non-linear dynamic of the RER toward PPP.

It seems clear that the main drawback of the PPP as stated above is that it only applies for homogeneous traded goods. If one wants to obtain general conclusions for the whole prices in the economy, additional (and questionable) assumptions have to be made; particularly, that internal relative prices remain constant in time. Probably because of these limitations, PPP has also been presented as a theory of RER determination based on other theoretical foundations. Some scholars implicitly or explicitly present PPP as a theory of competitiveness among countries, in which not only homogenous commodities are considered, but also imperfect substitutes traded goods and non-traded goods. Under this view, the international competition and the internationalization of production are the main forces producing PPP. This version of PPP would predict that a RER cannot depreciate (appreciate) permanently because substitution effects in domestic and foreign demands and supplies would moderate this trend through nominal exchange rate appreciation (depreciation) or relative higher (lower) domestic inflation. Moreover, non-traded (traded) goods may become tradable (non-tradable) when the RER depreciates (appreciates) sufficiently, reinforcing these mechanisms. However, it is not clear how precise predictions regarding the level and dynamics of RER are. Under this version, the level of RER could remain stable (without tendency to change) within a relatively wide range of values. In other words, this alternatively interpretation of PPP does not predict an “equilibrium” RER, but just a probable long-run tendency of the RER and a short and medium run indeterminacy within a fuzzy and relative large range of values. For future reference, I call this interpretation the “lax version of PPP”.

There is another general version of PPP, which focuses on capital account transaction. Hallwood and MacDonald (2000) refer to it as the "efficiency markets view" of PPP. This starts by assuming that the real interest rate parity (RIP) holds. According to the RIP, real interest rates should tend to be equal across countries. Otherwise, capital would migrate from countries with lower returns to those with higher returns. This force would tend to equalize real interest rates. The RIP theorem is formalized in equation 3.8, where r and r^* are domestic and foreign real interest rates, respectively.

$$r = r^* \qquad (3.8)$$

This version also requires that both the Fischer equation and the uncovered interest parity (UIP) hold. The latter implies that home and foreign bonds are perfect substitutes. Equations 3.8-3.10 formalize these additional assumptions, with i and i^* being domestic and foreign nominal interest rates and the subscript E expressing expectation.

$$r = i - \hat{P}^E \qquad (3.9)$$

$$r^* = i^* - \hat{P}^{*E} \qquad (3.10)$$

$$i = i^* + \hat{E}^E \qquad (3.11)$$

Assuming that expectations are formed rationally, we get from system 3.9-3.11 an expression similar to relative version of PPP embodied in equation 3.5:

$$\hat{P} = \hat{E} + \hat{P}^* + \varepsilon \qquad (3.12)$$

However, equation 3.12 has a dramatically different implication. Since ε is a white-noise variable arising from the differences between the actual and expected variables, this version of the PPP would predict that the RER should follow a random walk. This prediction is at odds with the traditional view. The latter states that shocks would momentarily move the RER away from PPP, but it would gradually return to equilibrium. The efficiency market view, on the contrary, states that shocks would have permanent effects and therefore that there is no equilibrium PPP level for the RER. This version of the PPP does not receive much support. This is probably due to the lack of empirical evidence supporting the efficiency market hypothesis, particularly the RIP and the UIP (Sarno and Taylor, 2002, chapter 2).

3.2. The Harrod-Balassa-Samuelson model

As discussed above, the influential monetary models suggest that the RER may show short-run deviations from PPP, but it should converge to the parity level once the effects of nominal stickiness fade away. From a theoretical perspective, the Harrod-Balassa-Samuelson (HBS) hypothesis rationalises long-run deviations from PPP. The standard presentation is a two-country and two-sector (tradables and non-tradables) model. Prices are determined by the production conditions; therefore, the demand-side of the economy is omitted. In accordance with the neoclassical condition of equality between the value of marginal productivity of factors and their rewards, prices depend positively on wages (*W*) and negatively on marginal product of labor (*Q*). Equation 3.13 formalizes this condition for sector l in the country j.

$$P_l^j Q_l^j = W_l^j \tag{3.13}$$

The model also assumes that within each country the wage rate is the same for both sectors ($l = T,N$) due to inter-sectoral labor mobility:

$$W_T^j = W_N^j \tag{3.14}$$

From 3.13-3.14, it follows that the internal RER in each country corresponds to the ratio between the marginal labor productivities in the non-traded and the traded goods sectors.

$$e_i^j = Q_N^j / Q_T^j \tag{3.15}$$

Recall that identity 2.7 in section 2 establishes that the rate of variation of the external RER depends on the rate of variation of the external RER for traded goods plus the difference between the variation rates of the internal RER in the home and foreign countries.

$$\hat{e} = \hat{e}_T + \alpha \hat{e}_i - \beta \hat{e}_i^* \tag{2.7}$$

The HBS model assumes that PPP holds for the traded good sector; thus we know that $\hat{e}_T = 0$. If we additionally assume the same weigh for traded and non-traded goods prices in the aggregate price index for both countries ($\alpha = \beta$), identity 2.7 turns into equation 3.16, in which $\hat{Q}_l^j$ means the rate of variation of the marginal product of labor in sector l in country j:

$$\hat{e} = \alpha(\hat{Q}_T^* - \hat{Q}_T + \hat{Q}_N - \hat{Q}_N^*) \tag{3.16}$$

The above expression can be modified so that to express the relationship between the dynamics of the RER and each sector total productivities. This can be done formally by simply assuming a Cobb-Douglas production function for each sector output. If the degrees of capital and labor intensity in each sector are the same across countries, equation 3.16 would turn into the following expression, where $\hat{A}_l^j$ is the rate of variation of the total productivity of sector *l* in country *j*

$$\hat{e} = \alpha(\hat{A}_T^* - \hat{A}_T + \hat{A}_N - \hat{A}_N^*) \qquad (3.17)$$

Equation 3.17 indicates that the evolution of the RER depends on the international productivity differential in each sector. The HBS model considers that within countries productivity in traded goods sector is greater than in the non-tradable sector, and also that international productivity differences are greater in the production of traded goods than in the production of non-traded goods. Formally, this can be translated into: $\hat{A}_T^j > \hat{A}_N^j$, $\hat{A}_T^* \neq \hat{A}_T$ and $\hat{A}_N = \hat{A}_N^*$. These assumptions imply that:

$$\hat{e} = \alpha(\hat{A}_T^* - \hat{A}_T) \qquad (3.18)$$

Equation 3.18 summarizes the key prediction of the HBS model: the *dynamics* of the RER would depend on the international productivity differential in the traded good sector. The RER would appreciate (depreciate) when the productivity in the home tradable sector is greater (lower) than that in the foreign country. The intuition behind this result is as follows. Suppose a rise in the productivity of home traded goods sector. This may lead to a rise in wages without any change in the prices of tradables. Given that PPP holds for tradable production, no variation in the nominal exchange rate will occur. However, workers in the non-tradable sector will demand a similar rise in their wages. Since there was no change in the productivity of this sector, the increase in wages would surely generate a proportional rise in non-traded goods prices so that to keep non-tradable profitability unchanged. This in turn would result into an increase in the aggregate price level and therefore into a RER appreciation.

3.3. Remarks

Before moving to the analysis of other models of RER determination, it is worth to make a few observations about those analyzed in this section. As mentioned above, both the PPP theory and the HBS model are not macroeconomic general equilibrium schemes. They just predict the possible behaviour of the RER without considering the conditions of domestic and foreign markets for all goods and assets. In that respect, they cannot be considered as macroeconomic models. An implication of that feature is that none of these models presents the RER as market-clearing variable, as other theories reviewed in the following sections do.

The traditional version of the PPP predicts an equilibrium RER, in the sense that there are arbitrage forces driving this variable to certain point (or band) of attraction. Once in that level (or band), there are no tendencies toward change. On the contrary, in the efficiency market version there is no equilibrium RER. The RER follows a random walk. Again, this latter version has little recognition within the profession.

It is worth noticing that the HBS model is not really a theory of RER determination, but one determining the RER dynamics. As equation 3.18 clearly shows, the model predicts the *movement* of this variable but not its *level*. In this respect, this theory neither predicts an equilibrium level of RER. The model just offers a predictable direction of the RER movements. Since this direction is determined by the behaviour of productivities, which are typically considered as given in the short-run, predictions arising from this model apply for long-run horizons.

It is not clear the relevant time-horizon for the analysis under the traditional version of the PPP. This will depend on the characteristics of arbitrage forces leading the RER toward PPP. If incomplete information is assumed, it can be argued that the adjustment process will require relatively long periods. Most scholars agree in that PPP should be interpreted as theory of long-run determination of the RER. However, this view seems to be influenced more on empirical results rather than on theoretical conclusions. In the academic literature, it is not always clearly stated the theoretical reasons to expect a convergence toward PPP and therefore the time-horizons for adjustment.

4. Current account models

In this section we focus on models for economies that are open to international trade but remain close to capital movements. First, it is analyzed the tradable/non-tradable model and then the Keynesian open economy model. Both are simple general equilibrium settings analysing the conditions for internal and external equilibrium. The notion of internal equilibrium varies between the models. More important for the present discussion, we will see that both models treat the external balance or equilibrium condition in a similar way. Since capital account transactions are not considered, external equilibrium is represented as a balanced trade. This is because these models were developed during 1940s and 1950s, when international capital movements were of little relevance. Their inclusion in this review is justified not only because some of their conclusions are still relevant for current policy debates, but also because that modelling strategy influenced the way some models considering open capital account were built.

4.1. The tradable/non-tradable (T-NT) model[8]

We present here a simple case of a small economy, which is price taker in the world market for both its exports and imports (i.e. the dependent economy model). Therefore, terms of trade are given. Since there is no need to distinguish between exportable and importable goods, they can be integrated into a composite traded good. There is also domestic production of a non-traded good. The labor market represents the third market analyzed in the model. Prices and wages are assumed to be perfectly flexible and both the capital stock and labor supply are fixed in the short-run. Capital account inconvertibility is assumed and the real exchange rate is defined as an internal RER.

Labor demand functions for each sector are derived from standard profit maximization exercises in competitive perfect markets. Both demand functions are negatively related to the nominal wage (W) deflated by their respective prices (P_T or P_N). This implies that employment and output in the traded sector depend positively on the RER, while the opposite happens for the non-tradable good sector. Equations 4.1 and 4.2 describe production in both sectors (Y_T and Y_N) as functions of the RER.

$$Y_T = Y_T(e_i) \qquad \partial Y_T / \partial e_i > 0 \qquad (4.1)$$

$$Y_N = Y_N(e_i) \qquad \partial Y_N / \partial e_i < 0 \qquad (4.2)$$

Demands functions are derived from consumer's utility maximization behaviour. Both increase with aggregate income (Y) valued in terms of the non-traded good. Since the internal RER is the relative price between the two goods, a rise in the RER lowers the demand for tradables (A_T), and increases the demand for non-tradables (A_N).[9]

$$A_T = A_T(Y, e_i) \qquad \partial A_T / \partial Y > 0, \ \ \partial A_T / \partial e_i < 0 \qquad (4.3)$$

$$A_N = A_N(Y, e_i) \qquad \partial A_N / \partial Y > 0, \ \ \partial A_N / \partial e_i > 0 \qquad (4.4)$$

$$Y \equiv Y_N + eY_T \qquad (4.5)$$

The complete and instantaneous price flexibility assumption guarantees that the economy is always at full employment. This implies that nominal wage would adjust so that making *aggregate* demand equal to *aggregate* supply of labor. The RER would affect the composition of aggregate demand for labor. A rise in the RER would lead to a reallocation of labor from the

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[8] This section draws on Dornbusch (1980).

[9] It is assumed that the substitution effect is greater than the income effect in the demand for traded goods.

non-tradable to the tradable sector. Accordingly, this would imply a rise in tradable production proportionally matched with a fall in non-tradable output. In other words, the economy would always move along the production possibilities curve.

Given that the model has three markets, we know from Walras' law that the general equilibrium would be achieved when traded and non-traded good markets are in equilibrium. Thus, we can ignore the formal analysis of the labor market and focus on the other two. The equilibrium in the traded goods market requires that demand and supply coincide. This implies that the sum of local and foreign tradable production should be equal to the sum of local and external demand for those goods. This equilibrium condition is represented by equation 4.6, where M and X represent domestic imports and exports, respectively.

$$Y_T + M = A_T + X \tag{4.6}$$

The general equilibrium of the model additionally requires a condition of external balance or equilibrium, defined as a balanced trade ($X = M$). When this condition is included, equation 4.6 simply requires that local production and absorption of traded goods should be equal:

$$Y_T(e_i) = A_T(e_i, Y) \tag{4.7}$$

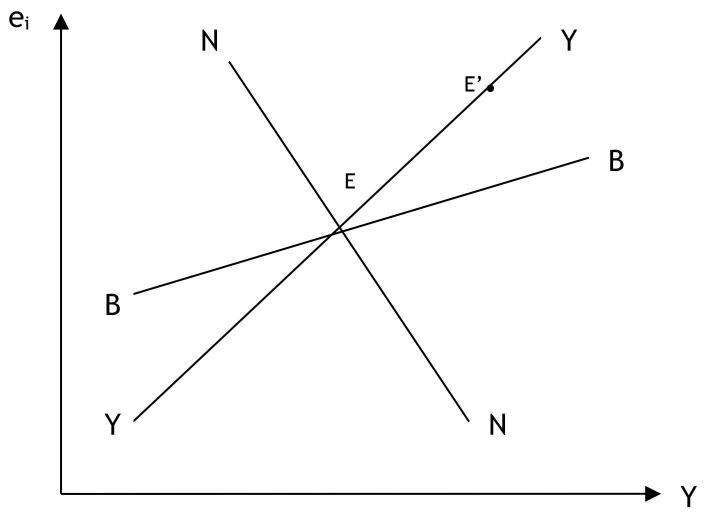
Since by definition non-traded goods cannot be exported or imported, the equilibrium condition for this market simply requires the equalization of local demand and supply:

$$Y_N(e_i) = A_N(e_i, Y) \tag{4.8}$$

Therefore, ignoring labor market because of Walras' law, the model has three endogenous variables: tradable and non-tradable output and the relative price between them (Y_T, Y_N and e). The equilibrium values of these variables are obtained by solving conditions 4.7-4.8 and the identity 4.5.

The system can also be represented diagrammatically, as in Graph 1. The YY curve derives from 4.5 and illustrates the fact that output in terms of non-traded goods increases with RER depreciations. Since a depreciation implies a transfer of resources from the non-tradable sector to the tradable keeping the economy at full employment, YY slopes up because of the valuation effect on the tradable production. The BB curve represents the combination of Y and e that maintain the external equilibrium. It is upward sloping because an increase in the income generates an excess demand for tradables, which should compensated by a depreciation of the RER. Finally, the NN curve represents equilibrium in the market for non-traded goods. It has a negative slope because an excess demand generated by an increase the income level is offset by a RER appreciation (increases non-tradable output and decreases demand for non-tradables).

Graph 1



The analysis of a disequilibrium situation will illustrate the role of the RER in the adjustment mechanism of the model. Assume an initial equilibrium, which is altered by a change in domestic agents' preferences in favour of non-traded goods. The initial situation is represented by point E' in Graph 1. In E' there would be an excess demand for non-traded goods equivalent to an excess supply in the traded goods market (i.e. trade surplus). Since prices are completely flexible, the price of tradables would fall and the price of non-tradables would rise. The resulting RER appreciation would make tradable output contract, while non-tradable production would increase. At the same time, the change in the relative price would moderate the demand for non-traded goods in favour of tradables. The new equilibrium – represented by point E- would show a more appreciated RER and lower income level in terms of non-traded goods.

One peculiar aspect of this model deserves to be mentioned. The full employment assumption implies that prices adjust to clear disequilibrium situations. However, if unemployment is allowed, excess supply or demand situations would not necessarily adjust through prices, but through quantities. Thus, if market disequilibrium clears through output adjustment, the RER may no longer be considered as an equilibrium variable. RER may be set exogenously, at least till full employment is achieved.

4.2. The general open economy Keynesian model

We present here a modify version of the Salter-Swan model, in which traditional elasticities and absorption approaches are presented in a unified framework. It is assumed that the home economy produces a composite good, which is an imperfect substitute for foreign goods. Domestic prices are fixed, making goods adjust through output. The real exchange rate is defined as an external RER. Since domestic and foreign prices are given, *variations* in the nominal and real exchange rates are the same. To simplify the exposition, we assume that both domestic and foreign prices are normalized to the unity. In such a setting, the *levels* of the nominal and real exchange rates coincide:

$$E = e \tag{4.9}$$

As the competitiveness of local production *vis a vis* foreign production increases with the RER, exports are postulated as an increasing function of the RER. For the same reason, imports decrease with the RER. Imports also vary with home aggregate income. Assuming that Marshall-Lerner condition holds[10], a real depreciation improves the balance of trade (TB). Equation 4.9 sets the external equilibrium condition.

$$TB = X(e) - M(Y,e) = 0 \qquad \partial TB/\partial e > 0,\ \partial M/\partial Y > 0 \tag{4.10}$$

As this is any Keynesian model, output is demand determined. Domestic absorption (A) and net exports are the two components of aggregate demand. The former depends positively on home income; with a marginal propensity to spend (the marginal propensity to consume plus the marginal propensity to invest) lower than 1. Domestic absorption is also affected by the behaviour of the RER. The RER may impact domestic absorption through many channels. Contractionary effects of RER depreciations are well documented in the literature, especially for the developing world (Frankel, 2005). Since the present model omits the effects of stocks, it would make little sense to consider contractionary effects arising from debt denominated in foreign currency. On the contrary, *flows* effects such as those arising from income redistribution from workers to capitalists or from private to public sector or from the existence of trade deficits as in Krugman and Taylor (1978) seem more appropriate in this context. However, since the relationship between domestic absorption and the RER is not central for this study, we will follow the conventional textbook-approach and consider that they are positively related.

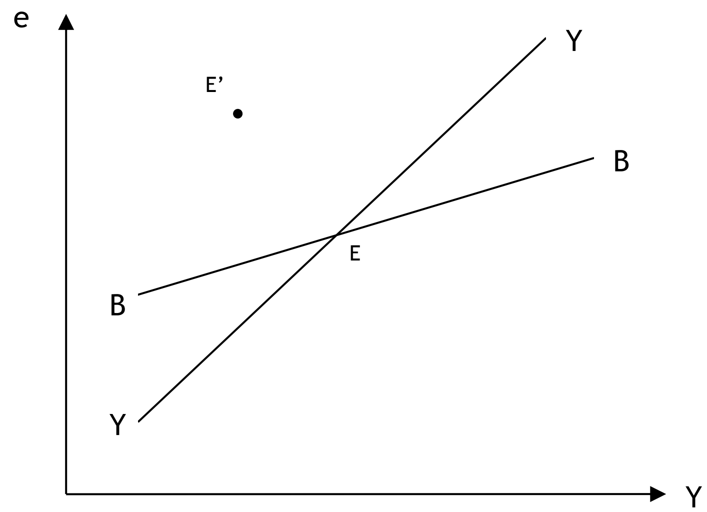
$$Y = A(Y,e) + TB(Y,e) \qquad \partial A/\partial Y > 0,\ \partial A/\partial e > 0 \tag{4.11}$$

The system of equations (4.10) and (4.11) define the model, which determines the equilibrium values for *Y* and *e*. The system can be

[10] This assumption will hold along the paper.

represented graphically by two curves derived from these equations as in Graph 2. The BB curve represents the combinations of *Y* and *e* that maintain the trade balance in equilibrium. The positive slope derives from the assumption that Marshall-Lerner condition holds: an increase in income generates a deficits which can be cancelled out by a real depreciation. The YY curve shows the *Y* and *e* locus for the goods markets or internal equilibrium. Given our assumptions, this curve also has positive slope. The BB curve has a flatter slope than the YY curve to guarantee the stability of the general equilibrium. The intersection of the curves gives the equilibrium values for the RER and income.

Graph 2



Again, assume a disequilibrium situation to see the role of the RER in the adjustment process. Point E' represents a trade surplus and an excess demand for domestic goods. The dynamic behaviour assumptions typically postulate that the former would adjust through a RER appreciation. Since the foreign exchange proceeds from exports are higher than the imports needs, the nominal and real exchange rate would appreciate. The adjustment in the goods market is the typical Keynesian type: an excess demand clears through output expansion. The new equilibrium is represented by point E.

4.3. Remarks

The two models presented in this subsection differ in a number of issues. While the T-NT model defines the real exchange rate as an internal RER and assumes full employment, the simple Keynesian model focuses on the external RER and assumes unemployment. Despite these differences, both models share the mechanism through which the RER is determined. We analyse this feature below.

There are three absolute prices in the T-NT model: the nominal wage rate (W) and the traded and non-traded good prices (P_T and P_N). Since W adjusts to clear the labor market, full employment is guaranteed. Therefore, the relevant issue addressed by the model is not the determination of aggregate production level, but its composition. The relative price between goods (i.e. the internal RER) is the key variable in that respect. Since the labor market is dichotomized from the other two, traded and non-traded goods markets reach equilibrium simultaneously. As shown above, the RER varies so that to achieve that simultaneous equilibrium, by equalizing demand and supply in each market. Given that traded goods market equilibrium is represented as a balanced trade, this condition guarantees the simultaneous equilibrium in both markets.

Although it is not an explicit assumption of the T-NT model, assume that the PPP holds for traded goods ($P_T = EP_T^*$). Since in the dependent economy version foreign prices are fixed, we can set $P_T^* = 1$ for simplicity. If we additionally use non-traded goods as numeraire ($P_T = 1$), absolute prices would be expressed in terms of non-traded goods. For instance, E_N would measures the units of foreign currency per unit of non-traded goods. With these assumptions, the internal RER would be defined as follow:

$$e_i = E_N \qquad (4.12)$$

Two interesting results can be drawn from our interpretation of the T-NT model: 1) the equilibrium RER results from the trade balance equilibrium and 2) the RER is equivalent to the exchange rate between the foreign currency and the non-traded good. In a world without international trade of assets –as assumed in the models reviewed in this subsection- foreign currency is only useful to undertake international trade transactions. In other words, foreign currency is not able to perform the function of storage of value; it only serves as medium of exchange. In such a context, the proceeds from exports are equivalent to the supply of foreign currency, and imports needs to the demand for foreign money. A trade surplus implies an excess supply of foreign currency, which generates an appreciation in the nominal exchange rate (E_N) equivalent to the appreciation in the RER (e_i). On the contrary, a trade deficit implies an excess demand for foreign currency, generating a depreciation trend in the nominal and real exchange rate.

Equations 4.9 and 4.10 in the simple Keynesian model also establish that 1) the equilibrium RER is determined by trade balance and 2) the RER is equivalent to the nominal exchange rate. Therefore, the above interpretation is applicable to this model as well. Our conclusion seems clear: in both models the foreign exchange market behaviour plays a key role in the RER determination. The RER –through the nominal exchange rate- adjusts in order to reach trade balance equilibrium. A trade deficit (surplus) implies an excess demand for (supply of) foreign currency, which generates a nominal depreciation (appreciation) that corrects the disequilibrium through an equivalent RER depreciation (appreciation). In other words, under our view the equilibrium RER in these models is a market-clearing variable.

Certainly, the link between nominal and real exchange rates is no longer valid in the case of fixed exchange rate regimes. However, the role of the foreign exchange market still plays a key role in the RER determination. Consider a trade imbalance leaving the foreign exchange market in disequilibrium under a fixed exchange rate regime. In the T-NT model, the excess supply of (demand for) foreign currency would imply a monetary expansion (contraction). The effects of changes in the money supply are not specified in this model. Given the full-employment nature of this model, it seems reasonable to assume that the some version of the quantitative theory of money holds. Since prices are fully flexible, the expansion of money supply would make the non-traded good price rise (fall). The domestic traded good price would not change because both the nominal exchange rate and the foreign traded good price are given. In other words, through a Humean price-specie-flow mechanism the RER would appreciate (depreciate) through the behaviour of the foreign exchange market. The market-clearing properties still hold.

In the Keynesian model when the nominal exchange rate is fixed the RER is also fixed because prices are sticky. For this model consider that the initial equilibrium is altered by a fiscal expansion. This would result in a situation with higher output level and trade deficit. The excess demand for foreign currency would imply a loss of international reserves and a monetary contraction. As in the T-NT model, in this one the effects of money supply changes are not modelled either. Thus, let us evaluate this case through the IS-LM-BP model with capital account inconvertibility, which is identical to the Keynesian model but it also incorporates the money market behaviour. In such a setting, this situation would lead to rise in the interest rate and a contraction of economic activity back to the original equilibrium. The conclusion is straightforward: the working of the foreign exchange market made the economy return to the equilibrium compatible with the fixed RER. True, since the RER is fixed it cannot move to clear the foreign exchange market. However, through the variation in output level, the system returned to the unique equilibrium compatible with the fixed RER. In that sense, the fixed RER is also a market-clearing equilibrium RER.

5. Models with capital mobility

In this section, we analyze the determination of the RER in models that also consider the influence of international transaction of assets in the macroeconomic equilibrium. We begin with a brief discussion of the monetary approach to balance of payment, in which the RER is assumed determined by the PPP. In section 5.2, we discuss the Mundell-Fleming (MF) model. One important result of this model is that countries can reach equilibrium with current account imbalances. This aspect has been criticized from two different perspectives. First, it has been argued that MF neglects the effect of changes in resident's wealth arising from current account imbalances. Since a current account deficit (surplus) implies a fall (increase) in the country net foreign asset position, the consequent changes in wealth should affect the macroeconomic equilibrium. The family of portfolio balance models, synthesized in section 5.3, incorporates those effects. The second criticism points to the omission of intertemporal considerations of current account imbalances. In section 5.4, we sketch a simple version of the intertemporal approach to current account and the way RER is determined under that framework.

5.1. The Monetary Approach to Balance of Payments

As discussed above, although with different interpretations and predictions, PPP is seen as a theory of RER determination in its own right. However, PPP has also been used as a building part of many influential open economy macroeconomic models, particularly those following the monetary approach tradition. Since in these models the RER is determined by PPP, we are not interested in a detailed analysis of them, but just in pointing some of their conclusions. Besides, the monetary approach can be seen as a bridge between current account and capital account models.

As it is well known, the main argument of the monetary approach is that the balance of payment is essentially a monetary phenomenon. The money market would reflect balance of payment imbalances only if it is assumed that the monetary authority does not perform sterilization operations. Another usual assumption is that tradable goods are homogenous and therefore that PPP holds.[11] A necessary condition for that to happen is that prices are flexible. Price flexibility has been introduced in the model with the assumption of full employment or simply exogenous output level. Since the major currency started to float in mid seventies, the monetary approach has been widely used as a theory of nominal exchange rate determination. One equation describing the behaviour of assets market was incorporated. The assumption in this case has been that domestic and foreign bonds are

[11] Caves, Frankel and Jones (2002) point that the monetary approach is characterized only by the assumption of non-sterilization, while (global) monetarist model assumes perfect price flexibility. Since these differences are not relevant for the present discussion, we will treat both approaches as being the same.

perfect substitutes and therefore that the UIP holds. With these assumptions (i.e. nonsterilization, PPP, full employment or exogenous output and UIP), two versions of the model have been widely recognized. The key difference between them is the speed at which prices adjust when the goods market is in disequilibrium.

In the flex-price version, prices adjust immediately (or at similar speed as the asset market) and therefore PPP holds permanently. Under a fixed exchange rate regime, the model determines the level or rate of variation of money supply. On the contrary, the model predicts the level or rate of variation of the nominal exchange rate (and domestic prices) under free floating regimes. Therefore, this model concludes that policy intervention is able to affect only nominal variables, while real variables are determined by the Walrasian general equilibrium system. Since, the RER is conceived as the exchange rate between identical goods, it cannot be different from the unity (i.e. absolute PPP) or a constant if frictions hampering international trade (transportation costs, tariffs, etc.) are considered (i.e. relative PPP).

Dornbusch (1976) modified the above setting by assuming that goods market adjusts slowly due to the existence of sticky prices. Since prices are fixed in the short-run and assets market adjusts instantaneously through the UIP condition, unanticipated monetary expansions generate a fall in the domestic interest rate and an appreciation trend in the exchange rate. Given that private agents know that RER is determined by the PPP, the exchange rate jumps (i.e. overshoots) allowing the UIP to hold permanently while domestic prices adjust. Importantly for the present discussion, throughout the price adjustment the RER deviates from its PPP level. Therefore, in the fixed-price monetary model public intervention can move the RER away from its PPP level only temporarily.

It is worth noticing that both flex-price and fix-price versions of the monetary model assume the traditional (arbitrage) view of the PPP. In the former, the RER is always in equilibrium, while in the latter the RER tends to equilibrium after shocks (i.e. it is a mean-stationary or mean-reverting variable).

5.2. The Mundell-Fleming model

The open economy version of the traditional IS-LM model is probably the most popular open macro-model. The IS-LM-BP model considers a variety of cases ranging from null to full capital mobility (Young and Darity, 2004). We focus here in the free capital mobility case: the Mundell-Fleming model. The small economy version assumes that the home economy exports a good, which is imperfectly substitute to the one that imports. The goods market adjusts in the Keynesian way, namely through the variation of output since prices are considered fixed. Hence, contrarily to the monetary approach, in the MF model, goods are imperfect subsitutes, prices are fixed and output is not at full employment. Consequently, as in the Keynesian model for the current account summarized in the previous section, nominal and (external) real exchange rate can be considered the same ($E = e$). Goods market equilibrium condition is represented through the IS relation:

$$Y = A(e, Y, i) + TB(Y, e) \qquad \partial A/\partial i < 0 \tag{5.1}$$

Equation 5.1 represents the goods market equilibrium virtually in the same way as in the general Keynesian model (equation 4.11), except for the fact that the interest rate now is incorporated in the model and affects negatively the domestic absorption. The rest of the variables still behave in the same fashion that in the general Keynesian model for the current account.

The home economy issues money and a bond. The latter is a perfect substitute for the one issued by the rest of the world. There is no substitution between local and foreign currencies. The implicit assumption that agents keep their nominal wealth in local currency or bonds implies that both markets are in equilibrium only if one of them is in equilibrium. Thus, by Walras' law, domestic asset markets equilibrium is represented just by the money market equilibrium condition contained in the LM relation:[12]

$$M = L(i, Y) \qquad \partial L/\partial i < 0 \;\; \partial L/\partial Y > 0 \tag{5.2}$$

In this simple version, the money supply (M) is defined as the non-remunerative liability of the central bank. The demand for money is affected by real income and the interest rate, indicating the demand for money for transaction motive and the opportunity cost of holding money.

Equations 5.1 and 5.2 provide the internal equilibrium, almost identical to the one in the IS-LM for a closed economy, except for the introduction of net exports. The determination of external balance depends on the behavior of both current and capital account. Since bonds are perfect substitutes, the free capital mobility assumption implies that the external balance condition is represented by the UIP.[13] In the small economy context, the UIP can be interpreted as the existence of an infinitely elastic supply/demand of international credit at a given (foreign) interest rate. In such a context, the behavior of the current account is not relevant; it is swamped by the capital account result. The UIP condition is therefore the third equation of the model.

$$i = i^* + \hat{E}^E \tag{5.3}$$

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[12] For simplicity, it is assumed that $P = P^* = 1$

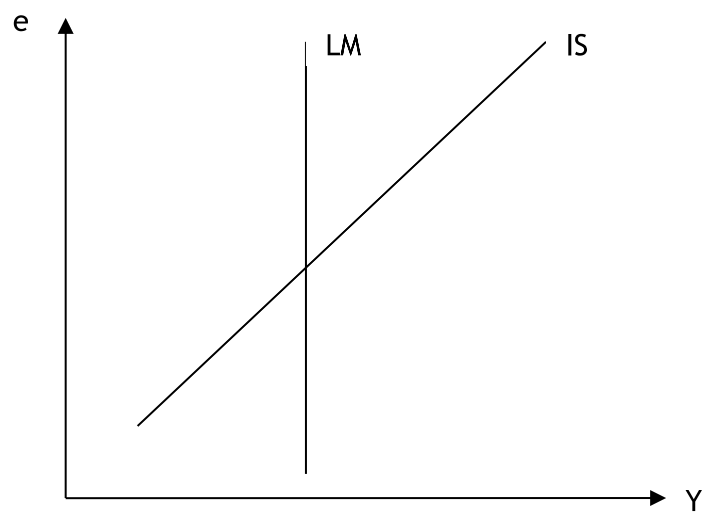
[13] To avoid any confusion, we are following the standard definition of perfect capital mobility, namely the combination of perfect substitution in assets and instantaneous adjustment (i.e. free capital mobility). See, for instance, Dornbusch (1980), chapter 10.

The original and many subsequent versions of the MF assume static expectation, which makes the last term of the right-hand side equal to zero ($\hat{E}^E = 0$). Some modern presentations, on the contrary, present the model under the rational expectation-perfect foresight paradigm to describe the behavior of exchange rate expectations (see Sarno and Taylor, 2002 and Blanchard, 2006). Since the conclusions of this section are not altered by any of these modeling strategies, we will follow the simpler case of static expectations. In that setting, the interest rate equals the international interest rate exogenously set by the foreign central bank:

$$i = i^* \qquad (5.4)$$

Plugging equation 5.4 into equations 5.1 and 5.2, the model is reduced to a system of two equations and two unknowns: Y and e. The equilibrium conditions are represented in Graph 3. The IS schedule is upward sloping because an increase in the output level generates an excess supply of goods (given the propensity to spend lower than the unity) and therefore a RER depreciation increases aggregate demand to reach equilibrium. The LM schedule is vertical because for a given foreign interest rate there is only one level of income which guarantees the money market equilibrium.

Graph 3



Comparative static exercises show that the RER would adjust to reach goods and money market (internal) equilibrium. For instance, an expansionary fiscal policy would result in a RER appreciation with no change in the output level. The change in the relative price is the mechanism through which the increase in government spending crowds out net exports and private domestic absorption. Aggregate demand and output level remain unchanged. Graphically this is represented by a shift of the IS curve to the right. On the contrary, a monetary expansion moves the LM to the right, illustrating the RER depreciation and the increase in income that result in the new equilibrium. The injection of liquidity by the central bank generates an *incipient* reduction in the domestic interest rate triggering a massive capital outflow. The consequent RER depreciation increases the aggregate demand and output.

Notice that if in both comparative exercises the initial situation was characterized by a balanced trade (or current account) the resulting new equilibriums would show trade balance (or current account) deficits.[14] Two aspects are worth highlighting. First, the MF model predicts that an economy is in equilibrium with a current account deficit. Since a current account deficit/surplus implies a fall/increase in the country net foreign asset position, it is clear that the MF neglects the effects of changes in wealth on the macroeconomic equilibrium. The portfolio balance approach reviewed in the next subsection considers these effects.

The second aspect is that the MF model provides a picture in which the behaviors of the RER and the trade balance/current account are delinked. The RER simply adjusts in order to achieve internal equilibrium, affecting both the level and composition of the aggregate spending. However, it plays no role in the determination of the external equilibrium. This is at odds with the predictions of the models reviewed in the previous section, in which the RER adjusts to balance the external accounts (i.e. to clear the foreign exchange market). Equilibrium RER was the one that achieve external equilibrium (i.e. foreign market equilibrium). Since the RER does not perform the role of clearing any market, nor there is a unique "attractor" value (as in the traditional PPP), it remains unclear whether it makes sense to consider the RER in the MF as an equilibrium variable.

5.3. The Portfolio Balance Model

Differently to the models reviewed so far, under the portfolio balance approach nominal exchange rate is interpreted as an asset price; consequently its determination depends on stock rather than flow variables. There are two distinguishing features of this model. First, it is the assumption that domestic and foreign bonds are imperfect -rather than perfect- substitutes. Consequently, the UIP does not hold because there is also a risk premium (γ) that introduces a wedge between the return of both assets.[15] Formally, the modified parity condition is expressed by the following equation:

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[14] In fact, the monetary expansion would result in a deficit only if the trade balance is affected more by the output expansion than by the RER depreciation.

[15] The existence of risk premium requires the following assumptions: 1) the risk of holding domestic and foreign bonds differs, 2) investors are risk adverse and 3) they cannot hold the risk minimizing portfolio and thus they ask for a risk premium to compensate the additional risk of their actual portfolio.

$$i = i^{*} + \hat{E}^{E} + \gamma \qquad (5.5)$$

The second key feature of the portfolio balance model is that it takes into account the effects of current account imbalances. Current account imbalances generate changes in the net external asset position (or net external debt) of the home country. A current account surplus implies external asset accumulation (or external debt reduction) and vice versa with a deficit. As shown above, the general equilibrium in the Mundell-Fleming does not require a balanced current account, ignoring the effects of wealth variations in the macroeconomic adjustment.

Usual presentations of the portfolio balance model divide the adjustment mechanism in two periods. In the short run, asset price (i.e. interest rate and exchange rate) are determined in a context of free capital mobility by assets demand and supply functions. These variables in turn have some real effect on flow variables, typically the current account, leading to changes in the stock variables (net external asset position) that ultimately affect long run level of the interest rate and the exchange rate. A simple formal presentation of the model is as follow.

There are three assets in the small open economy: money *M*, domestic public bonds *B*, and foreign bonds *F* (denominated in foreign currency)[16]. In the short run, there is a fixed net supply of domestic and foreign bonds, which are held by the private sector and the central bank (designed by the subscript *p* and *cb*, respectively). Additionally, the money supply (monetary base) is defined as the sum of domestic and foreign bonds held by the central bank. These relations are described in the following equations:

$$\bar{B} = B_{p} + B_{cb} \qquad (5.6)$$

$$\bar{F} = F_{p} + F_{cb} \qquad (5.7)$$

$$M = B_{cb} + EF_{cb} \qquad (5.8)$$

Total financial wealth of domestic private sector is given by the following identity:

$$W = M + B_{p} + EF_{p} = B_{cb} + EF_{cb} + B_{p} + EF_{p} = \bar{B} + E\bar{F} \qquad (5.9)$$

---

[16] In this context, the term "bonds" should not to be interpreted as asset for the holder. Since the home economy could easily be a net debtor *F* can take negative values. This could happen when a country have run current account deficits in the past. A similar caveat *a priori* applies for the public bonds, although it seems no realistic to assume a private sector being net debtor of the government. For simplicity, we will assume that both *B* and *F* take non-negative values. I am indebted with Mario Damill for alerting me about this point.

The next step is to define how private sector allocates its financial wealth. Assuming static expectations ($\hat{E}^E = 0$) and neglecting capital gains for holding assets, the imperfect substitution assumption implies that the demand functions depend on domestic and foreign interest rates. They are defined as homogenous of degree one in nominal financial wealth, *W*. Asset markets equilibrium are described in the following system of equations:[17]

$$M = m(i,i^*)W \qquad m_i < 0, \quad m_{i^*} < 0 \qquad (5.10)$$

$$B_p = b(i,i^*)W \qquad b_i > 0, \quad b_{i^*} < 0 \qquad (5.11)$$

$$EF_p = f(i,i^*)W \qquad f_i < 0, \quad f_{i^*} > 0 \qquad (5.12)$$

Asset markets equilibrium conditions 5.10-5.12 are illustrated in Graph 4. They determine nominal exchange rate and domestic interest rate.[18] Money market equilibrium is represented by the ME schedule. It slopes up because exchange rate depreciations increase nominal wealth[19] and therefore the demand for money, which can be offset by an increase in the interest rate. Exactly the inverse happens with the domestic bonds market, represented by the schedule BE. It has a negative slope because an increase in the demand for bonds generated by a rise in *E* generates a rise bonds prices and therefore a fall in the interest rate. Finally, the foreign bonds market equilibrium is illustrated by the FE schedule. The negative slope derives from the fact that a higher interest rate would generate a substitution from foreign bonds to domestic assets making the exchange rate appreciate. The FE schedule is flatter than the BE schedule under the assumption that a change in the domestic interest rate has a greater effect on domestic bond demand than on foreign bond demand. This feature guarantees the stability properties of the equilibrium.

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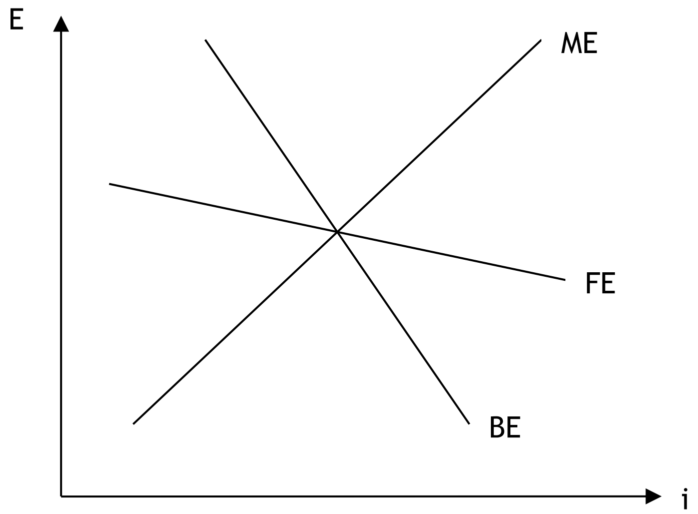
[17] Partial derivatives are indicated by the respective subscripts.

[18] The three asset market equilibrium conditions determine only two endogenous variables because only two of these conditions are independent. This occurs because the total wealth identity makes the Walras' law operate for the assets markets.

[19] In the case of the Graph 5, we are strictly assuming that F>0, so that a nominal exchange rate depreciation (appreciation) leads to a rise (fall) in nominal wealth.

Graph 5



Without significantly altering the conclusions, the goods market can be represented in two different ways: 1) with one composite good or 2) with two goods (tradable and non-tradable). We follow the second alternative as presented in Hallwood and MacDonald (2000).[20] Equations 5.13-5.17 describe the real sector of the economy similarly as in the T-NT model. The real exchange rate is the internal RER, although in this case the LOP is explicitly assumed to hold for traded goods. Domestic absorption of traded (non-traded) goods depends negatively (positively) on the RER. Both increase with real wealth (w). Output in the tradable (non-tradable) sector increases (decreases) with the RER.

$$e_i = \frac{EP_T^*}{P_N} \tag{5.13}$$

$$A_T = A_T(w, e_i), \qquad \partial A_T / \partial w > 0 \text{ and } \partial A_T / \partial e_i < 0 \tag{5.14}$$

$$A_N = A_N(w, e_i), \qquad \partial A_N / \partial w > 0 \text{ and } \partial A_N / \partial e_i > 0 \tag{5.15}$$

$$Y_T = Y_T(e_i), \qquad \partial Y_T / \partial e_i > 0 \tag{5.16}$$

$$Y_N = Y_N(e_i), \qquad \partial Y_N / \partial e_i < 0 \tag{5.17}$$

The aggregate price level is geometric weight average of tradable and non-tradable prices, with weight α for non-tradables. Real variables, such as real wealth (w), are the nominal magnitudes deflated by the price level.

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[20] Sarno and Taylor (2002) present the model with one good and with adjustment mechanism in the gods and asset markets *alla* Dornbusch (1976).

$$P = P_N^{\alpha}(EP_T^*)^{1-\alpha} \qquad (5.18)$$

$$w = \frac{W}{P} = \frac{M + B_P + EF_P}{P} \qquad (5.19)$$

As in the T-NT model, it is assumed that the economy operates at full employment and that prices are fully flexible. Since by definition non-traded goods can only be consumed in the home country, the full price flexibility assumption guarantees a continuous equilibrium.

$$Y_N(e_i) = A_N(w, e_i) \qquad (5.20)$$

The second equilibrium condition for the real sector is a balanced current account. The rationale is as follows. Assuming that taxes to private sector capture the interest earnings coming from the domestic public bonds holdings and given that non-traded goods markets is continuously in equilibrium, private sector surplus (S) is equal to current account result[21].

$$S = CA = Y_T(e_i) - A_T(e_i, w) + i^* EF_p \qquad (5.21)$$

If we define a desired level of real wealth ($\overline{w}$), it should be expected that private sector will run a current account surplus (deficit) if the current level of real wealth is below (above) that target. In equilibrium, actual and desired level of real wealth would be equal and the current account would be balanced. The surplus generating behavior of private sector is represented by the following equation:

$$S = \beta(\overline{w} - w) \qquad \beta > 0 \qquad (5.22)$$

Therefore, the balanced current account condition derives from the notion that there is an optimal or desired level of real wealth; once it is reached there is no tendency of the system to move away from equilibrium.[22]

How is the real exchange rate determined in this model? As mentioned above, the nominal exchange rate is determined jointly with the interest rate by the asset market equilibrium conditions. Consider, for instance, a monetary expansion through an open market operation ($dM = -dB_p$) that moves the system away from the initial equilibrium. Assume for simplicity that in the original equilibrium private sector foreign asset holdings were nil. The open market operation would move the ME schedule upwards and

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[21] We assume that investment is just to restore capital depreciation and that physical wealth (i.e. machines) is at its steady state or equilibrium value.

[22] Other textbooks as Sarno and Taylor (2002) and Gandolfo (2000) do not refer to desired targets of real wealth, but simply state a balanced current account as equilibrium condition, arguing that that is required for the steady state properties of the system. The authorized work by Branson and Henderson (1985) follows a similar strategy.

the BE schedule to the left. Asset markets would adjust immediately, reaching a short-run equilibrium with a higher nominal exchange rate and a lower domestic interest rate. The jump in the exchange rate would have a less than proportional effect on aggregate domestic price level, leading to real exchange rate depreciation. Assuming certain reasonable values for the parameters[23], the rise in the nominal exchange rate would also result in a reduction of the real wealth, below the desired level. In order to restore real wealth up to the initial value, the economy would need to start running a current account surplus. This would be possible since the real exchange rate depreciation would make traded goods production and consumption switch so that generating a trade balance surplus. While restoring the real wealth up to the desired target, the excess supply of traded goods (i.e. excess demand of non-traded goods) would make the real exchange rate initiate an appreciation trend. This adjustment process is similar to that in the T-NT model. There is, however, a difference. In this model the real exchange rate would not stop appreciating when the trade balance reaches equilibrium again. Domestic private sector is also earning interest payments derived from the accumulation of foreign assets during this process. The adjustment would stop when current account is balanced, with a trade balance deficit equal to the interest earnings ($A_T - Y_T = i^* EF_p$). In the long-run equilibrium, the RER would be lower than the one at initial equilibrium. This is a direct result from the foreign asset accumulation.

It is worth noticing that the stock flow consistency nature of this model implies a key difference with respect to the T-NT model. The external equilibrium condition is a current account –instead of trade- balanced. However, despite this relevant difference, in both models the equilibrium RER is the one that balances the external accounts (i.e. foreign asset market). Therefore, equilibrium RER in the portfolio balance model is also a market-clearing variable.

5.4. The intertemporal approach to balance of payments

As traditionally emphasized by the absorption approach, we know from national accounting that the current account is domestic income less absorption or national saving less investment. With this implication in mind, modern new open economy macroeconomics has build models where gaps between national saving and investment, and hence current account deficit or surplus, appear as intertemporal decisions. The main insight of this novel approach is that those decisions are based on forward-looking considerations. Current decisions are made by agents that can anticipate future events through rational expectations. These models are built with explicit individual optimal choice microeconomic foundations, typically

[23] It is generally required that the proportion of wealth maintain in the form of foreign assets is lower than the share of traded good prices in the aggregate index ($f < 1-\alpha$). This condition holds in this case, since $f = 0$.

through a unique representative agent. Following Gandolfo (2001), we present here a very simple two-period version of the standard intertemporal approach model.

Assume a logarithmic Cobb-Douglas utility function, with the property of being time separable (i.e. the utility in each period only depends on that period's consumption).

$$U = (1-\alpha)\ln C_t^T + \alpha \ln C_t^N + \frac{(1-\alpha)}{(1+\rho)}\ln C_{t+1}^T + \frac{\alpha}{(1+\rho)}\ln C_{t+1}^N \qquad (5.23)$$

Where α is the weigh for non-tradable goods, ρ is the individual rate of time preference, and therefore $(1+\rho)^{-1}$ is the subjective factor. The representative agent maximizes her utility subject to the following budget constraint.

$$\frac{E_{t+1}P_{t+1}^{*}C_{t+1}^{T}}{(1+i)} + E_t P_t^{*} C_t^T = \frac{E_{t+1}P_{t+1}^{*}Y_{t+1}^{T}}{(1+i)} + E_t P_t^{*} Y_t^T \equiv Y_p^T \qquad (5.24)$$

$$P_t^N C_t^N = P_t^N Y_t^N \qquad (5.25)$$

$$P_{t+1}^N C_{t+1}^N = P_{t+1}^N Y_{t+1}^N \qquad (5.26)$$

The first equation indicates that the present value of consumption in tradable goods should be equal to the present value of tradable output (Y_p^T). The interest rate i is exogenously determined in the international market at which the domestic economy has unlimited access. The law of one price applies for the tradable goods. To make the model as simple as possible, we assume that consumption smoothing in non-tradable goods is not an option. We omit government spending in both markets.

Forming the Lagrangian, obtaining the first order conditions and doing a little algebraic manipulation, we get two important relations:

$$E_t P_t^{*} C_t^T = \beta Y_p^T, \quad \beta \equiv \left(1 + \frac{1}{1+\rho}\right)^{-1} \qquad (5.27)$$

$$\frac{P_t^N C_t^N}{E_t P_t^{*} C_t^T} = \frac{\alpha}{1-\alpha} \qquad (5.28)$$

The first expression shows that the representative agent maximizes her utility by smoothing tradable goods consumption: the spending on tradable goods in each moment t is equal to the permanent income in tradable goods (βY_p^T). Any discrepancy between current and permanent income in tradable goods would imply a current account imbalance and therefore a change in domestic agent's net foreign asset position. The second equation delivers a common result in Cobb-Douglas logarithmic utility functions, namely that the share of non-tradable and tradable goods in total consumption is equal.

From equations 5.27 and 5.28, we obtain the basic expression for the real exchange rate derived from this model:

$$e_i = \left(\frac{1-\alpha}{\alpha}\right)\frac{E_t P_t^* Y_t^N}{\beta Y_p^T} \tag{5.29}$$

The latter indicates that the (internal) real exchange rate depends on the relative evolution of non-tradable and tradable output. Since this is a simple presentation, output in both sectors has been assumed exogenous. In a more elaborated model, output would be determined by the parameters defining the production functions. The real exchange rate is also determined by parameters affecting the representative agent's preferences, particularly α and ρ. As it can be seen, the intertemporal approach to current account predicts that the real exchange rate is determined by parameters affecting both production and preferences. This result is line with neoclassical theory in which the determination of real variables can be traced back to the "deep" parameters explaining demand and supply behaviors. In this case, the underlying optimization process is done by agents with substantial cognitive capacities, who are able to anticipate future events with high precision. As a result, the RER in this framework is seen as optimal and no concept of overvalued RER leading to unsustainable current account deficit is involved.

5.5 Remaks

In this section, we showed that in the MF model equilibrium can be achieved with a current account imbalance. Since under perfect capital mobility there is a perfectly elastic international demand/supply of capital, there is no need for correcting forces to equilibrate the current account. The model implicitly assumes that international capital market can provide or absorb the required funds to sustain current account disequilibrium. On the contrary, in the portfolio balance approach current account imbalances are corrected in the *long run* through the RER adjustment. The RER tends to appreciate (depreciate) when there is current account surplus (deficit). It is important to notice that this adjustment mechanism is similar to those implied in the current account models of section 4. In the adjustment process of the portfolio balance model, the current account surpluses (deficits) correspond to excess supply of (demand for) foreign assets. Therefore, the equilibrating role of the RER is obtained through the movements of the nominal exchange rate. The only difference is that in this model the behavior of the foreign asset market corresponds to the situation in the current account, instead of the trade balance. Such difference results from the effects of international asset accumulation arising from the fact that the portfolio approach deals with economies with opened capital accounts.

In the intertemporal approach model, the RER is determined by parameters affecting preferences and production. A key element in these models is that optimization is done by a representative agent with rational expectations. The resulting conclusion is that the value of the RER is always optimal. This framework neglects problems associated to aggregation and uncertainty and therefore offers little insights to address real world problems such as long-run volatility in the real exchanges rates, balance of payment crises, and unsustainable foreign debt paths.

6. Conclusions

The theories covered in this review are usually termed as fundamental-based models of RER determination, in the sense that there are macroeconomic forces and market conditions determining the equilibrium level of the RER. Even when this review points to the conceptual aspects of the theories, it is worth mentioning that empirical work on exchange rate determination systematically concludes that there is no fundamental model that performs well in econometric tests.[24] Certainly, "good" theories need not be disregarded because they are not performing well when exposed to data. Future research may provide supporting evidence and therefore reinforce their theoretical appeal. But, it is also likely that the poor empirical performance derives from the fact that theories (hypothesis) are missing relevant factors in their explanation. Along this review, we point to potential relevant aspects that each theory may be overlooking or just neglecting.

We emphasized that the PPP theory –in both the arbitrage and the efficiency markets version- relies on very restrictive (and questionable) assumptions. The efficient market version is questionable on all its fundamental assumptions. In the case of the traditional version, when assumptions are relaxed in order to consider real world conditions (i.e. varying transaction costs, imperfect information, non-homogeneous traded and non-traded goods, etc.) the predictions of the PPP not longer hold. International commodity arbitrage and trade under these relaxed assumptions would vaguely predict that the RER should not follow permanent appreciation or depreciation trends and should remain undetermined within a relatively large range of values. The reading of the PPP literature give one the sense that it is not always clear what are the equilibrating forces that researchers have in mind when presenting the

[24] Frankel and Rose (1995) is the classical reference in this regards. Although their analysis focuses on nominal exchange rate determination, their conclusion is also applicable to RER. The textbooks quoted in this review also emphasize the poor empirical performance of the models and provide a wide empirical literature review.

PPP. Our own feeling is that the empirical research on PPP has been rigorous only in defining the techniques for carrying the tests, but fuzzy in specifying the theoretical foundations and the definition of PPP. If by PPP it is meant international competitiveness (i.e. what we called "lax version of PPP), then this theory does not seem to offer a handy notion of equilibrium RER, but just provides an insight to predict the long-run tendency of the RER. In our view, evidence on RER time series behavior is consistent with these lax predictions. However, the economic profession seems to interpret those results as a validation of the purest version of the PPP (Taylor and Taylor, 2004).

The predictions of the Harrod-Balassa-Samuelson model refer to the long-run tendency of the RER exchange rate and say nothing regarding its level. Even when it could be questionable on the assumption of higher productivity growth in the traded goods sector, the logical argumentation looks solid. However, the (very) long run nature of the predictions certainly undermines its appealing as a general theory of RER determination. Besides, its explanatory power is not well established in the empirical research (Roggoff, 1996).

The Mundell-Fleming model seems a *rara avis* among the theories of RER determination reviewed in this paper. We showed that the RER resulting from this model is affected by policy variables (i.e. monetary and fiscal policies), and contributes to the determination of the internal equilibrium. However, it plays no role in the determination of external equilibrium. The fact that the *resulting* RER clears no market in the internal equilibrium and has no link with external equilibrium makes dubious the label of "equilibrium RER". Finally, the salient feature of the MF model consistent in that general equilibrium can be achieved when the current account is unbalanced undermines its appealing. We return to this issue below.

Our insight of the current account models of section 4 emphasizes the link between the trade balance result and foreign exchange market situation. The equilibrium RER adjusts to balance the trade account: trade deficits lead to RER depreciations and trade surpluses to RER appreciations. There is *a priori* no reason to expect that economic forces would move the RER in that direction. Trade imbalances simply reflex that the levels of domestic spending and income are different. Why should they be equal? The answer is simple: they have to be equal because international borrowing and lending are not feasible in an inconvertibility capital account setting. Thus, since foreign currency can only be held for international trade transaction purposes, trade surpluses (deficits) are equivalent to excess supply of (demand for) foreign currency. In a free floating regime, the nominal exchange rate (i.e. the domestic price of foreign currency) adjusts to clear the foreign exchange market. Therefore, the nominal exchange rate moves to make the RER adjust in the required direction to equilibrate trade.

The portfolio balance model presents an analogous picture. The key difference in this case is that trade and/or current account imbalances can be maintained because international financing is allowed (i.e. the capital account is open). Why does the model demand the current account to equilibrate in the *long-run*? Current account imbalances imply that domestic income and spending differ. This in turn implies that residents' net external asset position is changing over time. A *permanent* current account surplus would imply that domestic agents postpone consumption *indefinitely*. In turn, a *permanent* current account deficit would imply that domestic agents issue additional external debt *indefinitely*. In the first case, that kind of behavior does not seem *optimal*. It is hard to see the rationale of working to finance someone else's consumption. In the second case, the behavior seems not *sustainable*. One would probably like to consume above what one's income allows; the problem is to find someone willing to finance such a behavior.[25]

It seems reasonable therefore to ask a model an equilibrated current account as a *long run* condition, as in the portfolio balance model. The equilibrating mechanism is also made through the trade balance adjustment. For this to happen, the RER has to move in the right direction. It has to appreciate when the current account is in surplus, and to depreciate when there is a deficit. As in models of section 4, RER movements are also generated through changes in the nominal exchange rate. Since the current account surpluses (deficits) correspond to excess supply of (demand for) foreign assets, the nominal exchange rate tends to appreciate (depreciate) and thus generating a RER appreciation (depreciation). In other words, the equilibrating role of the RER to guarantee the *long-run* condition is made through the "right" movements of the nominal exchange rate.

We can summarize our interpretation of the implicit adjustment mechanism in the portfolio balance and in the current account models as follows. External imbalances require a correction. In closed capital account contexts, this correction should be done immediately. In open capital account contexts, the correction has to be done in the *long-run*. The correction needs are transmitted through the foreign exchange markets, which activates a price movement: a nominal exchange rate variation. This variable moves to modify the key relative price affecting the current account-trade balance behavior: the RER. The change in the RER corrects the original external imbalance. We find no flaw in this implicit logic. Why do these models perform poorly when exposed to data?

In the case of the models for the current account, this might happen because they do not consider the effects of capital account openness. Their explanatory power seems to have been reasonable good for the Bretton

[25] Although it is not relevant for the purpose of the present paper, the distinction between optimality and sustainability points to a key asymmetry between situations of current account surplus and deficit. We return to this point below.

Woods era[26], but not for the nowadays financial globalization context. The portfolio balance, on the contrary, is well equipped to analyze countries with capital account convertibility, but it still has not done well in the empirical tests.

Following Blecker (2004), we present a possible explanation for this failure. In the implicit adjustment process of the portfolio balance model, the capital account is the mirror of the current account: the same value but opposite sign. Capital account behavior is passive. We know, however, that one stylized fact of financial globalization is the growing autonomy of capital account transaction with no connection with current account operations. Capital account transactions certainly have an impact in the foreign exchange market. It is not difficult to imagine cases in which pure financial transactions may move the nominal exchange rate in the opposite direction to the one required by a current account imbalance. Therefore, it can easily happen that the RER shows for long periods no tendency toward current account adjustment, because of the influence of autonomous financial movements affecting the foreign exchange market in the "wrong" direction.

A second possible explanation does not rely on the autonomy of capital account transactions. Consider a case in which the capital account adjusts passively to the financial requirements of the current account. In this scenario there is always a capital account result matching the current account needs. If the current account imbalance remains unaltered, both the nominal and real exchange rates would also remain constant. This is the case described by the equilibrium situations in the Mundell-Fleming model. As mentioned above, the problem with this situation is that current account imbalances should be corrected in the *long-run*. In fact, the attacks to the Mundell-Fleming model are grounded on those principles (Obstfeld and Rogoff, 1995).

A key issue in this discussion is the concept of *long-run*. This term refers to the properties of equilibrium when it is conceived as a *permanent* situation. Because of the already mention reasons a long-run or permanent equilibrium cannot be consistent with a current account imbalance. However, long-run equilibrium does not necessarily imply adjustment within relevant long periods (i.e. 10, 20, 50, 100 years?). Consider first the case of a country with a current account deficit. The long-run equilibrium condition demands that it will be *eventually* corrected. But nothing guarantees that this should happen within certain relevant period. Persistent current account deficits depend upon the decision of foreign

[26] I cannot document this statement rigorously. During the Bretton Wood period countries adopted fixed exchange rate regime making external adjustments rely more on output than on price level (and therefore, RER) variations. However, the recurrent experiences of official devaluations to correct trade deficits, at least in Latin America (the region I studied the most), make me think that the current account models reviewed in section 4 provide a relatively good description of the role of the RER in the external adjustments. I should further research this issue.

creditors to keep financing. This decision ultimately depends on foreign creditor's assessment on the sustainability of the deficit country's external debt. As Frenkel (2005) points "sustainability is a judgment with respect to uncertain future events, based on present information and probable conjectures". Judgments, uncertainty and expectation, we know, are difficult to assess scientifically. Are we capable to scientifically determine when a country's external debt is not sustainable, anticipate that creditors' wiliness to lend will stop and therefore that the RER will adjust (depreciate)? Real world experience shows that prolonged current account deficits are not easy to maintain and that adjustments frequently occur. However, it also tells us that some countries remained in deficit for very long periods without any clear tendency toward adjustment[27] and also that changes in creditors' wiliness to lend are unanticipated (the so-called sudden stops).

We observed above that the assessment of current account surplus situations involves the concept of optimality instead of sustainability. To run a *permanent* current account surplus seems not optimal. However, there might be good reasons to do it for *long periods*.[28] For instance, The SCRER strategy to promote growth mentioned in the introduction could be an eloquent example. But it is not difficult to find others, such as the protection of the domestic economy against the international capital markets volatility (Feldstein, 1999). Notwithstanding the reasons, what it is relevant is that countries may find important to run current account surplus and thus avoid the RER adjustments. Certainly, fallacy of composition or global-imbalance-type of arguments may be raised against this view. However, those are not necessarily relevant for small economies during finite periods. Evidence also shows many cases of surplus countries with no relevant changes in the RER.

In short, cases of sustained current account imbalances without generating RER adjustments, as described by the Mundell-Fleming model, are not necessarily lacking of rationale or of empirical evidence.

The conclusions reached in this paper are eminently preliminary. A closer look at the models studied in this review and the addition others would be necessary in future steps of this research program. These caveats been said, one is tempted to conclude that standard theoretical models of RER determination rely on assumptions that may not be completely adequate to analyze the actual behavior of the RER. Even without relying on empirical evidence, theories surveyed in this paper do not provide convincing arguments against the notion that public authorities could manage the RER for a period relevant for economic policy.

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[27] Obstfeld and Rogoff (1996, chapter 2) exemplify this possibility with the cases of Australia and Canada, which shown persistent current account deficits for more than one century.

[28] Notice that even when it is common to treat them as synonymous, they are not. *Permanent* and *long-run* are theoretical concepts which are intended to assess dynamic characteristics of equilibrium. On the contrary, *long period* is a dimension that applies to real world cases.

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