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Abstract
This paper discusses the long-term determination of the exchange rate, given that it may remain depreciated or overvalued for some time. It defines the equilibrium exchange rate and the competitive exchange rate; the latter makes investment projects competitive internationally. Instead of starting from the PPP theory, it starts from the concept of the value of foreign money or the exchange rate around which the price, the exchange rate, revolves according to the supply and demand of foreign money. This, in turn, is influenced by three factors: the terms of trade, the current-account balance as a determinant of the net capital flows or inflows, and the interest rate differential. This paper criticizes the “fundamental equilibrium” concept and develops two econometric tests. The first checks whether the four determinant variables used in the model are relevant. The second verifies whether this model is a good predictor of the exchange rate throughout time.

Key words. Terms of trade, exchange rate, capital flows, current account, interest rate

JEL classification: F31, O24

Introduction
There are five macroeconomic prices: the profit rate, the interest rate, the wage rate, the inflation rate, and the exchange rate. The profit rate is crucial because the survival of capitalism depends on it. The interest rate is operational because it is the central bank’s main instrument for controlling inflation. The wage rate is valuable because its level is the best indicator of a people’s standard of living. The inflation rate is the object of perpetual concern because, when it is high, it represents a threat to the stability of the economic system. Finally, the exchange rate is the utmost strategic price; it affects imports, exports, the acquisitive power of wages and salaries and the revenues of rentier capitalists (interests, dividends, and real estate rents),
investment, consumption, and growth; if it is overvalued, it makes non-competitive the companies and the investment projects employing the best technology available in the world. From these five prices, the exchange rate is less studied. The literature on the exchange rate assumes that it is volatile in the short-term, but, as it is a price determined competitively in the market, it cannot be overvalued or depreciated in the long-term. While the exchange rate depended mainly on imports and exports, it could be predicted; that since capital flows became extensive, it would have become practically unpredictable. We don’t accept this pessimistic approach concerning the exchange rate; conventional economics handed over the towel too soon.

During the last 20 years, several studies have demonstrated that the exchange rate is a determinant of growth. To better understand why and how it is determined, economics needs to differentiate the short from the long-term, and, for that, it must recognise that the real exchange rate may often remain overvalued or depreciated for several years. From this observation we will examine in this paper the determination of the exchange rate and its relationship with the current-account balance – a key macroeconomic account that has also received less attention in economics than it should. We will work from the perspective of a new theoretical approach that is being developed mainly in Brazil, the New-Developmental Economics.

In this paper, we discuss the long-term determination of the exchange rate. Four economic variables determine the exchange rate: two are well known, the interest rate differential and the terms of trade; the other two are new, the value of the foreign money, which replaces the PPP approach, and the current account balance. In the short-term, the exchange rate is a volatile price which will float around the current equilibrium; this is the “normal”, market-determined condition. In the long-term, the current account may show a recurrent deficit, and the exchange rate will be overvalued; or the current account may show a recurring surplus and the exchange rate will be competitive and relatively depreciated. Thus, there is a close relationship between the current account and the real exchange rate. The net capital inflows or outflows that result from the current account balance determine an additional positive or negative supply of foreign money that appreciates or depreciates the exchange rate.

We argue that in the short-term, a variation in the exchange rate, which is the exogenous variable, will cause a deficit or a surplus; in the long-term, however, the causality will be inverted because the current-account balance will be the exogenous variable – a policy variable. We argue that the policymakers of the countries that exhibit recurrent current-account deficits are happy with the deficit, saying they are “growing with foreign savings” or that “they are using the exchange rate as an anchor to control inflation”, while the policymakers of the countries that exhibit surpluses are also happy because they are making their economy more competitive although with a cost.

This paper is organised into eight sections: In the first section, we will conduct a short survey of the literature. In the following four sections, we will discuss the four key variables determining the exchange rate: the value of the foreign money given by the comparative unit labour cost index, the terms of trade, the current account and the corresponding net capital inflows or outflows, and the interest rate differential. We discuss Williamson’s “fundamental
exchange rate” in the sixth section. In the seventh section, we conduct an econometric test to check whether these four variables are the crucial variables in determining the exchange rate variations and if these four variables prove significant. In the eighth section, we undertake a second econometric study, in this case, to check how well the real exchange rate conforms to our model’s predicted exchange rate. We apply it to three countries; in one of them, Brazil, we are successful. In the other two, we were unsuccessful: in the United Kingdom, the interest rate differential proved problematic, and in Thailand, the exchange rate showed minor sensitivity to the market variables of the model.

1. Short literature survey

Determining the long-term equilibrium real exchange rate is one of the most controversial and poorly discussed subjects in economic literature. The conventional/neoclassical literature assumes that the long run is characterised by fewer constraints, rigidities, or transaction costs. Therefore, once market forces are free to operate, long-term full-employment and long-term equilibrium of the exchange rate are guaranteed. The heterodox literature is more realist. It emphasises historical time and path dependence. According to this literature, identified with the post-Keynesian and developmental traditions, the long run results from the aggregation of short runs. Therefore, there are no built-in mechanisms in market economies to drive economic agents to the long-run equilibrium of full employment. Under this assumption, the management of economic policy and market regulation plays a decisive role in setting the conditions for long-term growth.

The core of the conventional exchange rate theory is the Purchasing Power Parity (PPP). The PPP theory defines the real exchange rate as the relative price of a common basket of goods traded between two countries converted into the same numeraire. In the absence of price rigidity, transport costs, trade barriers or other short-term disturbance, that ratio should equal 1. If this relation does not hold, it is assumed that an arbitrage operation will equalise the prices for goods and services between the two countries. The country with ‘low’ prices will attract buyers who demand its currency by appreciating its exchange rate, and the reverse occurs in economies with ‘high’ prices. This way, trade movements will drive the exchange rate and restore the trade balance in both economies. Capital flows have no role in PPP. Although intuitively appealing as an explanation of the long-term real exchange rate, this theory has been performing poorly.

Dornbusch (1976) offers another well-known conventional model. It incorporates the uncovered interest rate parity equation into the IS-LM framework to determine the exchange rate. Once the level of income and the interest rate are known, the model uses the uncovered interest rate parity equation to determine the exchange rate. As in any conventional model, the PPP results hold in the long run, but in the short run several events occur following a disturbance on the money supply until price adjustment is restored and trade is rebalanced. Harvey's main criticism of the Dornbusch model is that it assumes that the expectations of exchange rate movements are exogenous. In this sense, the exchange rate always moves to match the expectations of economic agents. Therefore, there is no permanent role in capital
flows. In our model, capital flows are part of the game and are associated with the current account policy that the country adopts.

Having looked at the conventional literature, let’s now turn to the heterodox literature on determining the real exchange rate. Here, the focus is on persistent misalignments and their impact on economic growth. Post-Keynesian literature elaborates on the relationship between monetary policy and the international capital market to explain the determination of the real exchange rate. Based on the uncovered interest rate parity theory of the exchange rate, as established by Keynes (1923), the expectation channel in determining the real exchange rate is at the forefront of the explanation. The uncovered interest rate parity theory determines that $i = i^* + e\varepsilon + \psi$, where $i$, is equal to the international rate, $i^*$, plus the expectation of exchange rate devaluation, $e\varepsilon$, and the country risk premium, $\psi$. Any difference between $i$ and $i^*$ implies variation in either $e\varepsilon$ or the country risk or both. Therefore, the exchange rate should move to compensate for the investors’ financial gains measured in the same currency whenever $e\varepsilon$ or $\psi$ varies. Monetary authorities will only preserve their autonomy to set the domestic interest rate if they are willing to let the exchange rate bear the burden of the adjustment.

In the real world, where capital flows dominate international transactions, monetary authorities interfere in the foreign exchange market to minimise the impact of exchange rate volatility on domestic prices. Mainly in the financially integrated developing countries, it is observed that the uncovered interest rate parity theory of the exchange rate has been constantly violated. Harvey (2009: chapter 5) sets a post-Keynesian model for determining the real exchange rate, which is incorporated into the post-Keynesian model for determining aggregate demand. The main feature of his model is to consider a forecast of the exchange rate movements, which, together with Minsky’s investment theory, explains why the uncovered interest rate theory does not hold in the real world. As Harvey (2006: 397) states,

> the uncovered interest rate parity deviation is a forecast, and forecasts are never certain. In general, the more confidence agents have in their predictions, the more funds they are willing to commit in speculation. The more realistic way to incorporate this into this model would be to make capital flows (for a given uncovered interest rate parity deviation) go from a trickle to a strong flow as forecast confidence increased.

2. The value of the foreign money

Having done a short review of both the classical and heterodox literature, we propose an alternative, to which we now turn. Instead of using the PPP, we propose to use the value of the foreign money as the primary reference. The PPP is just a pragmatic way of understanding the exchange rate, while the value of the foreign money concept is based on solid economics; it is found in a theory: the classical theory of value.

First, let’s return briefly to PPP. Robert Z. Aliber, in the first edition of *The New Palgrave Dictionary of Economics*, distinguished four approaches to explain the exchange rate level and exchange rate changes. They are purchasing power parity, elasticities, portfolio balance, and asset market approach. The simple existence of so many different methods indicates how poor PPP is in explaining the long-term exchange rate. The “absolute” purchasing power parity is the exchange rate that equals the cost of the same basket of goods and services in two countries
with different currencies. Thus, if the price of a basket of goods in Brazil, in reais (say R$90.00), is equal to the price in dollars of the same basket of goods in the United States (US$30.00), the absolute PPP will be R$ 3.00 per dollar. The PPP theory assumes that goods are homogeneous, and that the real exchange rate fluctuates around a constant long-term level, which also implicitly ensures the balance of payments' current account balance. In this scenario, the “one price law” prevails, which the representative company of the country defines; the homogeneous goods should have the same price in different countries, where any difference is due exclusively to the nominal exchange rate. This may make sense in countries with similar cultures and levels of economic development; it doesn’t make sense when, for instance, one country is developing while the other is wealthy or when a country is in the West while the other is in the East. Even between similar countries, the national tax system can vary greatly, resulting in countries having very different relative prices. Then there is the problem of which goods and services to include in the basket. In countries with Dutch disease, commodity prices will be low relative to other tradable goods. None of these factors is considered in the PPP.

Instead of using PPP, we return to the classical political economy and argue that foreign money, like other goods and services, has a value and a price. The price is the exchange rate, which varies around this value. The foreign money (and the exchange rate that says how much each foreign money is exchanged with the national money) is not a good or a service. Still, it has a value because it represents the value of the goods and services that the money of the base-country can buy in another country. As classical political economists have taught, the value of a good is equal to the quantity of labour socially necessary to produce it. This concept requires transforming value into a price, which has been the object of a long and scholastic debate. A pragmatic shortcut is that the value of a good or service corresponds to the value that covers its cost of production plus a reasonable profit. As to the foreign money, the pragmatic shortcut is to make this cost equal to the unit labour cost – to how much a company pays its workers to produce one unit of output. According to the glossary of the OECD, the unit labour cost (ULC) is equal to the average cost of labour per unit of production and is calculated as the ratio of total labour costs to actual output, which is equal to the average wages divided by the average productivity.

The value of foreign money is a “necessary price” – the exchange rate companies require involved in foreign trade. We wrote “necessary price” with quotation marks because, in a market economy, prices are never “necessary” – they are what they are – while the value is necessary, it does not result from demand and supply, but from the variations in the comparative unit labour cost (CULC). When the exchange rate is equal to its value, the companies using cutting-edge technology will be competitive and able to participate successfully in the country’s domestic and foreign markets.

The exchange rate is a relationship between currencies; thus, its value depends on the country’s unit cost of production and the average unit cost of production of the countries in which the base country competes (a basket of countries). In other words, it depends on the CULCI (the index of the country’s unit labour cost divided by the unit labour costs of the basket of competing countries). There is an inverse relationship between the CULCI and the value of
the foreign currency. When this comparative index goes up, it means that wages increase more and/or productivity increase less in the base country than in the basket of nations, and, therefore, the exchange rate will have to depreciate to keep the companies competitive; when the CULCI is going down, this means that wages are increasing less or the productivity is increasing more in the base-country, and it will have to appreciate its currency to keep the current account balanced. In the first case, in the case that the country will see its currency devalued, it incurs a cost to remain commercially competitive. The depreciation will make the country poorer because labour’s wages and rentier capitalists’ dividends, interests and real-estate rents will all lose acquisitive power vis-a-vis the competitors’ wages and other revenues; the same amount of money will buy fewer goods and services. This is what the Balassa-Samuelson effect tells us; this is the reason why European economists used “internal exchange rates” in each country to explain the 2010-2015 Eurozone crisis. Both things become much clearer when we have the concept of the value of the foreign currency thus having the CULCI behind such explanations.

Note also that the prices in this model are always expressed in real terms. Note also that we are not discussing an alternative to the real exchange rate. We are offering an alternative to the PPP approach. One could argue that the determination of the exchange rate by the value of the foreign money defined by the CULCI is not different from the productivity adjusted PPP equation to the extent that the unit labour costs are the main determinants. Yes, the two concepts are similar, but while the PPP is a mere comparison between the prices of two baskets of goods in two countries, the value of the foreign money is solidly based on theory. When we say that the exchange rate is in equilibrium or is competitive, we recognise that the exchange rate has behind it the production system of each country and whether this system is up to date in relation to the more advanced technology.

Note also that the concept of value does not correspond precisely to the “current equilibrium” (the exchange rate that balances the current account of a country intertemporally) that Bresser-Pereira used in opposition to the “industrial equilibrium” (the exchange rate that makes competitive the industrial projects using the best technology available in the world) to develop his 2008 Dutch disease model. They are close but not equal concepts. Both reflect the variations in the CULCI, but the current equilibrium exchange rate depends additionally on variations in terms of trade (thus, on the demand and supply of foreign money originating from trade). In contrast, the value of the foreign money does not depend on the terms of trade. While the value of the foreign money is relatively stable because changes in wages and productivity are usually small and gradual, the current equilibrium will be volatile due to the instability of the commodity prices. In developing countries, particularly commodity exporters countries, we observe exchange rate cycles associated with cyclical financial crises and the ensuing capital outflows.

3. Terms of trade

If the first determinant of the exchange rate is foreign money, the second is the terms of trade. The exchange rate depends on the supply and demand of foreign money which, if we exclude the capital flows on the changes on the current account – changes in foreign trade and
in the balance of services, mainly interests paid and profit remittances. Considering a well-behaved market, where the exchange rate fluctuates around the value of the foreign money and the current account is balanced, changes in terms of trade will cause a deficit or a surplus in the current account and compensatory changes in the exchange rate so that after a time lag the current account balances again. Supply or demand shocks impacting international prices are the leading cause of changes in terms of trade. Such shocks are stronger in commodity-exporting countries because commodity prices are much more volatile when compared to the costs of manufactured goods and services. Changes in the volume of profit remittances to the rich countries or income remittances of immigrants to their home countries will also have similar effects, but they will tend to be more gradual.

Summing up this and the previous section, foreign money has value and price. The value varies according to the variations of the CULCI; the price is the real exchange rate, which varies around its value according to the supply and demand for foreign money. Changes in the terms of trade depend mainly on the variations of commodity prices. Changes in the CULCI directly affect the real exchange rate; changes in terms of trade affect the exchange rate by increasing or decreasing the supply and demand of foreign money.

4. Current account balance and capital inflows

This model's third long-term determinant of the exchange rate is the current-account balance coupled with capital inflows. In the short-term, the current account deficits may be endogenous, caused by supply or demand shocks, but in the long term, we need an economic explanation for their role. Capital flows have become very large over the last 40 years and made the exchange rate more volatile and more tightly associated with speculative bubbles than they once were, but this does not justify the widespread belief that the size and variability of such flows make it impossible to determine the exchange rate theoretically. Contrary to widespread belief, capital flows don’t make the exchange rate unpredictable; they are determinant of the exchange rate because they have a sense or a direction. Net capital flows increase the supply of foreign money and appreciate the national currency; the inverse happens when capital outflows exceed the capital inflows.

There is a close relationship between the current-account balance and the real exchange rate. Conventional economics assumes that in the long-term, countries show a balanced current account. Still, besides this possibility, there are two other: countries that show a persistent current-account deficit while others show a persistent current account surplus. In the case of persistent current account deficits, they will require net capital inflows that increase the supply of foreign money and appreciate the local currency for the time the deficit remains; the opposite will be confirmed in the case of recurring current account surpluses. The signal of the current-account balance determines in which sense the capital flows affect the exchange rate. The assumption here is that there is a correspondence between the current-account balance and the exchange rate, as seen in Figure 1; the higher the current account deficit, the more appreciated the currency, and the higher the current account surplus, the more depreciated it will be.

In the long-term, countries’ current accounts should be balanced. If the market was doing its job, we would only have deficits or surpluses in the short-term, which would respond to
provisory shocks in the demand or the supply of foreign money. But we see that many countries exhibit long-term current-account deficits or long-term current account surpluses. In the countries that incur deficits, their exchange rate will be overvalued and the tradable companies utilizing the best technology will not invest or will invest just to modernize their plants because they will not be commercially competitive. The exchange rate is like a switch that gives or denies competent companies access to the demand.

For the countries that incur current account deficits, the limit is the financial crisis that may result from the increase in the foreign debt to GDP ratio. For the opposite alternative, there is no limit except the possible unconformity of the people in the country with its depressed income or the competing countries' response to the unfair trade practice involved.

In this model, we reject the “fix or float” assumption and assume the exchange rate is floating, but the exchange rate regime is a managed float regime. Current account deficits characterise the Latin American countries and the US, while Germany, Japan and the other East Asian countries usually hold current account surpluses. These recurrent deficits and surpluses are necessarily policy determined. If they were not, the market, despite its shortcomings, would keep the current account balanced in the long-term. The deficits or the surpluses do not derive from demand or a supply shock because they are long-term results. On the other hand, the deficits in the current account cannot be attributed to a “structural” condition; the foreign constraint is indeed structural, it is consequence of two perverse income-elasticities, but it does not cause deficits; It just leads the market to set the exchange rate at a more depreciated level than it would be if the constraint was not present.

![Figure 1](image.png)

**Figure 1.** The current account balance and the exchange rate

Why would a country choose to incur current account surpluses, as is the cases of Germany and most East Asian countries? Simply because these countries prefer a competitive exchange rate and a competitive manufacturing industry over the choice of increasing the acquisitive power of wages, salaries, and the rentiers’ revenues (interests, dividends, and real-estate rents). The US, on its turn, incurs systematically in current account deficits since the 1960s, probably because Americans believe they enjoy the famous “exorbitant privilege”: the dollar is the
universal currency, and the United States gets indebted only in dollars. Actually, there is a cost in this policy, because the current account deficit involves net capital inflows that appreciate the dollar and make the American manufacturing industry less competitive than it could be.

In the case of the Latin American countries, their governments have as policy to incur in current account deficits because they believe that they “are growing with foreign savings” and count with the support of the liberal orthodoxy and the international financial agencies – a policy that new-developmental economics views as usually mistaken because it appreciates the national currency and does not cause the increase of the investment but of consumption. This is only not true when the economy is already increasing fast, the marginal propensity to consume falls, and companies invest because the profit opportunities are high, and the expected rates of profit are satisfying despite the currency appreciation. In adopting the growth with foreign indebtedness policy politicians are practicing exchange rate populism which is usually coupled with fiscal populism because to exhibit a current-account deficit they also incur in fiscal deficit. These governments are practising fiscal populism and exchange rate populism – they are attending the demands of wage and salary earners and rentier capitalists who receive dividends, interests and real estate rents which have their acquisitive power increased artificially.

A third form of justifying current-account deficits is specific to countries exporting primary goods; is to say that they are “structural”, that the deficits derive from the foreign constraint originated from two perverse income-elasticities: while these countries exhibit an income-elasticity above 1 in the imports of manufactured goods, the industrialised countries have an income-elasticity below 1 in their imports of primary goods. Proposing this simple model, Raúl Prebisch did not aim to defend current account deficits and growth with foreign indebtedness but to define an economic disadvantage faced by the exporters of commodities that only industrialization or “structural change” would overcome.

5. Interest rate differential

Our last primary determinant of the exchange rate is the interest rate differential. In the case of developing countries, the interest rate will often be higher than the international interest rate – higher than country risk that markets consider in setting it. Why do central banks of many developing countries set the interest rate above the international rate plus the country risk? To attract capitals that finance the long-term current-account deficits and to control inflation. These are poor justifications. We already criticized the growth with foreign indebtedness policy. As to the control of inflation, there is no reason why countries would need to use the exchange rate as an anchor (appreciated) to meet the inflation targets. It is curious that these often “austere” policymakers that are right in criticizing the use the prices of state-owned enterprises to control inflation don’t hesitate to use “the price of the country”, the exchange rate, to achieve the same objective.

The interest rate differential is determinant of the exchange rate to the extent that they attract capital inflows or, after the country has achieved a level of international reserves viewed as secure, the export capitals financing other countries. It depends on the policies adopted by
developing countries, as we just have seen, but they also depend on the interest rate policy of the other countries – mainly the United States. Local financial markets pay great attention to their monetary policy. If the Fed increases the basic rate for US dollars, other currencies will depreciate, and vice-versa.

6. The “fundamental equilibrium”

Which is the equilibrium exchange rate? The New-Developmental Economics argues that besides the “current equilibrium” – the real effective exchange rate that balances intertemporally the country’s current account, there is a “industrial equilibrium” – the exchange rate that makes competitive, profitable, the non-commodity tradable companies (mostly, manufacturing companies) who utilize cutting-edge technology.13 John Williamson (1994) offers a different concept of the long-term equilibrium real exchange rate, the “fundamental equilibrium exchange rate” (FEER) – the exchange rate that is consistent with “macroeconomic balance” – which, given the interest rate, makes the percentual increase of the foreign debt equal or smaller than the rate of growth of the country’s GDP, thus not increasing the foreign debt to GDP ratio and not leading the country to a currency crisis.14

According to Williamson (1991: p.45) the FEER aims to provide “the right criterion for assessing whether a currency is correctly valued”. Because of that, several authors have used it as an analytical tool to assess exchange rate misalignment.15 The FEER approach would determine the real exchange rate that will emerge when the economy is in “internal and external balance”. Since policymakers adopt economic “right policies”, which are compatible with the economic fundamentals (for instance, keeping the economy operating at NAIRU), the internal equilibrium will be reached in the long run, while the FEER assures the “external” equilibrium. Thus, the FEER would be a formula to “optimise” securely the rate of capital inflows that would allow the increase in the investment rate, while it ensures the foreign debt-to-GDP ratio remain constant. The internal and external equilibriums are linked through a definition of the “desired” level of the current account deficit,16 which is defined according to a “long-term stock equilibrium of foreign assets”, which is never clearly defined.

Montiel (1999: 264) goes in the same direction as Williamson. He defines the long-run equilibrium real exchange rate as “the value of the real exchange rate that emerges from the economy’s macroeconomic equilibrium when policy and exogenous variables are at sustainable ‘permanent’ levels ...” This sustainable level is the fundamental equilibrium – a misleading “equilibrium,” which may not lead the country to a currency crisis. Still, it will render its competent companies uncompetitive.

We reject this concept of exchange rate equilibrium. It makes no sense to say that a country is in “external equilibrium” because its foreign debt is not increasing in relation to GDP. A national economy is in external equilibrium when the current account is zero, not when the country is not threatened by a currency crisis. In the case of the Dutch disease there is an equilibrium for the non-commodity tradable goods (which include the remittance of dividends and interests) – the industrial equilibrium which, in this case, is the competitive equilibrium – is the exchange rate that assures that the cutting-edge investment projects will be viable. It is impossible to understand the extraordinary growth of the East Asian countries and specially
China if we don’t reject the growth with foreign indebtedness policy. Since China opened its economy, it experienced an incredible growth; in 42 years, it only experienced small current-account deficits in three years, thus keeping its exchange rate competitive.

The FEER is essentially a justification of the exports of capital by the richer countries; it is a defence of the growth with foreign indebtedness policy that new-developmental economics rejects, only admitting it when the country is growing fast and the rate of replacement of domestic by foreign savings is small.

The explanatory power of the four key variables

This model explains the exchange rate and its variations with four variables (the four being the variations in the comparative unit labour cost index, the variations in terms of trade, the variations in the interest rate differentials, and the current account deficits or surpluses which correspond to the net capital flows). Given that, three empirical questions follow. First is a question on the explanatory power of the four key variables, on the evidence that these are the key variables in determining the exchange rate variations. The second question is whether these four variables have predictive power as to the current equilibrium, and the third, whether the exchange rate is overvalued, undervalued, or floating nicely around the equilibrium.

Given the analysis of the theoretical model, we intend to implement an empirical study of the determinants of the exchange rate in emerging countries and the G7 countries. The basic structure of the models to be used is as follows:

\[ REER = f(CC; I\_DIFF; ULC; TOT) \] (model 1)

In this baseline model, the real exchange rate is determined (REER) by current account balance/GDP (CC); interest rate differential (I\_DIFF); unit labour cost (ULC) and terms of trade (TOT).

To model 1 we add the GDP per capita (GDPPC) (Model 2), degree of openness (OPEN) (Model 3) and exports of primary goods as a proxy for Dutch disease (DD) (Model 4). These included variables are traditionally used in the literature to explain the trajectory of the exchange rate; therefore, we chose them as control variables.

\[ REER = f(CC; I\_DIFF; ULC; TOT; GDPPC) \] (model 2)

\[ REER = f(CC; I\_DIFF; ULC; TOT; OPEN) \] (model 3)

\[ REER = f(CC; I\_DIFF; ULC; TOT; DD) \] (model 4)

Several authors support the selection of these variables (Helmers, 1988; Edwards, 1988; Calvo, Leiderman and Reinhart, 1993; Rodrik, 2008; Berg and Miao, 2010; Nassif et al., 2017).

The econometric translation of these models can be done as follows:
$$RER_{it} = \alpha_i + \beta'X_{it} + \epsilon_{it}$$

Where RER, the real exchange rate, is the dependent variable; X is a vector for the explanatory variables; $\beta$ is the parameters for the explanatory variables; $\epsilon$ is a term for the error; $i$ represents the countries (33); $t$ represents the year (1995 to 2017); and $\alpha$ is the constant of the model.

With this objective, a dynamic panel data model is considered using the generalized method of moments (GMM) proposed by Arellano and Bond (1991), which is appropriate in cases involving i) a linear functional relationship; ii) a lagged dependent variable, which means a dependent variable influenced by prior values; iii) potentially endogenous explanatory variables; iv) individual fixed effects; v) heteroscedasticity and autocorrelation within groups of individuals; and vi) the possibility of “internal” instruments based on their own lagged variables.

The description of the variables used in the model and their sources are summarized in Table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Acronym</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate: Real Effective Exchange Rate based on Consumer Price Index, Index</td>
<td>REER</td>
<td>IFS, IMF and Bruegel dataset</td>
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<td>Balance of payments: Current Account Balance percentage of GDP</td>
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<td>Terms of Trade</td>
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<tr>
<td>Primary Exports percentage of Total Exports (Dutch Disease)</td>
<td>DD</td>
<td>UNCTADStat</td>
</tr>
<tr>
<td>Unit Labor Cost</td>
<td>ULC</td>
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</tbody>
</table>

The choice of the period to be analysed (from 1995 to 2017, spanning 23 years) is limited in the availability of data for the selected variables to the following countries: Brazil, Canada, Chile, China, Colombia, Czech Republic, Egypt, Arab Republic, France, Germany, Greece,
Hungary, India, Indonesia, Italy, Japan, Kuwait, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Qatar, Russian Federation, Saudi Arabia, Singapore, South Africa, Taiwan, Thailand, Turkey, United Arab Emirates, United Kingdom and United States. Table 2 summarizes how the selected explanatory variables affect the exchange rate in four models. All variables are in log so that the coefficients can be interpreted as elasticities.

Table 2. Determinants of the exchange rate

<table>
<thead>
<tr>
<th>Variables</th>
<th>Variable</th>
<th>(1) logreer</th>
<th>(2) logreer</th>
<th>(3) logreer</th>
<th>(4) logreer</th>
</tr>
</thead>
<tbody>
<tr>
<td>l.logreer</td>
<td></td>
<td>0.768***</td>
<td>0.740***</td>
<td>0.754***</td>
<td>0.780***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.039)</td>
<td>(0.041)</td>
<td>(0.038)</td>
<td>(0.040)</td>
</tr>
<tr>
<td>l.logcc</td>
<td></td>
<td>0.120***</td>
<td>0.110**</td>
<td>0.158***</td>
<td>0.130***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.045)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>l.logi_diff</td>
<td></td>
<td>-0.026**</td>
<td>-0.021**</td>
<td>-0.029**</td>
<td>-0.023**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.010)</td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>l.logulc</td>
<td></td>
<td>0.081**</td>
<td>0.086**</td>
<td>0.079**</td>
<td>0.075*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.039)</td>
<td>(0.039)</td>
<td>(0.038)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>l.logtot</td>
<td></td>
<td>-0.067*</td>
<td>-0.101***</td>
<td>-0.068**</td>
<td>-0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.034)</td>
<td>(0.038)</td>
<td>(0.033)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>l.loggdppc</td>
<td></td>
<td>-0.061**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.029)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l.logopen</td>
<td></td>
<td></td>
<td>-0.099***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.028)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>0.580*</td>
<td>0.288</td>
<td>0.919***</td>
<td>0.273</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.321)</td>
<td>(0.348)</td>
<td>(0.324)</td>
<td>(0.344)</td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td>326</td>
<td>326</td>
<td>326</td>
<td>326</td>
</tr>
<tr>
<td># of countries</td>
<td></td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Sargan Test</td>
<td></td>
<td>365.86</td>
<td>311.64</td>
<td>338.75</td>
<td>356.4</td>
</tr>
<tr>
<td>Prob.</td>
<td></td>
<td>0.16</td>
<td>0.11</td>
<td>0.12</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results in Table 2 show that all the estimated coefficients are statistically significant and present the signs expected by our economic model in all regressions.

Regarding the baseline model, the current account balance is the variable that shows the highest coefficient in all four models. This means that, in the long run, the increase in the
current account balance contributes to a more depreciated exchange rate, and this result is in line with the thesis that growth strategies supported by foreign savings tend to appreciate the currency. This result is repeated throughout all the estimated models.

As for the effects of unit labour cost, it is known that this variable is important for the competitiveness of an economy in relation to its trading partners. The increase in this variable tends to be responsible for a significant part of an economy's trade surplus reduction, which may imply the need for exchange rate devaluations to compensate for the loss of competitiveness. The estimates of the four models corroborate this result.

The coefficients of the variable terms of trade present a negative sign. According to the empirical literature, an improvement in terms of trade appreciates the real exchange rate, assuming that the income effect of this variable dominates the substitution effect (EDWARDS, 1989).

The interest rate differential is significant in all models, and the coefficients are negative, as expected. When a country's interest rate is above the international interest rate, it attracts foreign capital, which causes an appreciation of the exchange rate.

In model 2, the GDP per capita was introduced to capture the well-known Harrod-Balassa-Samuelson effect, which suggests that, as Obstfeld and Rogoff (1996, ch.4) write, “price levels tend to increase (that is, the real exchange rate tends to appreciate) as a country increases its per capita income”. This variable was also significant in explaining the exchange rate trajectory in the emerging and developed countries that are part of our sample.

The result of model 3 shows that the degree of openness also negatively contributes to the determination of the real exchange rate. This variable measures the degree to which a country is affected by the international environment.

Finally, the proxy variable to capture the effects of the Dutch disease in determining the exchange rate was significant, as shown in model 4. Its coefficient was negative as expected since the presence of the Dutch disease allows a long-term exchange rate overvaluation in commodity-exporting countries. As explained in the new-developmental literature, the presence of Ricardian rents and favourable terms of trade in these economies contribute to the real exchange rate becoming more appreciated than the industrial equilibrium rate.

Therefore, the empirical models are an excellent guide to answering our first two questions. Regarding the first question, the four variables suggested were important in determining the changes in the exchange rate. As for the second question, the Dutch disease, measured by the exports of primary goods about GDP, was also an important variable to explain the exchange rate changes.

7. In equilibrium, overvalued or undervalued?

Having identified a set of variables that are relevant to determine the level of the real exchange rate, in this section we will use the variables of model 2, which adds to the base model the Harrod-Balassa-Samuelson effect which might be relevant to estimation of the real exchange rate in a middle-income country like Brazil. This permits us to answer the third
question: assuming the current account balanced in the model, do these variables explain the existing equilibrium in terms of reais per dollar? And is the actual exchange rate approximately in equilibrium, is it overvalued, or is it undervalued? The list of variables and the respective statistical sources are shown in Table 3.

Table 3 – Brazil: List of the variables

<table>
<thead>
<tr>
<th>Description</th>
<th>Acronym</th>
<th>Unity</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Effective Exchange Rate based on Consumer Price Index</td>
<td>REER</td>
<td>Index</td>
<td>Brazilian Central Bank Database</td>
</tr>
<tr>
<td>Policy Rate Differential</td>
<td>I_DIFF</td>
<td>Value</td>
<td>BIS</td>
</tr>
<tr>
<td>Current Account Balance as percentage of Gross Domestic Product</td>
<td>CC</td>
<td>%</td>
<td>CEIC Database</td>
</tr>
<tr>
<td>Gross Domestic Product constant prices, annual*</td>
<td>GDPPC</td>
<td>Value</td>
<td>Brazilian Central Bank Database</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>TOT</td>
<td>Index</td>
<td>World Bank (WB)</td>
</tr>
<tr>
<td>Unit Labor Cost</td>
<td>ULC</td>
<td>Index</td>
<td>New Developmentalism Center**</td>
</tr>
</tbody>
</table>

*Quarterly GDPPC was estimated by dividing quarterly GDP in US dollar (series 4385 available at the Brazilian Central Bank database) deflated by US Implicit GDP deflator (FRED database) and divided by Population (series 21774 available at the Brazilian Central Bank database). **(https://eaesp.fgv.br/metodologia-calcu-lo-valor-taxa-cambio-equilibrio-industrial-0)

Table 4 summarizes the coefficients of the econometric estimation of the real effective exchange rate for the Brazilian economy, using the methodology of the Correction Vectors Model (ECM), which shows how each of the explanatory variables affects the exchange rate. The choice of this methodology is justified because the variables present unit root and cointegration relation.

Table 4. Brazil: Determinants of the real exchange rate (1999-2019)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>ECM coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>constant</td>
<td>4.72***</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
<td>Coefficient</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>$lnGDPPC_{(-4)}$</td>
<td>Log of the GDP per capita</td>
<td>-0.53112***</td>
</tr>
<tr>
<td>$lnI_DIFF$</td>
<td>Log of the interest rate differential</td>
<td>-0.06130***</td>
</tr>
<tr>
<td>$lnCC_{(-2)}$</td>
<td>Log of the Balance of the Current Account/GDP</td>
<td>2.0102***</td>
</tr>
<tr>
<td>$lnTOT_{(-1)}$</td>
<td>Log of the Terms of Trade</td>
<td>-0.5424***</td>
</tr>
<tr>
<td>$lnULC_{(-1)}$</td>
<td>Log of the Unit Labor Cost</td>
<td>0.3851***</td>
</tr>
</tbody>
</table>

**R2**

<table>
<thead>
<tr>
<th>N° of observations</th>
<th>0.53</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lags</td>
<td>81</td>
</tr>
<tr>
<td>Period of time</td>
<td>1999Q1 – 2019Q1</td>
</tr>
</tbody>
</table>

Note: T statistic in square brackets.

*** Significant at 1%; ** Significant at 5%; * Significant at 10%.

All the coefficients for the Brazilian economy presented the expected signs. The negative coefficient of the GDP per capita is associated with the Harrod-Balassa-Samuelson effect. The negative sign of the interest differential ($I\_DIFF$) captures the impact of an increase in the domestic interest rate (given the external interest rate) in stimulating the net inflows of capital and, therefore, appreciating the currency in real terms. The negative coefficient of the terms of trade (TOT) shows that an improvement in the terms of trade of the country tends to appreciate the domestic currency. The unit labor cost coefficient (ULC) coefficient is positive as higher wages relative to productivity should signal a depreciated currency. It is interesting to observe that this coefficient is higher than the estimated coefficient for the current account balance (CC). This last coefficient is also positive because surpluses, in long run, are associated with a depreciated currency in real terms, as has been extensively discussed in the structuralist and in the new developmentalism literature.

Once the coefficients of each variable are estimated, the next step is to use them to calculate the long-term equilibrium real exchange rate in the current account, which is the one that considers a zero balance current account. As suggested by Edwards (1989) and Alberola (2003), this article applies the Hodrick-Prescott (HP) filter to estimate both variables.

Figure 2 shows two curves: the observed index of the real effective exchange rate of the Brazilian economy (REER) and the estimated series of the long-term equilibrium real exchange rate in the current equilibrium, that is, assuming that the current account is in balance (REER_EQCC).
Figure 2. Real exchange rate and long-term equilibrium real exchange rate in current account: Brazil 1999-2019

Based on the estimated long-term equilibrium real exchange rate of current account, our next step is to calculate the value of the nominal exchange rate for the latest data available. This exercise allows us to conclude, according to our model, how much the Brazilian currency appreciated in relation to the estimated long-term equilibrium real exchange rate in the current account at a given point in time (Table 5).

Table 5. Brazil: Estimated nominal exchange rate

<table>
<thead>
<tr>
<th></th>
<th>REER Index</th>
<th>Nominal exchange rate (R$/US$) on March 31, 2019</th>
<th>Percentage of appreciation (-)/depreciation (+) March 31, 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>REER_EQCC (current equilibrium in reais per dollar)</td>
<td>150.37</td>
<td>4.14</td>
<td>-5.80</td>
</tr>
<tr>
<td>REER (nominal exchange rate in reais per dollar)</td>
<td>141.65</td>
<td>3.90</td>
<td></td>
</tr>
</tbody>
</table>

Source: Authors’ calculations.
In an attempt to apply this model to other countries, we observed how the estimates for the United Kingdom and Thailand would look. In the case of the United Kingdom, the interest rate differential proved problematic, and the model did not present a reasonable adjustment. In the case of Thailand, the exchange rate path is relatively stable, showing minor sensitivity to the model’s variables; it is not a market-determined exchange rate. Despite these observations, we believe that our baseline model offers a good guide for determining the real exchange rate, which, when considering the particularities of each country, can provide insights into the determinants of the real exchange rate over time.

8. Conclusion

In conclusion, in this paper, instead of starting from the PPP, we started from the classical political economy tradition in the determination of prices: the exchange rate has a value and a price; the latter floats around its value according to the demand and supply of foreign money and the associated expectations. And we argued that only in the short-term the current-account balance and capital inflows or outflows reflect supply or demand shocks in the exchange rate; in the long-term, the direction of the causality changes: the current-account balance and the corresponding net capital flows are the policy variable that determines the real exchange rate. Together with the changes in the interest rate differential and the variations in the terms of trade, they affect the demand and supply of foreign money, while the value of the foreign money sets an axe around which this supply and demand evolve.

In the paper, the market is always present but not always it achieves the desired equilibriums. Observation is also always present; we are permanently asking how the economic agents and the economic variables behave. For that reason – because we consider these habitual models in our claims and models – we use expressions like “usually” and “often”. For example, we say that usually hold current account surpluses, or current-account deficits, and this observation is considered in our analysis.

Most of these variables become effective as economic agents form expectations about them. For example, a fall in terms of trade will lead agents to expect an increase in the demand for foreign currency and the exchange rate will appreciate before real consequences of the deterioration of terms of trade materialize. Or, when the country adopts the growth with foreign indebtedness policy explicitly, economic agents will expect that the country will incur a current account deficit and increase their demand for foreign currency, thus appreciating the national currency before the current account deficit materialized. This is reasonable prediction based on adaptative expectations. But the fundamental equilibrium hypothesis says that agents will make a step further; besides predicting the appreciation of the national currency and the consequent increase in the demand for foreign currency, they will expect that the market will keep the current account permanently balanced, only disturbed by exogenous shocks. But this is rational expectations prediction that makes little sense. It is asking the agents to achieve rationality beyond human possibilities.

The exchange rate will always be a challenge for economists. There are many variables that interfere in determining the critical macroeconomic prices. They are in some moments active, in others not. Predict the future exchange rate will always be a quasi-impossibility. Still, in this
paper we defined four main variables in the determination of the exchange rate, two well known (the variations in terms of trade and the interest rate differential) and two that we are proposing (the value of the foreign money associated to the comparative unit labour cost index and the capital flows associated to the country’s current-account policy). We hope that in offering this new theoretical approach to the exchange rate, we are posing further research questions to be defined and answered.

References


BLANCHARD, O; MILESI-FERRETTI, G. M. (2011) “(Why) Should Current Account Balances Be Reduced?” IMP Staff Discussion Note, March 1, 2011, SDN/11/03.


1 See Razin and Collins (1997); Bresser-Pereira and Nakano (2003), Gala (2006); Rodrik (2008); Rapetti, Razmi, Skott (2012); Missio, Jayme Jr. and Oreiro (2015).

2 We refer to the New-Developmental Theory. For a summary of this approach, see Bresser-Pereira (2020). For the relation between the exchange rate, capital accumulation and growth, see Bresser-Pereira (2012; 2015).

3 See, for instance, Blanchard and Milesi-Ferretti (2011).

4 Harvey (2009: 16). According to him, the most tested model is the ‘monetary model’, which incorporates the PPP theory in the quantitative theory of money. But, in his words (p.19): “...while it may be suggestive in terms of long-term movements, it is a poor guide to policy over the time horizon in which we live our lives.”

5 According to Harvey (2009: 90): “The problem with the neoclassical version of interest rate parity is that it assumes complete confidence in the forecast ($/FX$). If agents are, because they are unsure, less anxious to ‘put their money where their mouth is’, then it is very likely that the capital flows that serve as the adjustment mechanisms will not occur in sufficient volume to set the two sides of the equation equal. In fact, given the level of uncertainty in the market, such a complete adjustment would be the exception rather than the rule.”

6 When, for instance, the country’s risk premium increases, the domestic currency is expected to depreciate ($e' > 0$). Therefore, if high instability in the foreign exchange market is observed, the threat of depreciation puts pressure on the domestic interest rate to rise so as to keep domestic assets attractive. This suggests a positive correlation between the short-term interest rate differential and the nominal (and real) exchange rate.


8 Bresser-Pereira (2013); Bresser-Pereira, Oreiro and Marconi (2016).


10 Bresser-Pereira (2008).

11 This phrase is attributed to the former president of France, Giscard d’Estaing while he was minister of general Charles de Gaulle.

12 Bresser-Pereira and Gala (2007); Bresser-Pereira, Araújo and Gala (2014).

13 The current equilibrium is very close to the value of foreign money, but it is not the same because the value does not consider prices, while the current equilibrium depends on prices: the terms of trade.
See also Williamson (2008), Williamson and Cline (2010); Cline and Williamson (2011).

In the case of Brazil, see, for instance, Marçal (2012) and Marçal (2019).

See, for instance, Cline (2017) for estimates of the fundamental equilibrium exchange rates for a set of developed and developing countries. The calculations were first introduced in Cline and Williamson (2008), and according to Cline (2017, p.15), since then, the target of limiting the current account deficit to no more than 3 percent of GDP has remained unchanged for both developing and advanced economies.