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Carry Trade, Exchange Rates and the Balance-of-Payments Constraint

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Abstract: this paper presents a partial equilibrium model that integrates interest-rate arbitrage with the balance-of-payments constraint to determine the real exchange rate. The sequential logic is that carry trade determines the term premium, with the spot rate showing greater volatility than the forward rate. Then uncovered-interest rate parity determines the spot rate based on the real exchange rate consistent with a financial constraint, defined as a stable ratio of foreign reserves to foreign debt. To close the model, the net exports consistent with the financial constraint determines the real exchange rate for a given ratio of domestic to foreign income.

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The exchange rate is a crucial variable for macroeconomic dynamics, especially in emerging economies. The evolution of the relative price of foreign currency usually has an important short-run effect on domestic prices and income, as well as on the balance sheet of the government, firms and families (Frenkel and Taylor 2006). The value at which the real exchange rate eventually stabilizes also have a huge impact on international competitiveness and the allocation of resources between tradable and non-tradable activities, which in their turn influence the growth of potential output (Guzman et all 2017) .

The role of the exchange rate in the macroeconomics of small open economies is the topic of many models in development economics (Bresser-Pereira et all 2016). The standard approach is to define a real or financial constraint on the country under analysis, from its balance of payments, and then investigate what level (or levels) of the real exchange rate is consistent with a non-Ponzi financial relation with the rest of the world (McCombie and Thirlwall 1994). Since the equilibrium exchange rate also depends on the level of economic activity, the external constraint creates a trade-off between income and the relative price of foreign currency along the logic of gap models (Taylor 1994).

In the jargon of heterodox development models (Thirlwall 2011), small open economies face a balance-of-payments constraint (BoPC), meaning that their income and exchange rate are constrained to generate the current account balance (surplus or deficit) compatible with a stable financial position in foreign currency in the long-run. The exact definition of the constraint varies with the country and period under analysis, including, for example: balanced trade (Thirlwall 1979), unbalanced but stable trade-income ratios (Thirlwall

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and Hussain 1982 and Moreno-Brid 1998), a stable ratio of foreign debt to income (Barbosa-Filho 2001A) or a stable ratio of international reserves to foreign debt (Barbosa-Filho 2001B).

In parallel to the literature on developing economics, the determination of the nominal and real exchange rate has also been the object of long literature in international and financial economics (Macdonald 2017). The current consensus is that financial conditions determine nominal exchange rates in the short run through covered interest-rate parity (CIP), whereas uncovered interest-rate parity (UIP) and the purchasing power parity (PPP) define the trend of the real exchange rate, subject to the influence of relative per-capita income levels and structural breaks (Taylor 2000 and Taylor and Taylor 2004).

The objective of this paper is to link the development models of the BoPC with the financial models of the real exchange rate. The main hypothesis is that the BoPC defines the long-run expectation about the real exchange rate and, therefore, it can complement or close the determination of the real exchange rate by uncovered interest rate parity (UIP) in standard macroeconomic models. The models of this paper come from the Brazilian experience and, when adequate, their functioning will be illustrated with data and results from Brazil.

To facilitate the exposition the text is in five sections. Section one presents the CIP hypothesis and its functioning in emerging economies. Section two presents the UIP hypothesis and the role of long-run expectations in the determination of the real exchange rate. Section three uses the traditional BoPC hypothesis about trade to analyze the steady-state values of the real exchange rate and income growth. Section four redefines the BoPC as a liquidity constraint and checks its implication for the exchange rate and income growth. Section five concludes the analysis with some comments based on the Brazilian experience.

1 – Covered interest rate parity and the nominal exchange rate

Define the nominal exchange rate as the domestic or home price of foreign currency. According to the CIP hypothesis, the difference between the spot (s_t) and the forward (f_t) nominal exchange rates should equal the difference between the home ($i_{h,t}$) and foreign ($i_{f,t}$) nominal interest rates adjusted by risk ($\sigma_{h,t}$). Formally, in logs:

$$i_{h,t} = i_{f,t} + \sigma_{h,t} + f_t - s_t, \tag{1.1}$$

where all variables are defined at the end of period t as it is usual in monetary economics (Walsh 2010).

The economic interpretation of (1) is that arbitrage between the home and foreign monetary markets makes the term premium ($f_t - s_t$) equal to the carry-trade gain ($i_{h,t} - i_{f,t} - \sigma_{h,t}$). The taxonomy of finance usually divides the risk premium in three components:

(1) The degree of risk aversion, since investing in foreign currency is uncertain in relation to the sure bet of investing in the domestic currency (Jensen's inequality).
(2) The country risk, measured by the difference between the interest rates paid by home and foreign agents, for the same maturity, in the foreign currency.
(3) The currency risk, the difference between the interest rate paid by the same home agent, for a given time maturity, in the home and the foreign currencies.

For the purpose of this paper I will consider the risk premium as an exogenous variable, that is, a variable that depends mostly on the international financial cycle (Rey 2015) and domestic political factors.

The evidence from Brazil indicates that the CIP hypothesis is a good guide for the determination of the term premium in the short run (Cieplinski et all 2018), that is, when we estimate

$$f_t - s_t = \alpha + \beta\left(i_{h,t} - i_{f,t} - \sigma_{h,t}\right) + \varepsilon_t, \tag{1.2}$$

we cannot reject the joint null hypothesis that $\alpha = 0$ and $\beta = 1$ for derivative contracts between one and six months. For longer time horizons the risk premium becomes larger than its market proxy, probably due to rising uncertainty and risk aversion, and the null hypothesis cannot be rejected at low levels of statistical significance. Be that as it may, the CIP equation tells us how to obtain the term premium from the carry-trade gain in the short run and it also sheds some light on the adjustment of nominal exchange rates to interest rates.

More formally, according to (1.1), an increase in the domestic interest rate should raise the term premium for a given value of the foreign interest rate and the country's risk premium. Mathematically this kind of adjustment can happen in one of three ways:

1) an increase in f_t and a decrease in s_t;
2) an increase in both f_t and s_t, but with $|\Delta f_t| > |\Delta s_t|$; or
3) a reduction in both f_t and s_t, but with $|\Delta f_t| < |\Delta s_t|$.

The evidence from Brazil (Rossi et all 2017) indicates that the third case is the usual one, that is, an increase in the domestic interest rate tends to appreciate both the forward and spot nominal exchanges rates, but the spot rate appreciates relatively more than the forward rate, so that the term premium rises as predicted by CIP. The opposite happens after a reduction of the domestic interest rate.

One possible explanation for case 3 is institutional, that is, the Brazilian derivatives forward market is more open and, therefore, less volatile than the spot market. Whether or not the same pattern happens in other emerging economies is a topic to be investigated empirically. The other possible explanation for case 3 is theoretical, that is, when the home interest rate is too high, arbitrage attracts capital inflows, which in their turn raise the supply of foreign exchange in the spot market and the demand for hedging in the forward market. The first factor pulls the spot rate down, whereas the second one pushes the forward rate up. However, since the term premium must equal the risk-adjusted interest-rate difference for arbitrage to cease, the second adjustment mechanism is limited, meaning that the forward exchange rate may appreciate depending on the magnitude of the carry-trade gain.

Overall, the CIP hypothesis gives us a good description of the adjustment of the term premium to interest rates, but it does tell us much about the level of the exchange rate. The determination of the exchange rate must come from other factors, and this where the combination of UIP with the BoPC can help.

2 – Uncovered interest rate parity and the real exchange rate

The term premium represents the average market opinion about the path of the nominal exchange rate, but at any premium someone will be long and someone else will be short in the domestic currency. The UIP hypothesis helps us determine the long and short positions of each agent in the derivatives market. Those that expect the home currency to depreciate less than predicted by the term premium will borrow in foreign currency and invest in the home currency. In contrast, those who expect the opposite will be short in the home currency and long in the foreign currency. The two forces cancel out when the term premium satisfies the CIP condition.

Considering each agent in isolation, the uncovered interest-rate (UIP) arbitrage will be neutral if:

$$i_{h,t} = i_{f,t} + \sigma_{h,t} + E_t s_{t+1} - s_t \ . \qquad (2.1)$$

where $E_t s_{t+1}$ is the current expectation of the spot rate at the end of period t+1.

In comparison to CIP, equation (2.1) states that arbitrage will be neutral for a rational agent when the carry-trade gain coincides with his or her expectation about the term premium.

In macroeconomic models we can use (2.1) to derive an interest-parity condition for the real exchange rate based on the representative agent of the economy. To do this, use the Fisher equation to define the expected real interest rate as:

$$r^e_{j,t+1} = i_{j,t} - E_t \pi_{j,t+1} \qquad (2.2)$$

where $E_t \pi_{j,t+1}$ are is the expected inflation in country j, for j equal to h and f. Based on (2.2), we can rewrite the UIP condition as:

$$r^e_{h,t+1} = r^e_{f,t+1} + \sigma_{h,t} + E_t q_{t+1} - q_t, \qquad (2.3)$$

where

$$q_t = s_t + p_{f,t} - p_{h,t} \qquad (2.4)$$

is the log of real exchange rate at the end of period t, meaning that $p_{j,t}$ is the price level in country j also at the end of period t.[1]

To see how UIP fits nicely into the usual New Keynesian model, just solve (2.3) for q_t. The result is an equation that defines the current real exchange rate as a function of the home and foreign nominal interest rates, the home premium, the expected inflation at home and abroad for period t+1, and the real exchange rate expected for t+1.

Equation (2.3) fits easily with a forward-looking Phillips, IS and monetary-rule curves in the usual New Keynesian 3-equation model to determine the dynamics of the exchange rate together with the nominal interest rate, inflation and the output gap (Poutineau et all 2015). In fact, UIP is just one additional equation in a log-linear dynamic stochastic general equilibrium (DSGE) that describes the dynamics of the endogenous variables as a vector autoregressive process fully determined by the initial conditions of the economy (Blanchard and Kahn 1980 and Binder and Pesaran 1997).

For the purpose of this paper and given the logical and econometric problems of DSGE models (Fair 2012 and Romer 2016), we will take an alternative partial equilibrium route based on conventional or anchored expectations to analyze the real exchange rate. The approach of this paper is closer to what people do in financial markets and in the government because of bounded rationality.[2] More formally, from (2.3) we have:

[1] To obtain (2.3) from (2.1), just add and subtract the expected home and foreign inflation rates to (2.1) and do some algebraic operations.

[2] In terms of post Keynesian theory, preferences and technology change over time and, therefore, the statistical distributions of the data-generating process are not stable enough to allow rational

$$q_t = \sum_{j=0}^{N-1} E_t[(i_{f,t+j} - \pi_{f,t+j+1}) + \sigma_{h,t} - (i_{h,t+j} - E_t\pi_{h,t+j+1})] + E_t q_{t+N}. \qquad (2.5)$$

The economic logic of (2.5) is that the value of the exchange rate at the end of period t depends on the "short-run" expected path of the real interest rates at home and abroad (up to period N-1) and the "long-run" expected real exchange (at period N). The yield curve and inflation forecasts gives us the short-run expectations, whereas the BoPC helps us determine the long-run or fundamental value of the real exchange rate based on a financial constraint.

To simplify the exposition, assume that N=1 in (2.5), so that the determination of the nominal and real exchange rates comes from a system of just four equations: the CIP condition given by (1.1), the definition of the real exchange rate given in (2.4), the UIP condition given in (2.5) and the following assumption about the exchange-rate expectations:

$$E_t q_{t+1} = q_t + \gamma(q_t^* - q_t). \qquad (2.6)$$

In words, the "market" has a conventional or anchored expectation about the long-run real exchange rate (q_t^*) and it assumes that the effective real exchange rate will converge to it at velocity $\gamma > 0$.

Now, if substitute (2.6) in (2.3), the result is

$$q_t = q_t^* - \left(\frac{1}{\gamma}\right)(i_{h,t} - i_{f,t} - \sigma_{h,t}) + \left(\frac{1}{\gamma}\right)(E_t\pi_{h,t+1} - E_t\pi_{f,t+1}), \qquad (2.7)$$

which is the usual specification of the real exchange rate in one-equation or partial-equilibrium econometric models.

The economic meaning of (2.7) is that the current real exchange rate is a negative function of the carry-trade gain, a positive function of the expected excess of home inflation over foreign inflation, and a positive function of the long-run exchange rate as well. The value of q_t^* depends on the agents' expectations about the financial constraint on the home economy in the long run, which is our next topic.

3 – Trade and the balance-of-payments constraint

The BoPC can be specified in real or financial terms. The first approach comes from the assumption of rigid or fixed coefficients of production function (Chennery and Bruno 1962), so that imports can constraint output from the supply side as any other factor of production. If there is some degree of substitution between the home and domestic income, then the BoPC becomes a financial constraint, that is, a condition derived from a non-explosive balance of payments.

The most famous and used specification of the BoPC comes from Thirlwall's model (Thirlwall 1979), according to which the trade flows have constant price and income elasticities, the real exchange rate is stable and trade must be balanced over a long period of times. More formally, assume that the real import and export functions take the following form:

$$M = Aq^{-\alpha}Y_h^{\beta} \qquad (3.1)$$

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expectations based on past information. Agents deal with such kind of uncertainty based on conventional rules which, whatever they may be, are constrained by the accounting identities of the economy ("macrofoundations").

and

$$X = Bq^{\gamma}Y_f^{\delta}. \tag{3.2}$$

Then define the BoPC simply as:

$$X = qM. \tag{3.3}$$

After some algebraic operations we have:

$$\hat{Y}_h = \left(\frac{\alpha+\gamma-1}{\beta}\right)\hat{q} + \left(\frac{\delta}{\beta}\right)\hat{Y}_f \tag{3.4}$$

where $\widehat{w} = (1/w)(dw/dt)$, is the exponential growth rate of w, for any variable w.

The economic meaning of (17) is that a depreciation of the real exchange rate accelerates growth only if the Marshall-Lerner condition is satisfied ($\alpha + \gamma > 1$), as well as that the home growth rate is a function of the foreign growth rate when the real exchange rate is stable. In Thirlwall's model the exchange rate is assumed to be stable in the long run, so that the BoPC boils down the foreign growth rate multiplied by the ratio of the income elasticities of exports to imports.

Thirlwall's model gave rise to a long empirical literature, which usually confirms its validity in the long run, that is the average period during which trade is balanced and the real exchange rate reverts to its mean. From a theoretical point of view, the main limitations of Thirlwall's original specification of the BoPC lie in the assumptions of balanced trade and constant price and income elasticities. Fortunately, these two hypotheses can be relaxed without loosing Thirlwall's original view that the growth rate of a small open economy may be limited by the growth rate of the rest of the world (McCombie and Thirlwall 2004).

To illustrate the above point, consider a model where trade can be unbalanced, but the ratio of exports and imports to income must be stable in the long run. In economic terms this means that the open economy can have a permanent trade deficit or surplus, provided that the imbalance is stable in terms of its income. To investigate this case mathematically, let $m = qM/Y_h$ and $x = X/Y_h$ be the import-income and export-income ratios, respectively.

The second step is to drop Thirlwall's constant elasticity functions and define real exports as a ratio of foreign income, and imports as a ratio of home income, that is: $X = \chi Y_f$ and $M = \mu Y_h$, where the ratios χ and μ are assumed to be functions of the level of the real exchange rate.

Third, to simplify the analysis, assume that the trade ratios are linear functions of the real exchange rate, at the economically relevant range of the real exchange rage,[3] that is:

$$\hat{\chi} = \phi_{\chi}(\chi_0 + \chi_1 q - \chi), \tag{3.5}$$

and

$$\hat{\mu} = \phi_{\mu}(\mu_0 - \mu_1 q - \mu). \tag{3.6}$$

[3] Since it is reasonable to assume that the real exchange cannot do miracles, that the market for some products is not only accessible by relative price, the logistic function is an alternative and probably more proper functional form for the trade-ratio functions in applied works. Given the theoretical focus of this paper, we will proceed with linear approximations to simplify the exposition.

The economic meaning of (3.5) and (3.6) is that the export-foreign income and the import-home income ratios adjusts gradually to their long-run values at the “speed” given by the positive parameters ϕ_χ and ϕ_μ, respectively. By assumption the long-run values of the trade ratios have fixed components (χ_0 and μ_0) given, for example, by industrial policy and per-capita income levels. And the long-run trade ratios have a real-exchange-rate component as well, meaning that that a higher real exchange rate makes exports more ($\chi_1 > 0$) and imports less ($\mu_1 > 0$) competitive.

From the previous assumptions, the dynamics of the nominal trade-income ratios become:

$$\hat{x} = \phi_\chi(\chi_0 + \chi_1 q - \chi) + (\hat{Y}_f - \hat{Y}_h) \tag{3.7}$$

and

$$\hat{m} = \hat{q} + \phi_\mu(\mu_0 - \mu_1 q - \mu). \tag{3.8}$$

The steady state of the trade system happens when the real exchange rate is stable, the home and foreign economies grow at the same velocity, and the trade-income ratios are at the their long-run values, given by the real exchange rate and other fixed effects.[4]

Now, in line with the approach of BoPC models, the logic of the “trade-ratio” specification given in (3.7) and (3.8) is that real exports and imports move according to the exogenous trends given by the real exchange rate and the growth rates of the home and foreign income. Based on this view, our fourth and final step is to define $n = x - m$ as the ratio of net exports to home income, in nominal terms, so that at the steady state:

$$n = (\chi_0 + \chi_1 q)\frac{Y_f}{Y_h} - q(\mu_0 - \mu_1 q). \tag{3.9}$$

In the terminology of development economics, equation (3.9) gives us the trade-off between the real exchange rate and the domestic level of economic activity necessary to keep net exports at its BoPC. The net-export function is the link we need for the financial considerations of the next section.

Before we to move to what defines n, note that even when we assume linear long-run trade ratios, the net-export ratio is a quadratic “concave-up” function of q. In theory, this result means that a given value of net exports may be compatible with more than one positive value of the real exchange rate (multiple equilibria). In practice, most models in applied macroeconomics assume that the Marshall-Lerner condition holds, meaning that an increase in the real exchange rate raises net exports in proportion to GDP in the long run. We will proceed under this assumption in this paper, so that we can use (3.9) to obtain the real exchange rate as an inverse function of the net export ratio.

4 – The liquidity constraint

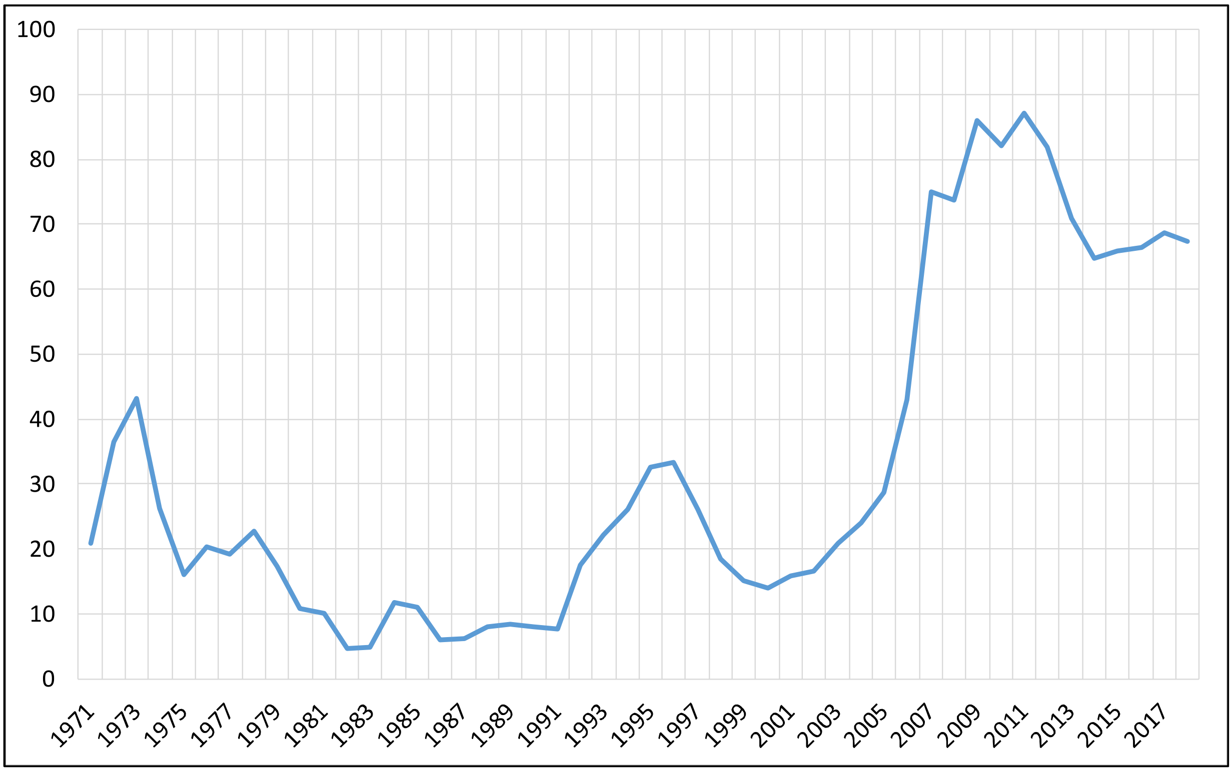
After the currency crises of the late 1990s and early 2000s, most emerging economies moved to a system of inflation targeting and floating exchange rates, but with the development twist of accumulating a sizeable amount of foreign reserves. From a geopolitical point of view, the decision to hedge against international shocks through foreign reserves was

[4] To link the BoPC with the usual models of macro policy, we can add a fifth differential equation that determines the growth rate of home income in terms of a Phillips, IS and monetary-rule curves, making it compatible with the standard New Keynesian 3-equation structure.

a response to the failure of the Washington multilateral institutions in providing adequate financial assistance when financial assistance was needed in the late 1990s.[5]

From a theoretical point of view, the transformation of the BoPC into a liquidity constraint can be described through a model in which the home country aims to maintain its foreign reserves above a minimum level of its foreign debt. The inspiration for the model is again the Brazilian case (Barbosa-Filho 2001B), since the Brazilian government started accumulating foreign reserves more actively in 2006 and, in recent years, the country's liquidity ratio seems to have stabilized at a high level, as shown in figure 1.

Figure 1: Brazilian liquidity ratio (foreign reserves as a percentage of gross foreign debt)



Source: IPEADATA and author's calculation

To translate figure 1 in a proper model, start by defining the ratio of foreign reserves (Z) and foreign debt (D) to home income as $z = sZ/P_hY_h$ and $d = sD/P_hY_h$, respectively. The liquidity ratio is therefore $l = z/d$ and we can investigate its logical implication from the dynamics of the reserve and debt-income ratios. To do this, assume that the balance of payments of the home country in home currency is:

$$N - sH - isD + s(F_E + F_D) = s\dot{Z}, \qquad (4.1)$$

where N represents net exports of goods and services (in home currency), H the net payment of factor income and transfers, i the nominal interest rate of foreign debt, and F_E and F_D the net capital inflow through variable income (equity) and fixed-income (debt) instruments,

[5] In the late 1990s, currency crises usually became full-fledged fiscal or financial crises in emerging economies due to the home country's government net debtor position in foreign currency. Since the early 2000s, the government became a net creditor in foreign exchange in many emerging economies, so that when adverse international shocks hit the economy, the Treasury or the Central Bank has a capital gain and this opens space for counter-cyclical initiatives domestically.

respectively. Apart from N, all other elements in (4.1) are expressed in foreign currency, so they must be multiplied by the spot exchange rate to be added to N.

Equation (4.1) is an accounting identity, that is, it states that the change in foreign-reserve assets must be equal to the sum of the current account and capital flows excluding foreign-reserve assets.[6] Based on this fact, the dynamics of the reserve and debt-income ratios are:

$$\dot{r} = n - h - id + f_E + f_D + \left(\hat{q} - \hat{P}_f - \hat{Y}_h\right)r \tag{4.2}$$

and

$$\dot{d} = f_D + \left(\hat{q} - \hat{P}_f - \hat{Y}_h\right)d. \tag{4.3}$$

where n is the ratio of net exports to income that we analyzed in the previous section. By definition $h = sH/P_hY_h$, $f_E = sF_E/P_hY_h$ and $f_D = sF_D/P_hY_h$ are the variables already introduced in (4.1), but now expressed in terms of the home real income.[7]

In mathematical terms, (4.2) and (4.3) form a system of two linear differential equations for r and d. To find its long-run solution, assume that the real exchange rate is constant ($\hat{q} = 0$). At the steady state, the values of the reserve and debt-income ratios are:

$$d^* = f_D/\left(\hat{P}_f + \hat{Y}_h\right) \tag{4.3}$$

and

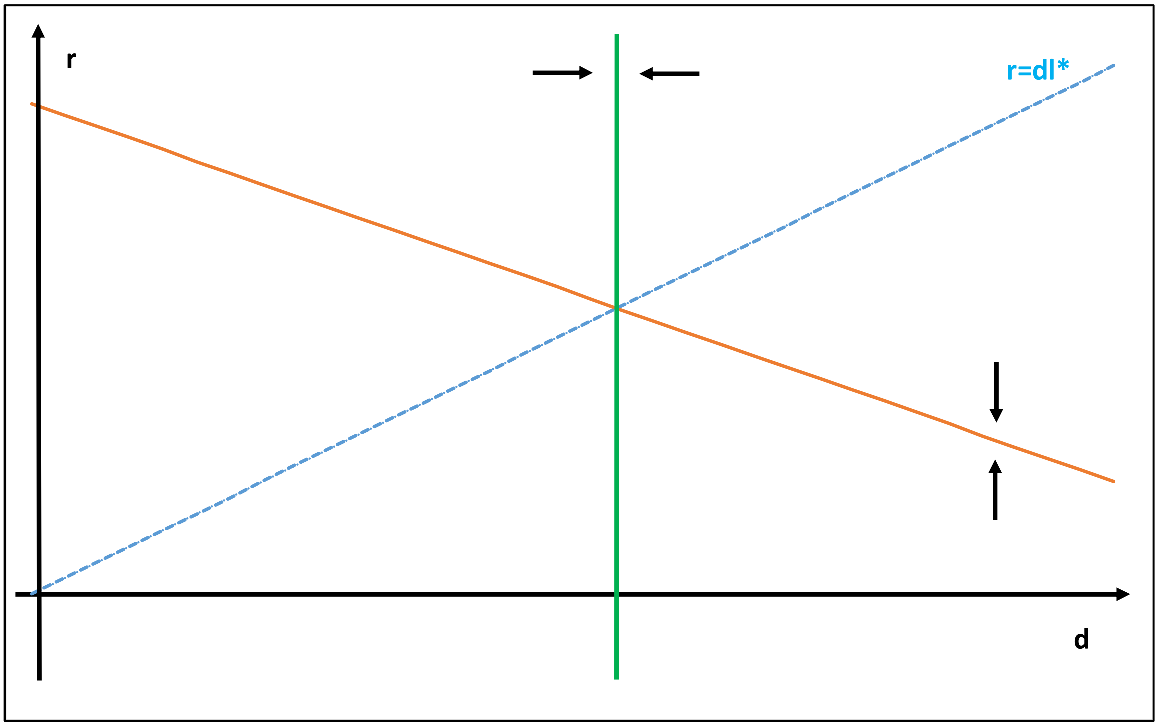
$$r^* = [n - h - id^* + f_E + f_D]/\left(\hat{P}_f + \hat{Y}_h\right). \tag{4.4}$$

In words, given the foreign rate of inflation ($\hat{P}_f$) and the home growth rate ($\hat{Y}_h$), the net debt inflows (f_D) determines the home country's debt ratio in (4.3). Then, given the debt ratio, the current-account balance ($n - h - id^*$) and the net equity inflows (f_E) determine the home country's reserve ratio in (4.4). Figure 2 shows the phase diagram of the system.

<u>Figure 2: phase diagram of the ratio of foreign reserves and foreign debt to income</u>

[6] In the most recent balance-of-payments methodology (the BPM6), the IMF recommends that the BoP must always be zero, that is, that the change in the Central Bank's foreign reserve assets should be registered as an outflow in the financial account of the BoP. In terms of equation (4.1), the IMF recommendation just means moving $s\dot{Z}$ to the left-hand side of the identity.

[7] To obtain (4.4) and (4.3) from the time derivate of r and d we also used the fact that $\hat{s} - \hat{P}_h = \hat{q} - \hat{P}_f$.



Source: Barbosa-Filho (2011B)

The long-run liquidity ratio is the slope of the ray linking the origin to the steady state in figure 2. We can calculate this value by dividing (4.4) by (4.3), that is:

$$l^* = \frac{n-h+f_E}{f_D} + 1 - \left(\frac{i}{\hat{P}_f+\hat{Y}_h}\right). \tag{4.5}$$

Then, since we defined the BoPC as a target value for the liquidity ratio, we can solve (4.5) for the net-exports ratio and obtain

$$n = h - f_E + f_D\left[l^* + \left(\frac{r-\hat{Y}_h}{\hat{P}_f+\hat{Y}_h}\right)\right], \tag{4.6}$$

where to simplify notation $r = i - \hat{P}_f$ is the real interest rate paid by the home country.

We can now link the BoPC with net exports, the real exchange rate and home income. To do this, recall that we showed how a trade constraint defines a trade-off between the real exchange rate and the ratio of home and foreign income in (3.9). The BoPC closes the model by defining the equilibrium value of the trade balance in (4.6), that is, combining the two equations we have a relationship between the real exchange rate and home income that depends on the market's expectations about long-run trade and financial conditions:

$$(\chi_0 + \chi_1 q)\frac{Y_f}{Y_h} - q(\mu_0 - \mu_1 q) = h - f_E + f_D\left[l^* + \left(\frac{r-\hat{Y}_h}{\hat{P}_f+\hat{Y}_h}\right)\right] \tag{4.7}$$

In economic terms, the liquidity constraint gives us the long-run determinants of the equilibrium real exchange rate for a given ratio of home to foreign income. For example, assuming that the Marshall-Lerner condition holds, the higher the net factor and transfer payments (h) to the rest of the world, the higher the net exports will have to be to meet the liquidity constraint and, therefore, the higher the real exchange will also have to be. In the opposite direction, the higher the net equity inflows (f_E), the lower the net exports and real exchange can be.

The liquidity constraint itself also influences the steady-state value of net exports and the real exchange rate. For example, when the economy is net receiver of debt flows ($f_D > 0$), a high l^* pushes the value of n up, which in its turn pushes the value of the long-run real exchange rate also up. In the same vein, when the home country is a net receiver of fixed-income capital flows, the higher the real interest rate paid on its foreign debt (r), the higher its net exports and real exchange rate must be to keep the liquidity ratio on target.

5 – Conclusion

Based on the previous sections we can now summarize the link between carry trade and the BoPC as a sequential partial equilibrium model, that is:

(i) The long-run expectations about international financial conditions and the home country's net financial position determine the expected ratio of net exports to income necessary to maintain the home country's liquidity ratio at an appropriate level.

(ii) The expected long-run value of the trade balance then determines the expectation about the long-run or fundamental value of the exchange rate for a given ratio of home and foreign income.

(iii) If the expectations about the structural determinants of the BoPC change, the expectation of the long-run value of the real exchange rate also changes, which in its turn has an immediate influence on the real and nominal exchange rates in the short run, through interest-rate arbitrage conditions.

The result of the model is that, in a small open economy with an open capital account, the carry-trade gain determines the term premium, but the specific values of the nominal and real spot real exchange rate can only be obtained if we know the agents' long-run expectation about the real exchange rate. The BoPC helps exactly with the latter, that is, it gives us a framework to analyze the level of the real exchange rate consistent with non-Ponzi financial position.

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