

Discussion Paper No. 9113

November 1991

Foreign Borrowing and the Generalized Real  
Exchange Rate

by

Raul V. Fabela

(1991/12) 4.1.13

**Note:** UPSE Discussion Papers are preliminary versions circulated privately to elicit critical comment. They are protected by the Copyright Law (PD No. 49) and not for quotation or reprinting without prior approval.

2.6/93

Foreign Borrowing and the Generalized Real  
Exchange Rate

*Raul V. Fabella  
University of the Philippines  
Diliman, Quezon City  
Philippines*

Abstract

We propose a formula (the generalized real exchange rate) that reflects better the real price of the real dollar when the economy is financing trade deficits by foreign borrowing.

The real exchange rate (RER) is the ratio of foreign to domestic wholesale prices expressed in domestic currency (Branson, 1981). As wholesale prices exclude a major component of non-traded goods, services, this is also interpreted as a proxy for terms of trade (Katseli, 1984). Harberger (1989) also interprets it as the "real price of the real dollar". One of the multitude of contexts in which it finds usage is as an indicator of the overvaluation of the domestic currency (e.g., Cuddington, 1987; Ketkar and Ketkar, 1989). In the latter studies, overvaluation reflected by RER stimulates capital flight. Many central banks now use RER movements to signal either an exchange adjustment and by how much or to set in motion monetary countermeasures to mitigate the upward pressure. This is viewed as insuring that the exchange rate does not go too far out of line and precipitate a balance of payments crisis.

Williamson (1983) went farthest in addressing the problem of estimating the fundamental equilibrium exchange rate (FEER) ("which is expected to generate a current account surplus or deficit equal to the underlying capital flow over the cycle, given the country is pursuing 'internal balance' as best it can and not restricting trade for balance of payments reason.") in a world of extensive capital flows. In practice, he estimated the desired change in a country's current account balance and uses the IMF multilateral exchange rate model (MERM) to get at the required change in nominal exchange rate to effect the desired current account change. This is transformed into required real effective exchange rate (REER) change. From the equation  $CA = f(TOT, DP, REER)$ , where CA is current account, TOT is the terms of trade, DP relative demand pressure, one can solve the REER for a given CA

deficit (presumably a "good deficit") which defines the FEER. Thus, the FEER is really a refinement of the REER idea. He proceeds to do this for the USA, Japan, Germany, France and UK. Well and good. But as Williamson himself is quick to admit, "the procedures employed are uncomfortably ad hoc."

The principal attraction of RER lies in simplicity and doability accounting for its widespread use. We are interested in an index that improves on RER under capital flow while preserving the modest expertise and data requirement. Before we embark on the enterprise, we first discuss the context of the undertaking in the LDC setting.

Our concern specifically is the adequacy of RER levels in the presence of foreign debt-financed trade deficits which is common in LDCs. Borrowing from abroad allows the authorities to maintain the prevailing exchange rate level in the face of upward pressures on domestic prices either because of a rise in domestic demand, a shortfall in export receipts, or a deterioration of the terms of trade. If the external borrowing ceiling is not hit, the RER itself would be unchanged as debt-financed imports soak up domestic demand pressure and puts a lid on domestic prices. But, in an era of rational expectations, agents are not fooled by the absence of change either in the exchange rate or in prices. In the spirit of Barro (1974), agents recognize that this borrowing represents future liabilities and would react by either hoarding artificially cheap foreign exchange, hoarding artificially cheap importables or resorting to capital flight. Edwards (1989) shows in an elaborate real exchange rate general equilibrium model that a rise in anticipated tariff (due to anticipated future liabilities in our case) raises the equilibrium real exchange rate. However, Central

Bank authorities seeking counsel only from RER-type measures will fail to either adjust the exchange rate or initiate monetary countermeasures and reinforce the process towards a balance of payments crisis. Thus, the problem falls really within the rubric of Williamson's mobile capital world.

In Section II, we first review the raw RER index and its most popular cousins. We claim that all of them can underestimate the degree of overvaluation in a current account deficit economy. In III, we generate a partial equilibrium approximation of the price repression due to foreign borrowing-financed deficit and propose the "generalized real exchange rate" (GRER) index which corrects for this deficiency of the RER. In IV, some applications are given.

## II. The View from RER

The real exchange rate (RER) is defined as

$$(1) \quad RER = [\bar{E} P^*/P^0] [100]$$

where  $\bar{E}$  is the official exchange rate,  $P^*$  is the price level of the country's trading partner and  $P^0$  is the domestic price level. When a country has a multitude of trading partners, a derivative of the real exchange rate known as the "real effective exchange rate" (REER) defined (see, e.g., Krueger, 1978; Bhagwati, 1978; Bautista, 1989) as:  $REER = [\bar{E} \sum_j w_j E_j P_j / P^0]$ , where  $\bar{E}$  and  $P^0$  are as above,  $w_j$  is the import weight of country  $j$ ,  $E_j$  is  $j$ th exchange rate against the US dollar, and  $P_j$  is  $j$ th price level. When the distinction between the traded and nontraded sectors is of interest, the PPP is used (Officer, 1975; Katseli, op.cit.). With multiple trade partners, it is

also common to use a weighted wholesale price index known as the SDR - WPI which is constructed on the basis of wholesale price indices of the US, Germany, France, Japan and the UK using weights employed in the IMF calculation of Special Drawing Rights (SDRs). For convenience, we will present our case only on the basis of (1) although our results will hold for all the derivatives of RER.

The common practice is to use the domestic consumers price index (CPI) for  $P^o$  and the producers price index (PPI) of the trading partner for  $P^w$ . These, together with the SDR-WPI, are given in the IMF International Financial Statistics.

Although useful in many circumstances and definitely an improvement over an inflation-invariant exchange rate level, the RER-tracking official rate can itself generate a false sense of security. Consider an aggregate good  $Q$  for an open economy with demand  $D$  and supply  $S$  of  $Q$  at initial period. Let equilibrium price  $P^e = 1 = P^o$ . Let  $P^w = 1$  and  $\bar{E} = 1$ . Thus, the domestic price  $P^o = \bar{E} P^w$  and no deficit is incurred, i.e., imports equals zero. Note that  $RER = 1$ . Now, consider a parallel shift in the demand curve giving  $D'$  in the next period. Suppose  $P^{e'} = 2$ . Now imports start to flow in. Suppose  $\bar{E}$  is kept equal to 1 via foreign borrowing to finance imports. The domestic price remains at  $P^o = \bar{E} P^w = 1$ . In the second case, RER is still equal to 1. But the economy is now faced with a foreign debt (equal to the deficit). The RER price of the dollar is still unchanged but this is propped up only by borrowing from abroad. The domestic price level is really artificially too low and this results in a subsidy to foreign producers. To return the economy to a position of trade solvency, the official rate  $\bar{E}$  should rise to 2, thus, ensuring

that exports match imports (imports = 0 of aggregate good Q means that imports of some goods match revenue-wise exports of others). If  $P_e'$  is the domestic equilibrium price level at  $\bar{E} = 1$ ,  $RER = (1)(1)/(2) = 1/2$  or the real price of the dollar has fallen by half due to a shift in demand to  $D'$ .

As observed earlier, this RER-faithful official rate can lead to problems. Rational agents know a la Barro (op.cit.) that this borrowing represents an obligation that has to be made good in the future. As mentioned earlier, this translates into future taxes and as Edwards (op.cit.) shows, the equilibrium exchange rate should rise. Meanwhile, the domestic price level is too low and these agents either hoard imported goods or foreign exchange and/or resort to capital flight. This aggravates the pressure on the exchange rate, force additional borrowing and perhaps nudges the economy faster towards a dreaded balance of payments crisis. These are clearly the same predicaments that face (in a more explosive way, perhaps) the inflation-invariant exchange rate level!

### III. Price Repression and Approximation

When there is foreign borrowing to finance a trade deficit, the domestic price level is, in a sense, repressed relative to "trade balance price level". This latter is defined as "the domestic price level that should obtain if the economy is to meet its current and future foreign obligations." The current obligation comes in the form future debt service of debt service payments for accumulated past debt. The future obligation comes in the form of foreign borrowing incurred this period to finance current trade deficit. Both these obligations

are implicit demands for dollars which are normally not reflected by the RER when foreign borrowing is incurred.

Let  $D(P)$  be the demand function and  $S(P)$  be the supply function. Let the economy be faced by a debt service payment equivalent to  $N$  units of the aggregate good at world price  $P^w$ . Clearly, if the debt service is to be made good, the economy must spare and export  $N$  given  $D(P)$  and  $S(P)$ . Thus, there is a price level  $P'$  such that:

$$(2) \quad N = S(P') - D(P') > 0.$$

Suppose now that at  $P^w$  and current exchange rate  $\bar{E}$ , the economy is actually importing  $M$  units and incurring additional foreign debt to finance the deficit. (Note that when we say "M units is imported", we mean that some goods may be exported and some imported but that import payments exceed export earnings. In this sense,  $M$  is really the trade deficit.) We know that

$$(3) \quad M = S(P^0) - D(P^0) < 0$$

where  $P^0 = \bar{E} P^w$ . From (2) and (3), we have

$$(4) \quad (N-M) = [S(P') - S(P^0)] - [D(P') - D(P^0)] > 0.$$

The actual current price level in the economy is  $P^0$ . The price level that should obtain if the economy is to meet its present and future obligations is  $P'$ . Our purpose is to approximate the extent of price repression due to borrowings induced by the trade deficits. To do this, we first take the Taylor series expansion of  $S(P')$  and  $D(P')$  around the current domestic price  $P^0$ :

$$(i) \quad S(P') = S(P^0) + S_p(P^0)(P' - P^0) + \frac{S_{pp}(P^0)}{2!}(P' - P^0)^2 + \dots +$$

$$(5) \quad (ii) \quad D(P') = D(P^0) + D_p(P^0)(P' - P^0) + \frac{D_{pp}(P^0)}{2!}(P' - P^0)^2 + \dots +$$

where  $S_p(P^0) = dS/dP$ ,  $S_{pp} = d^2S/dP^2$ ,  $D_p(P^0) = dD/dP$  and  $D_{pp} = d^2D/dP^2$  all evaluated at  $P^0$ . In the following, we will, according to common practice, ignore all expressions of order greater than 2 as "n order small". Using (5), we get the following from (4):

$$(6) \quad (N-M) \approx (P' - P^0)[S_p(P^0) - D_p(P^0)] + [(P' - P^0)^2][S_{pp} - D_{pp}]/2.$$

Finally, we have

$$(7) \quad (P' - P^0) \approx \{(N-M)/[S_p(P^0) - D_p(P^0)]\} - \left[ \frac{[(P' - P^0)^2][D_{pp} - S_{pp}]/2}{S_p(P^0) - D_p(P^0)} \right].$$

Definition 1: There is price repression whenever  $(P' - P^0) > 0$  in (7).

$P'$  in (7) is the "trade balance price level."

Remark: The appropriate approximation will turn out to be (10) below rather than (7). In practice, then (10) should replace (7).

Now we have

$$(8) \quad (i) \quad S_p(P^0) = \epsilon_s(S(P^0)/P^0)$$

$$(ii) \quad D_p(P^0) = \epsilon_d(D(P^0)/P^0)$$

where  $\epsilon_s = S_p(P^0)(P^0/S(P^0))$  and  $\epsilon_d = D_p(P^0)(P^0/D(P^0))$  are aggregate supply and demand elasticities, respectively. Using (8) in (7), we get

$$(9) \quad (P' - P^0) \approx \{[(N-M)/S(P^0)]/[\epsilon_s + \epsilon_d]\}P + P^0(S_p)[(P' - P^0)^2][\epsilon_{dd}(D_p/S_p) - \epsilon_{ss}]/(2S(P)P)(\epsilon_s + \epsilon_d)$$

where  $\epsilon_{dd} = D_{PP}(P^0/D_P)$  and  $\epsilon_{ss} = S_{PP}(P^0/S_P)$  and  $\epsilon = [D(P^0)/S(P^0)]$ . We call attention first to  $(2S(P^0)P^0)$ . If we take, as we shall, the "gross domestic product" (GDP) as its proxy,  $(S(P^0)P^0)$  would be a very large number and the second expression to the right of the equality sign in (9) is vanishingly small for reasonable values of the other constituent expressions. On the other hand,  $[(N-M)/S(P^0)]$  can be significant. We may, therefore, drop the former expression from our approximation. We now have:

$$(10) \quad P' \approx P^0 + \{[(N-M)/S(P^0)]/(\epsilon_s + \epsilon_d)\}P^0.$$

One may be bothered by the approximate nature of (10) and may want to know when (10) is an exact expression. The following is obvious:

Claim 1: If  $D(P)$  and  $S(P)$  are linear, then (10) can be written as an equality, i.e.,

$$(11) \quad P' = P^0\{1 + [(N-M)/S(P^0)]/(\epsilon_s + \epsilon_d)\}.$$

Proof: Under the linearity condition, all orders higher than one disappear in (5). (10) becomes an equality. Q.E.D.

Thus, there is a case (which is also what comes to mind at first blush) where the regression estimate is exact. However, in the nature of things current,  $\epsilon_s$  and  $\epsilon_d$  are bound to be available only for very limited circumstance, if at all, and in most cases, as sectoral estimates in a double-log regression which constrains the demand and supply functions to a particular structure. In other words, in practice,  $\epsilon_s$  and  $\epsilon_d$  are parametric rather than variable. We are now ready to define GREER.

Definition 2: The Generalized Real Exchange Rate (GRER) is defined as

$$(12) \text{ GRER} = \bar{E} P^w/P' [100]$$

where  $P'$  is as in (10).

Note that the difference between RER and GRER is the use of  $P'$  in lieu of  $P^0$  in (1). The following is obvious and justifies the term "generalized".

Claim 2:  $\text{GRER} \begin{cases} < \\ > \end{cases} \text{RER}$  if  $(N-M) \begin{cases} > \\ < \end{cases} 0$ .

Proof: If  $(N-M) \begin{cases} > \\ < \end{cases} 0$ ,  $P' \begin{cases} > \\ < \end{cases} P^0$  by (11) and  $\text{GRER} \begin{cases} < \\ > \end{cases} \text{RER}$  by (1) and (12)  
Q.E.D.

Equality can also happen when there is a trade surplus that equals the debt service. We have shown that the RER gives an upwardly biased view of foreign exchange cheapening when the trade deficit and foreign borrowing to finance it is sizeable. The GRER corrects this. Note that the notion of price repression is general enough to apply to derivatives of RER such as the "real effective exchange rate". (REER).

The price repression expression  $(P' - P^0)$  implied in (10) gives the extent of domestic price adjustment required to put the economy in a situation to honor its current and future obligations. Although, we have associated  $M$  with the trade deficit, one can also associate this with the current account deficit if there are sustainable capital flows towards the economy. In the case of the Philippines and many Asian countries this comes in the form of overseas worker remittances. One can, however, go further. One can isolate when data is available those import items in the trade account that potentially pay their own way such as portions of capital imports and imported inputs for exports and

subtract these further from the current account deficit. This would then take care of what Williamson (1989) considers "good deficit." Thus, the GRER is flexible enough to accommodate dynamic concerns.

#### IV. Application

We now estimate the GRER and compare it with RER for selected instances. We assume that the data at the disposal of the researcher are only those from regularly available data sources. Before this can be done, we adopt the following proxies:

- (i)  $P^w$  is current US PPI(1973 = 100)
- (ii)  $P^o$  is current domestic CPI (1973 = 100)
- (iii)  $X$  is current debt service (\$)
- (iv)  $M$  is trade deficit (\$)
- (v)  $S(P^o)$  is Gross Domestic Product (\$)
- (vi)  $\bar{E}$  is the official exchange rate (1973=100)

All these are sources from the IMF International Financial Statistics.

We also adopt the following elasticity values:

- (a)  $\epsilon_s = 0.1$
- (b)  $\epsilon_d = 0.4$

These are short-run elasticities.  $\epsilon_s = 0.1$  is often adopted in CGE work.  $\epsilon_d = 0.4$  is about the mean of the battery of sectoral-demand elasticities adopted in the PIDS-TC (Philippine) Trade Liberalization Impact Analysis (Parial, 1989). The latter also adopts  $\epsilon_s = 0.1$  for the short run. The choice of the base year (1973) is due to the trade balance being a small positive for this year. Only in 1964 did this happen throughout the post-war period.

- a. For the Philippines in 1988,  $P^o = 740.8$ ,  $N = 2.8b(\$)$ ,  $M = -1.085b(\$)$ ,  $GDP = 38.5b(\$) = S(P^o)$ ,  $P^w = 237$ ,  $\bar{E} = 316$ ,  $(\epsilon_s + \epsilon_d)^{-1} = (0.512)^{-1}$ . Now,  $(0.512)^{-1} (0.10)(740.8) = 140.7$ . Thus,  $P' = 881.5$  and  $GRER = (316.6)(237.3)/881.5 = 85.23$ . Compare this with  $RER = 101.5$  for 1988. The RER gives the impression of a 1.5% subsidy to domestic producers compared to base year. The GRER picture shows a 14.77% subsidy to foreign producers relative to base year. A balance of payments crisis occurred in mid-1990.
- b. For Thailand, 1983, the year before the devaluation of 18% (from 23 to 27.15 baht to a dollar), we have  $P^o = 256.3$ ,  $GDP = 39.57b(\$) = S(P^o)$  and  $N - M = 5,014$ .  $P' = 256.3 + 61 = 317.3$ . With  $P^w = 225$ , and using the same aggregate elasticities,  $GRER = 80$ . Thus, a 20% penalty to domestic producers compared to base year was indicated.  $RER = 99.1$  for this year or a mere 1% penalty for the year. The devaluation, thus, reflected the GRER rather than the RER.

These calculations give the extreme case of the exchange rate change that would close the trade gap. That which would close the current account gap would be a little different. The choice of another base year will of course change the orders of magnitudes but the message of underestimation of the overvaluation will remain.

### Conclusion

When the open economy resorts to foreign borrowing to finance a trade deficit, the RER-based exchange rate management can give a false sense of security. The foreign borrowing can cause the RER to remain unchanged even when the economic fundamentals have changed. Economic

agents who know that the borrowing represents future liabilities are not fooled and adjust behavior a la Barro (op.cit.). They either hoard artificially cheap imported goods, hoard foreign exchange or resort to capital flight. Thus, the situation aggravates and the monetary authorities are still in danger of driving into a balance of payments crisis which the RER-based exchange rate management is supposed to avoid. We propose a more general index, the "generalized real exchange rate" (GRER) which corrects for foreign obligations current and future and show that the overvaluation is underestimated by RER. When trade deficit is zero and no debt service is being made, or if the trade surplus equals the debt service, the GRER equals the RER. We give two examples of underestimated overvaluation.

- Albuero, F. and G. Shepherd, 1985, "Trade Liberalization Experience in the Philippines, 1950-84," PIDS Working Paper No. 86-01, Philippine Institute for Development Studies, Manila.
- Barro, R. J., 1974, "Output Effects of Government Purchases," Journal of Political Economy 82, 1095-1117.
- Bautista, R. M., 1980, "Exchange Rate Policy, Aggregate Demand Management and the Real Exchange Rate in Developing Countries: an Empirical Note," Philippine Review of Economics and Business 17, 1-18.
- Bhagwati, J. N., 1978, Foreign Trade Regimes and Economic Development: Anatomy and Consequences of Exchange Control Regimes (New York: Columbia University Press).
- Branson, W., 1981, "Macroeconomic Determinants of Real Exchange Rates," NBER Working Paper No. 801.
- Cuddington, J. T., 1987, "Macroeconomic Determinants of Capital Flight: An Econometric Investigation," in Lessard, D. R. and J. Williamson (eds), Capital Flight and Third World Debt, (Washington D.C.: Institute for International Economics).
- Edwards, S., 1989, Real Exchange Rates, Devaluation and Adjustment (Cambridge, Mass: The MIT Press).
- Harberger, A., 1989, "Applications of Real Exchange Rate Analysis," Contemporary Policy Issues 7, 1-26.
- Katseli, L., 1984, "Real Exchange Rates in the 1970s," in Bilson, J. F. and R. C. Marston (eds), Exchange Rate Theory and Practice (Chicago: University of Chicago).
- Ketkar, S. L. and K. W. Ketkar, 1989, "Determinants of Capital Flight from Argentina, Brazil, and Mexico," Contemporary Policy Issues 7, 11-29.
- Krueger, A. O., 1978, Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences (New York: Columbia University Press).
- Officer, L., 1976, "The Purchasing-Power-Parity Theory of Exchange Rates," IMF Staff Papers, 23, 1-60.
- Parial, M., 1989, "Analysis of the Impact Effects of Import Liberalization and Tariff Changes," TC-PIDS Working Paper, Philippine Institute for Development Studies, Manila.
- Williamson, J., 1983, The Exchange Rate System (Washington, DC: Institute for International Economics).
- \_\_\_\_\_, 1989, in a speech at a Conference on International Finance and Banking held in October 24, 1989 and reported by IMF Survey (Nov. 13, 1989).

Albuero, F. and G. Shepherd, 1985, "Regional Generalization Experience in 14 the Philippines, 1960-84," PIDS Working Paper No. 86-01, Philippine Institute for Development Studies, Manila.

Barro, R. J., 1974, "Output Effects of Government Purchases," Journal of Political Econom