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Exchange Rate Assessment: A Review of
Concepts and Indicators

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Abstract

Real exchange rate volatility and real exchange rate misalignment have welfare costs: they generate incorrect signals that can misallocate resources and reduce economic efficiency. It is difficult to determine, both theoretically and practically, whether a country's real exchange rate is misaligned. However, there are several indicators - exchange rate indices, relative price index, elasticities, commodity-specific analysis, parallel market exchange rate, and regression residuals - that can be used in assessing the appropriateness of the prevailing exchange rate. The objective of this paper is to review the concept of misalignment and the different indicators used in exchange rate assessment.

EXCHANGE RATE ASSESSMENT: A REVIEW OF CONCEPTS AND INDICATORS

by

Fidelina B. Natividad-Carlos*

1. Introduction

Real exchange rate volatility and real exchange rate misalignment have welfare costs: they generate incorrect signals that can misallocate resources and reduce economic efficiency. But the most serious cost of real exchange rate misalignment, of overvaluation in particular, is that it is usually accompanied by severe exchange and trade controls such that the resulting loss of efficiency tends to be even larger than that resulting from the misalignment itself. For this reason, real exchange rate misalignment is usually associated with poor economic performance.

It is difficult to determine, both theoretically and practically, whether a country's real exchange rate is out of line with its long-run equilibrium level. However, there are several indicators - exchange rate indices, relative price index, elasticities, commodity-specific analysis, parallel market exchange rate, and regression residuals - used in exchange rate assessment. The objective of this paper is to review the concept of misalignment and the different indicators used in exchange rate assessment.

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2. The Concept Of Real Exchange Rate Misalignment

Real exchange rate misalignment is defined as sustained departures of the actual real exchange rate from its equilibrium value. Given this definition, the understanding of how the equilibrium real exchange rate respond to fundamentals is the first step in understanding real exchange rate misalignment.

2.1. Definitions of the Real Exchange Rate

The real exchange rate (RER) is usually defined as a relative price but it is not clear which relative price should be used. There are several alternative definitions of RER but the most popular ones are (Edwards, 1988):

$$(1) RER_1 = EP^*/P$$

$$(2) RER_2 = EPt^*/Pnt = Pt/Pnt$$

where E is the (nominal) exchange rate; P^* and P, the foreign and domestic price levels; Pt^* , the world price of tradables; and Pnt, the domestic price of nontradables. The first definition, which relies on the purchasing power parity (PPP) approach, is more traditional but still popular and widely used because of the difficulty of measuring Pt/Pnt . It is also an index of the degree of international competitiveness although it fails to capture relative price changes that guide resource allocation across tradable and nontradable sectors. The second definition, which is used in modern theoretical works, indicates that the RER is the relative price of tradable with respect to nontradable goods. It measures the cost of domestically producing the tradable goods and therefore a good proxy for a country's degree of international competitiveness.

2.2. Definitions and Determinants of the Equilibrium Real Exchange Rate

There are likewise several definitions of the equilibrium real exchange rate (ERER):

- (1) the ERER is the price of foreign goods relative to domestic goods that simultaneously equilibrate the money, domestic goods, and foreign goods markets (Mundell, 1971);
- (2) the ERER is the P_t/P_{nt} at which income equates expenditure and both the tradables and nontradables goods markets are in equilibrium (Dornbusch, 1980);
- (3) the ERER is the rate that equilibrates the current account in the long-run; the long-run equilibrium current account in turn is determined by the rate at which foreign and domestic residents wish to accumulate/decumulate domestic-currency-denominated assets net of foreign-currency-denominated assets in the long-run (Hooper and Morton, 1982); this definition distinguishes between the short-run and long-run sustainable ERER;
- (4) the ERER is the rate that is expected to generate a current account surplus/deficit equal to the underlying capital flow over the cycle, given that the country is pursuing external balance as best as without restricting trade (Williamson, 1983);
- (5) the ERER is that rate which is expected to be consistent with the requirement that, on average (in present and future periods), the current account is balanced (Frenkel and Mussa, 1985); and,
- (6) the ERER is the P_t/P_{nt} that, for given long-run equilibrium values of the fundamentals, results in simultaneous attainment of internal equilibrium and external equilibrium; here, internal equilibrium means that the nontradable market clears in the current period and is expected to clear in the future while and external equilibrium means that the current account balance in the present period and the balances expected in the future satisfy the intertemporal budget

constraint that the discounted value of the current account balances (current and future) equals zero (Edwards, 1988, 1989).

The real determinants or fundamentals of ERER, on the other hand, are (Edwards, 1988, 1989):

- (1) external ERER fundamentals - international prices or terms of trade, international transfers including foreign aid, and world real interest rates; and
- (2) domestic ERER fundamentals - those affected by policy decisions (import tariffs, import quotas, and export taxes, exchange and capital controls, and other taxes and subsidies) and those that are nonpolicy fundamentals (such as technological progress).

The various definitions and the determinants of ERER imply that the ERER changes as variables affecting the country's internal and external equilibrium change. Another implication is that there is not one single ERER but a path of ERERs through time that is affected not only by the current values of the fundamentals but also by their expected future values.

2.3. Misalignment of the Real Exchange Rate

RER misalignment (overvaluation/undervaluation) may be defined as sustained deviations of actual RER from its equilibrium value; if actual RER is greater (less) than the ERER, then there is undervaluation (overvaluation). Traditional policy analysis however has tended to follow the PPP doctrine of ERER wherein the RER is constant and its equilibrium level is found by looking at the value of the RER in some distant period that exhibited external equilibrium.

In both theory and practice, there is a need to distinguish between two types of misalignment of the RER (Edwards, 1988, 1989):

- (1) macroeconomic-induced misalignment, which occurs when the actual RER

- departs from the ERER because of inconsistencies between macropolicies and the official nominal exchange rate system; and,
- (2) structural misalignment, which occurs when changes in the long-run sustainable values of the fundamentals of the ERER are not translated in the short-run into changes of the actual RER.

Note that not all observed movements in RERs - not even large movements - necessarily represent a disequilibrium situation; since the long-run ERER depends on real variables, observed changes in RERs are an equilibrium phenomenon because they are brought about by changes in the fundamentals. With respect to changes in the fundamentals, it is important to distinguish between permanent and temporary changes because it is possible that a particular RER reflects a short-run equilibrium situation but is way out of line with respect to long-run equilibrium; this will arise whenever the fundamental determinants of the ERER experience temporary changes. Long-run equilibrium changes in RER are the result of permanent changes in the underlying real conditions in the economy; these are long-run equilibrium phenomena and will not require policy intervention. The problem however is to determine whether changes in the actual (measured) RER are a response to changes in the fundamentals or a reflection of disequilibrium.

Note also that while the ERER is a function of real variables the actual or observed RER responds to both real and monetary variables and therefore inconsistent macropolicies will generate RER misalignment. A devaluation, if accompanied by appropriate macropolicies, will help an economy reestablish equilibrium in a smoother fashion.

3. Indicators Used In Exchange Rate Assessment

There are various indicators that are used in the assessment of the appropriateness of the exchange rate: effective exchange rate indices,

relative price index, elasticities, commodity-specific analysis, parallel market exchange rate, and regression residuals (Johnson et al, 1985; Edwards, 1988, 1989). While no one indicator is wholly reliable for assessing exchange rate an informed judgment can be made if they are used in combination.

3.1. Effective Exchange Rate (EER) Indices as Indicators of International Competitiveness

In a world of generalized floating, we observe simultaneous appreciation with respect to some currencies and depreciation with respect to others. Thus, we need an index or summary measure of how a currency performs, on average, in foreign exchange markets.

3.1.1. Nominal and real effective exchange rates

The nominal effective exchange rate (NEER), which is a weighted average of various bilateral exchange rates, measures the average change in the value of a country's currency against that of all other currencies. It is used as an index of how a currency performs in foreign exchange markets.

A measure of competitiveness must take into account not only changes in exchange rates but changes in prices as well. Thus, we use real effective exchange rate (REER) indices which are NEER indices adjusted for relative changes in prices. REER measures the average change in country's exchange rate against that of all other currencies, adjusted for price developments. REER index is frequently used as an indicator of a country's international competitiveness and also as an indicator in determining EER or the appropriate level of the exchange rate.

3.1.2. Methodological and data problems

There are various EER indices and calculated values differ because of the following methodological and data problems.

Choice of partner/competitor countries. The first step in constructing an EER index is the selection of a representative group of currencies (involved in the international trade of the country) to be included in the index. EER indices can be constructed with various patterns of partner/competitor countries.

Choice of weights. EER can also be constructed with various patterns of country weights. Since the group of currencies included in the index must be involved in the international trade of the country, trade weights are usually used. There are many types of trade weights and hence there are many variants of EER indices depending on whether trade is measured on the basis of imports, exports or total trade; for instance, a bilateral trade weighted index is an effective exchange rate in which a currency's weight is assigned on the basis of the extent of its bilateral trade with home country.

However, one problem with trade-weighted index is that it does not take into account the sensitivity of exports and imports to various exchange rate changes; thus, if one is concerned with such sensitivity, MERM (multilateral exchange rate model) index should be used. Another problem is that it overstates the importance of trade partners whereas the real significance of a country's currency is often more closely related to the country's participation in world trade. Those countries that trade heavily in world markets and not necessarily with the home country alone will be more involved in competing with home country products; in this case, one should use global export (total trade) weighted index where foreign country i 's share in total exports to the world market (total world trade) excluding the market of the home country is used as weight.

The interpretation of EER depends on the choice of weights, while the weights used depend on the policy objectives selected as the focal point of

the index (Rhombert, 1976, p. 89); different objectives therefore imply different weighting schemes. If the focal point of index is the effect of exchange rate movements on a particular countries earnings (payments) from commodity exports (imports), a bilateral export (import) weighted index of NEER is appropriate. If the concern is on external price competitiveness, one should look at the performance of the domestic currency relative to the currencies of the major competitors in exports and competitor weights based on the share of their exports in total world trade.

Choice of price indicator. REER indices can be constructed with various indicators of prices. There are several alternative price indices: CPI which is used in calculating REER-PPP but as a measure of competitiveness it has the drawback of including a large number of nontraded goods; WPI which contain mainly tradable goods but since the indices contain highly homogeneous tradable goods whose prices tend to be equated, RER will not vary enough to measure actual changes in competitiveness; GDP deflator which is a price index of aggregate production is usually available on a yearly basis only and also has a large component of nontradables; and, wage rate index which is RER computed as the ratio of unit labor costs is a direct measure of relative competitiveness and can be corrected for productivity changes but is not usually available and takes into account only one factor of production.

In developing countries, CPI is commonly used as an indicator of cost developments domestically and abroad because better indicators such as unit labor costs are usually not available. CPI is preferable to WPI because the former gives a larger weight to nontraded goods thereby reflecting more fully developments in costs and prices of domestically produced goods and also because CPI is an important determinant of labor costs.

Calculation of proportionate changes in exchange rate. If the exchange rate is defined/calculated as the foreign (domestic) currency price of domestic (foreign) currency, then an increase in the index implies appreciation (depreciation) while a decrease implies depreciation (appreciation). Different calculations yield different proportionate changes.

Choice of base period. Large deviations in calculated values relative to properly selected base period determine exchange rate appropriateness. However, identification of base period is a problem.

Mathematical formulation of the index. This has influence on the calculated values of REER at two levels - the computation of the relative price indicator component of the index and the averaging method used in the index taken as a whole (Maciejewski, 1983).

As to the computation of the relative price component, there are two approaches. One is to compute an index of relative prices and an index of exchange rate changes, using the same weighting procedure, and then combine the two indices to obtain the selected index of adjusted relative prices; this has the property, in a geometric formulation, that the variances of the results obtained from either of the two indices can be decomposed into the constituent variances of the exchange rate and the relative price indices and the covariance of the two. The other is to combine the proxy for the relative price term of the index and the exchange rate for each individual country involved, and then combine the resulting adjusted ratios using the most appropriate weighting procedure. This is more restrictive in scope because it can only tell something about the geographic origin of distortions indicated by the calculated values of either of the two indices but owing to this may also be economically more meaningful.

As to the averaging method, there are also two approaches. One is the linear formulation, which may be an arithmetic averaging or a harmonic averaging technique. It is commonly used but does not have the uniqueness in determining relative changes and is heavily influenced in magnitude and/or direction by the choice of the base period. This major problem results from the asymmetric treatment of decreasing and increasing prices and exchange rates. The other is the geometric averaging formulation. It treats depreciating and appreciating currencies in an entirely symmetrical manner. As a result, the relative change between any two dates can be measured by simply comparing the corresponding levels of the calculated values of the index. For any given weighting procedure, the percentage changes are independent of the base dates, and there is an element of uniqueness in the determination of relative changes. This is appropriate for countries with a strong structural trend, especially if no equilibrium period can be clearly selected. However, its economic interpretation cannot be made direct in terms of levels as in the linear formulation.

The EER used in different studies differ in terms of the six factors discussed earlier: (1) choice of partner/competitor countries; (2) choice of weights; (3) choice of price indicator; (4) calculation of proportionate changes in exchange rate; specifically, Bautista (1980) defines an increase in exchange rate as depreciation whereas Rana (1981) and CB (1987) define it as a depreciation; (5) choice of the base period; and, (6) choice of mathematical formulation of the index; in particular, Bautista uses geometric averaging while the others - Rana, Dohmer et al (1988), and CB - use arithmetic averaging; however, Rana and Dohmer et al combine the relative price and the exchange rate for each country and then combine the ratios using some weighting procedure while CB and Mansur (1983) compute an index of relative

prices and an index of exchange rates using the same weighting procedure and then combine the two to get the index.

The interpretation EER indices depends on the six factors discussed above. However measured, EER measures are useful because they allow us to evaluate a currency's value relative to other currencies.

3.1.3. Significance of EER

According to Rana (1981), in fixed exchange rate regime, REER-PPP type deflation is a measure of disequilibrium, over/under valuation; in float, it is measure of speculation; and, as a purely analytical device, it is used to calculate appreciation and depreciation in real terms. However, calculated REER values should not be used in any direct sense to measure the extent of over/under valuation. At best, they may give some indications of the gain/loss in price competitiveness relative to the selected base period and, thus, only a rough measure of direction of change in competitiveness. Nevertheless, the advantage and appeal of EER is that as a concept, unlike elasticities, it is relatively easy to interpret; for instance, if the exchange rate is defined as the foreign currency price of domestic currency, then an increase in REER over its level in a base period (appreciation) when the external position was considered adequate implies that external price competitiveness has deteriorated. Given the way REER is defined, competitiveness can be restored through change in exchange rate, prices relative to foreign prices, or some combination of the two.

3.2. Relative Price Index

The ratio of price of traded good to price of nontraded good is an indicator of the internal terms of trade or the internal competitiveness of the traded goods sector, i.e., its ability to compete with nontraded goods for scarce factor of production. It is also a measure of the real exchange rate.

3.3. Parallel Market Exchange Rate

The parallel market exchange rate is a rate that is essentially determined by market forces. The existence of parallel markets where transactions take place at floating exchange rates that are more depreciated than the official rate is an evidence that the official rate is inappropriate; however, they may also be a reflection of how effective exchange and capital controls are. Nevertheless, the parallel market exchange rate is an indicator that could be useful in exchange rate management.

3.4. Elasticities

Another indicator in exchange rate assessment is the elasticity of economic variables to exchange rate changes. The procedure is to have an econometric estimation and simulation of a model to arrive at a recommendation on exchange rate, given a set of policies and objectives. Thus, it allows modelling of the way factors other than exchange rate affect BOP. It has the advantage of not being limited to comparison with a particular base period but, like indicators of competitiveness, it is based on historical experience and therefore needs to be qualified in the presence of structural changes.

3.5. Commodity-Specific Analysis: Domestic Resource Cost (DRC) Approach

This approach derives the domestic cost of producing exports and import substitutes per unit of foreign exchange earned or saved, after correcting for all price distortions and netting out taxes and subsidies. This provides for each commodity an implicit exchange rate, allowing a ranking of activities according to comparative advantage and an assessment of the exchange rate.

3.6. Regression Residuals

The index of misalignment can be computed using the residuals from a regression that explains RER movements in terms of a set of fundamentals - terms of trade, measure of extent of capital controls (lagged ratio of net

capital flows to GDP), government consumption on nontradables (proxied by G/GDP), measure of technological progress (real GDP growth), proxy for trade restrictions and exchange controls, ratio of investment to GDP, and country specific variables (Edwards 1988, 1989). The regression residuals or the deviations of actual RER from these estimated values (taken as proxy for ERER) are considered as a good measure of disequilibrium RERs. This empirical definition of RER misalignment is consistent with the concept of misalignment as deviations of the actual RER from equilibrium RER.

3.7. Other Considerations

Exchange rate indicators can not be considered in isolation. In interpreting such indicators, developments - persistent intervention in one direction, rising foreign borrowing, growth of arrears, or stricter rationing of foreign exchange - that particular indicators may not fully capture must be taken into account. While no single indicator is wholly reliable for assessing exchange rate an informed judgment can be made if they are used in combination and if their limitations are taken into account.

The movements in the indicators can be used to explain how past policies (including exchange rate policies) and exogenous circumstances brought the economy to its present position and to assess the appropriateness of the exchange rate (the appropriate level of exchange rate is usually defined as one which yields a sustainable balance on the external account, given appropriate monetary, fiscal and incomes policies). This is the backward approach to exchange rate assessment. However, since the prevailing exchange rate must be compatible with sustainable economic growth and BOP position in the medium term, conclusions using this approach must be combined with forward looking analysis. With the forward approach, one searches for the appropriate exchange rate level by specifying the adjustment mechanisms

(relating to wages, prices, the BOP and the government budget, etc.) that follow a given hypothetical exchange rate action given accompanying demand management policies. This approach is independent of the backward-looking approach but, conceptually, they are extensions of each other and can be mutually reinforcing. Thus, a better approach for the analysis of appropriate exchange rate is an integrated approach which contains both backward-looking and forward-looking elements (Mansur, 1983).

4. Concluding Remarks

The objective of this paper has been to review the concept of real exchange rate misalignment and the different indicators (exchange rate indices, relative price index, elasticities, commodity-specific analysis, parallel market exchange rate, and regression residuals) used in exchange rate assessment.

The different indicators can be used to determine whether the RER is misaligned. If misalignment exists, policy must be devised to reestablish RER equilibrium and a necessary condition is ending the inconsistent macroeconomic policies that generated the overvaluation. But even when consistent macroeconomic policies are implemented, the reattainment of equilibrium can be costly in the presence of sluggish wage-price adjustment. Nevertheless, in such a case, devaluation can help to achieve a smoother and less costly adjustment toward the reattainment of RER equilibrium. Note however that devaluation can only be expected to work if it is implemented at the time of disequilibrium and accompanied by a package of consistent macroeconomic policies.

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