

# **Inflation Differentials and the Real Exchange Rate**

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## ***Abstract***

*The real exchange rate defined as the domestic relative price of tradables to non-tradables (IRER) is usually approximated by an index of Multilateral Real Exchange Rate (MRER), which is compiled as the relative price of foreign goods to domestic goods. Masters and Ianchovichina (1998) claimed that there are two sources of systematic biases in the use of MRER as a proxy for IRER.*

*This paper presents an index of IRER for Sri Lanka using sectoral implicit price deflators available in national production estimates and compares it with an index of MRER. The study does not find a systematic relationship between the two series. It reveals that the pass through effect of a change in the prices of internationally traded goods in domestic currency on prices of tradables in Sri Lanka is far from perfect. This implies that nominal exchange rate changes are not effective in generating proportionate changes in the prices of all tradables. The study also reveals a strong positive link between the prices of tradables and non-tradables. This link coupled with the less than perfect pass through effect explains the relative stability of IRER compared with MRER. The study finds that nominal exchange rate changes would be effective in maintaining the competitiveness of the goods actually traded. However, these changes would not necessarily provide sufficient incentives for transfers of resources between tradables and non-tradables (JEL F31, F32).*

## I. Introduction

The real exchange rate is usually defined in theoretical literature as the domestic relative price of tradable goods to non-tradable goods. This is also known as Internal Real Exchange Rate (IRER). However, in practical applications, the real exchange rate is widely defined, on the basis of Purchasing Power Parity doctrine as the relative price of foreign goods to domestic goods irrespective of whether goods are tradable or non-tradable. The 'price of foreign goods' is approximated by an average of the prices of trade partner countries, which are made comparable with domestic prices by using nominal exchange rates. This definition is known as Multilateral Real Exchange Rate (MRER). The MRER indicates the relative competitiveness of domestic goods against foreign goods while the IRER summarises the incentives that govern the resource allocation between tradable and non-tradable goods sectors.

As highlighted in Edwards (1989), the IRER also is a good index of the degree of international competitiveness of a country's tradable goods sector. An appreciation of the real exchange rate i.e. an increase in the price of non-tradable goods, indicates the fact that there has been an increase in the cost of domestically producing tradable goods. If there are no changes in the relative prices in the rest of the world, this appreciation reflects a deterioration in the country's degree of international competitiveness. Though theoretically quite appealing, there are difficulties involved in operationalising this concept of real exchange rate. First, there are difficulties in categorising goods and services into tradable and non-tradable sectors and second, price indices designed to reflect movements of prices of these two categories of goods and services are generally not available. However, despite these difficulties, attempts have been made to operationalise it by using proxies. Edwards (1989) has used wholesale price indices of trade partner countries as an index of the prices of tradables and the consumer price index of the home country as a proxy for the prices of non-tradables. This in fact, is an approximation of IRER by an index of MRER.

Edwards (1989) has established mathematically, the link between MRER and IRER. Masters and Ianchovichina (1998) have made use of this relationship to identify two sources of systematic bias in the use of MRER as an approximation to IRER. First, MRER under-estimates the impact of a change in an economic fundamental on the real exchange rate and second, there is a spurious trend towards depreciation in the MRER approach. According to the authors, these biases can be corrected only with disaggregated data on domestic relative prices of tradables and non-tradables. The authors have in fact presented empirical evidences in support of this claim by using disaggregated data for Zimbabwe.

The present paper provides an index of internal real exchange rate for Sri Lanka using disaggregated national accounts data and contrasts it with an index of MRER. It examines in the case of Sri Lanka, the existence of the two systematic biases highlighted in Masters and Ianchovichina (1998). It is argued that these biases do not necessarily represents a general case, as the assumptions used in deriving the relationship between MRER and IRER may not necessarily be valid in each and every country.

## **II. Relationship between IRER and MRER**

The internal real exchange rate, IRER is defined as;

$$\text{IRER} = P_T/P_N$$

where  $P_T$  is an index of prices of tradables and  $P_N$ , an index of prices of non-tradables.

Multilateral real exchange rate, MRER is defined as,

$$\text{MRER} = EP^*/P$$

where  $E$  is the effective nominal exchange rate,  $P^*$  is an index of foreign prices and  $P$  is an index of domestic prices.  $P^*$  is usually computed as a trade weighted average price of the major trading partners and nominal

exchange rates are defined as number of units of domestic currency per unit of each foreign currency.

Edwards (1989) has derived a link between MRER and IRER under the following assumptions and shown that changes in the real exchange rate as measured by these two definitions are not equal in general.

$$P = P_N^\alpha P_T^{(1-\alpha)}$$

$$P^* = P_N^\beta P_{T^*}^{(1-\beta)}$$

$$P_T = EP_{T^*}$$

where  $\alpha$  and  $\beta$  are weights on non-tradables in home country and foreign country price indices respectively.

Using the same relationship Masters and Ianchovichina (1998) present the following result<sup>1</sup> :-

$$\hat{MRER} = \alpha \hat{IRER} + (-\beta \hat{IRER}^*)$$

where  $\hat{\phantom{x}}$  indicates the proportionate change of the variable.

Masters and Ianchovichina have used this relationship to show that there are two potential sources of bias in the use of MRER as a proxy for IRER, i.e.

1. Understatement Effect

As the  $\alpha$ , relative share of non-tradables in the home country is less than one, the impact of changes in IRER on MRER will be dampened.

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<sup>1</sup> In this presentation, changes in taxes and trade margins are ignored for simplicity.

## 2. Trend Effect

This reflects the impact of changes in the trade partner countries' real exchange rate,  $IRER^*$  on MRER. Accordingly, for every appreciation in trade partner countries' real exchange rate, there will be a corresponding depreciation in the home country's MRER. To the extent that the productivity and income in trade partner countries are improving, their real exchange rate,  $IRER^*$  tends to appreciate. Therefore, there is a tendency for MRER to depreciate and hence, it will show more depreciation or less appreciation than  $IRER$ .

On the above grounds, changes in MRER do not in general approximate the changes in  $IRER$  and, therefore do not provide accurate signals for resource allocation. However, the magnitude of these biases depends on the size of  $\alpha$  and  $\beta$ . If the wholesale price indices of trade partner countries include largely the prices of traded goods,  $\beta$  tends to be closer to zero and then the trend effect will be negligible. Similarly, if non-traded goods in the consumer price index are relatively large, understatement effect will not drastically distort the actual movements of  $IRER$ . In any case, the validity of the relationship and the magnitude of the biases need to be tested empirically.

Masters and Ianchovichina (1998) have estimated this relationship between MRER and  $IRER$  for Zimbabwe using trade unit value index for price of tradables and building materials component of the consumer price index for price of non-tradables. As expected, results provided evidence in support of the understatement effect and spurious trend towards depreciation. It was claimed that MRER proxy based results understate exchange rate misalignment by almost 25 per cent and exaggerate depreciation by 4 per cent per year in Zimbabwe.

### III. MRER and IREER for Sri Lanka

A time series (1960-96) of proxy based real exchange rate, MRER for Sri Lanka has been computed and used in a study of determinants of the real exchange rate in Wijesinghe (1999). The same series is used in the present paper to examine the relationship between MRER and IREER. The present study deviates substantially from the work of Masters and Ianchovichina (1998) in the compilation of IREER. The trade unit value index used by them represents only the prices of actually traded goods and therefore, not necessarily represents prices of the entire range of tradable goods in the economy. By using the prices of traded goods, the authors have maintained the assumption that  $P_T = EP_T^*$ , but the validity of this assumption needs to be empirically tested. Further, the appropriateness of the building material component of the consumer price index as a proxy for prices of non-tradables may also be questionable.

The present paper employs sectoral implicit price deflators available in national production estimates to compute indices of prices of tradables and non-tradables. In Sri Lanka, estimates of value added, both at current and constant factor cost prices are available for eleven broad production sectors of the economy. Among these sectors, manufacturing, agriculture and mining and quarrying are considered as tradable goods sectors while the rest, which includes construction, utilities and other services, are treated as non-tradables. Though this classification may not be entirely accurate, it would provide a reasonably good approximation for the prices of tradables and non-tradables<sup>1</sup>.

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<sup>1</sup> De Gregorio, Giovannini and Wolf (1994) have examined the ratio of total export across fourteen OECD economies to total production across all fourteen countries for each sector and defined a sector as 'tradables' if more than 10 per cent of production is exported. The result has supported the standard practice of treating Manufacture, Agriculture and Mining as tradables and services as non-tradables.

Movements of MRER and IRER of Sri Lanka during the period from 1960-96 are shown in Chart I <sup>1</sup>. In general, there does not seem to be a systematic relationship between movements of the two series. MRER was relatively stable during 1960s except for a substantial depreciation recorded in 1968 following the nominal depreciation of rupee. Then it depreciated continuously till 1979. This pattern has not been followed in general by IRER. During 1968-79, MRER depreciated steadily at an annual average rate of 11.9 per cent, whereas IRER index fluctuated within a range of 78.0 and 115.9 without showing any particular trend. Following the liberalisation of economy with the unification of exchange rates, MRER recorded a real depreciation of 15 per cent in 1977, whereas the rate of depreciation recorded in IRER was only 6.5 per cent. The liberalisation measures were introduced in late 1977 and hence their full impact was felt in 1978. Accordingly, MRER recorded a further depreciation of 37.7 per cent in 1978. However, IRER recorded an appreciation of 1.1 per cent as prices of non-tradables increased at a slightly higher rate than the prices of tradables.

During 1979-84, except for a slight depreciation in 1981, MRER appreciated at an annual rate of 3.7 per cent, whereas IRER appreciated, with a slight depreciation in 1980, at an annual rate of 7.0 per cent till 1982 and then depreciated by 8.3 per cent in 1983 and 6.3 per cent in 1984. During 1984-89, MRER depreciated by an annual rate of 5.7 per cent while IRER appreciated by 2.2 per cent except for a depreciation in 1987.

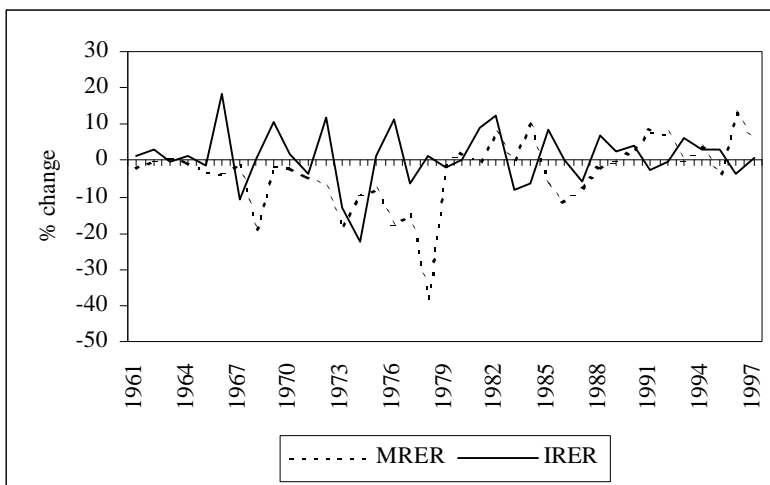
In 1990, MRER recorded a 3 per cent appreciation as against 4.2 per cent appreciation recorded in IRER. MRER recorded substantial appreciations in 1991-92 as against depreciations in IRER. Similar mixed results were shown during the rest of the period. In 1996, MRER recorded 12.7 per cent appreciation compared with 3.7 per cent depreciation recorded in IRER. An appreciation of 5.6 per cent was recorded in MRER in 1997 whereas the corresponding appreciation in IRER was less than one per cent.

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<sup>1</sup> Indices were compiled in such a way that an increase indicates an appreciation and a decline, a depreciation.

**Chart 1**

**Movements of IRER and MRER**



MRER = Multilateral Real Exchange Rate

IRER = Internal Real Exchange Rate

These differences in the movements of MRER and IRER are too substantial to be explained by the 'understatement' and 'trend' effects. Relative to 1990, MRER recorded appreciations continuously from 1991 to 1997. However, IRER depreciated in the first two years and then appreciated during the subsequent three years. Compared with 1990, MRER recorded a cumulative appreciation of 37 per cent by 1997 whereas the corresponding appreciation recorded in IRER was 6.6 per cent. This is quite contradictory with the expected outcome of 'understatement' and 'trend' effects. In particular, the rate of appreciation recorded in MRER should be lower than that in IRER as 'understatement' effect dampens the rate of appreciation and 'trend' effect works in the opposite direction. Even in the case of depreciation, the depreciation bias would not be more than a few percentage points, which could well be offset by the understatement effect.

Following, Masters and Ianchovichina (1998), the relationship between MRER and IRER was estimated for Sri Lanka for the period 1960-96 and reported below<sup>1</sup> :-

$$\Delta \ln \text{MRER} = -0.0404 - 0.0468 \Delta \ln \text{IRER}$$

$$(-1.4330) \quad (-0.2269)$$

$$R^2 = 0.1187$$

$$\bar{R}^2 = 0.0636$$

$$DW = 2.05$$

$$RHO = 0.3650$$

$$(2.1162)$$

It is quite obvious that the estimated relationship is rather poor. The coefficient of  $\Delta \ln \text{IRER}$  is statistically insignificant and wrong in sign and hence does not provide any evidence of an understatement effect. In fact, there does not seem to be any relationship between proportionate changes in MRER and IRER. However, there seem to be a trend towards

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<sup>1</sup> Equations reported in this paper were estimated by Ordinary Least Squares method (corrected for autocorrelation where necessary) using Micro TSP software package. The coefficients reported within parenthesis are t-statistics.

depreciation by around 4 per cent per year (rate closer to that estimated for Zimbabwe) but the coefficient is not statistically significant.

The lack of a relationship between proportionate changes in MRER and IRER in Sri Lanka could largely be attributed to the inappropriateness of the basic assumptions used in the derivation of the relationship. In particular, the general price level in the home country and the trade partner countries were considered as a weighted average of the prices of tradables  $P_T$  and non-tradables  $P_N$ , but ignored any possible relationship between  $P_T$  and  $P_N$ . Usually, it is assumed that subject to changes in taxes, trade margins and nominal exchange rate,  $P_T$  is externally given and  $P_N$  is determined by domestic factors. However, non-traded goods sector depends on imports for its inputs, and therefore there could be a positive link between  $P_N$  and  $P_T$ . If both  $P_N$  and  $P_T$  are moving in the same direction in the same magnitude, IRER will remain unchanged. Under such circumstances, it is very likely that the rate of depreciation or appreciation depicted in IRER be smaller than that depicted in MRER. This possibility was examined by estimating an equation relating  $P_N$  to  $P_T$ .

$$\ln P_N = 0.0759 + 0.1517 \ln P_T + 0.8785 \ln P_{N(-1)}$$

(5.5809)    (2.4606)                    (14.7962)

$$R^2 = 0.998$$

$$\bar{R}^2 = 0.998$$

$$DW = 1.7694$$

In the estimation, lagged adjustment process was assumed by incorporating the lagged dependent variable. The result suggests the existence of quite a strong relationship between  $P_N$  and  $P_T$ . Though the short run price elasticity of non-tradables with respect to price of tradables is 0.1517, the long run elasticity is 1.25. Therefore, over the time, every change in the price of tradables will lead to a corresponding change in the price of non-tradables. This is further highlighted by the near perfect simple correlation between  $P_N$  and  $P_T$ . Under the circumstance, the real exchange

rate is likely to remain quite stable, despite changes in nominal exchange rates.

It was also assumed that subject to changes in domestic taxes, trade margins, and nominal exchange rate, foreign price changes in the internationally traded goods are fully reflected in the prices of tradables. As noted earlier, Masters and Ianchovichina maintained this assumption by using prices of traded goods as a proxy for prices of tradables. However, in the case of developing countries like Sri Lanka, foreign price changes may not necessarily be fully reflected in the prices of tradables due to certain restrictive features and imperfect conditions of markets in these countries. For example, import of some of the goods, though few in numbers are regulated at least to some extent by government authorities and most of the trade is largely governed by institutions of oligopolistic nature in Sri Lanka.

The validity of this assumption was tested for Sri Lanka by examining the relationship between the price of tradables,  $P_T$ , as derived from national production data and price of traded goods,  $P_{TD}$ , computed as a weighted average of unit value of imports and exports derived from trade statistics (customs data). The simple correlation between these two variables was found to be nearly perfect but that could have well been due to the heavy trend present in each of these variables.

The estimated equations relating price of tradables to price of traded goods are reported below :-

$$\ln P_T = 16.1317 + 0.4202 \ln P_{TD}$$

(0.1218) (4.2178)

$$R^2 = 0.9960$$

$$\bar{R}^2 = 0.9958$$

$$DW = 1.7882$$

$$RHO = 0.9978$$

$$(41.6721)$$

$$\ln P_T = -1.2289 + 0.2307 \ln P_{TD} + 0.0139 \text{ TREND}$$

(-4.8830) (3.5695) (2.8261)

+ 0.5812 ln P<sub>T</sub> (-1)  
(6.7969)

R<sup>2</sup> = 0.9970  
 $\bar{R}^2$  = 0.9967  
DW = 1.6127

The first equation simply relates P<sub>T</sub> to P<sub>TD</sub> while the second expands it by incorporating a trend variable (TREND) and the lagged dependent variable. Each equation well explains the behaviour of the price of tradables and the estimated coefficients of the independent variables are statistically significant. According to the first equation, price elasticity of tradables with respect to traded good is 0.4202. This suggests that the pass through effect of a ten per cent change in the price of traded goods on the price of tradables is only 4.2 per cent. In terms of the second equation, a ten per cent change in the price of traded goods will result in only a 2.3 per cent change in the price of tradables during the same period. However, when provisions are made for the trend effect and lagged adjustment process, the same result suggests a long run price elasticity of 0.55, which also suggests that the pass through effect is far from perfect. Accordingly, price changes in traded goods are not entirely reflected in the prices of tradables in Sri Lanka. Therefore, the assumption P<sub>T</sub> = EP<sub>T</sub>\* needs to be respecified as P<sub>T</sub> = aEP<sub>T</sub>\* where 'a' is the pass through coefficient which is substantially less than one in Sri Lanka. However, the effect of 'a' is similar to the effect of taxes and trade margins incorporated in Masters and Ianchovichina and hence, would not necessarily change their basic argument. Nevertheless, it highlights the fact that price of tradables could deviate from the prices of the trade partner countries and therefore, nominal exchange rate changes may not necessarily lead to proportionate changes in the prices of tradables.

#### IV. Conclusion

The paper presented an index of Internal Real Exchange Rate computed using sectoral implicit price deflators available in national production estimates of Sri Lanka and compared its movements against the movements of real exchange rate as measured by an index of Multilateral Real Exchange Rate. It was revealed that the pass through effect of changes in the prices of trade partner countries on the domestic prices of tradables is far from perfect. It implied that nominal exchange rate changes are not effective in generating proportionate changes in the prices of all tradable goods. The most important fact is that there is a strong relationship between the prices of tradables and non-tradables. Therefore, nominal exchange rate changes do not appear to be effective in generating substantial changes in the real exchange rate in Sri Lanka. Nominal exchange rate changes will lead to changes in the real exchange rate as measured by an index of Multilateral Real Exchange Rate and hence would be effective in maintaining the competitiveness of the goods that are actually traded. However, these changes may not necessarily provide sufficient incentives for transfer of resources between tradables and non-tradables.

An index of Multilateral Real Exchange Rate is usually employed as a proxy for Internal Real Exchange Rate and Masters and Ianchovichina (1998) claimed that there are two systematic biases in this approximation. The present study did not find any evidence in support of this claim in the case of Sri Lanka. It was revealed that a Multilateral Real Exchange Rate is not a good proxy for Internal Real Exchange Rate as there is no systematic relationship between the two series.

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