EFFECTIVE EXCHANGE RATE CHANGES AND THEIR IMPACT ON THE TRADE BALANCE

D.S. WIJESINGHE

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FOREWORD

After a decade and a half of experience with the floating exchange rate regime, the volatility of exchange rates of major industrialized countries continues to plague the world economy. The turbulent movements of these exchange rates have serious implications on the external balances of the developing economies, particularly the small and open ones such as most of the SEACEN countries. Through the import and export prices (measured in domestic currency), frequent variations in key currencies have been the prime factor causing trade and payment imbalances. Accordingly, the developing countries have had to resort to exchange rate policy measures to adjust the external value of their currencies.

To be able to prescribe a timely and correct exchange rate policy, the policy-makers, first of all, need to find an effective way of monitoring the exchange rate changes. Accordingly, many methods of constructing an effective exchange rate index have been developed, the suitability of each of which depends on the objective of the exercise. In addition to having an effective monitoring system, the policy-makers must also be able to assess the effect of exchange rate changes and predict the likely outcome of such a policy move.

The research project on "Effective Exchange Rate Changes and Their Impact on the Trade Balance" was conducted to serve some of the needs outlined in the foregoing paragraph. Using Sri Lanka as a case study, the project aims to analyze the impact of exchange rate changes on the Sri Lankan trade balance, and to construct the effective exchange rate index using the simulated trade balance effects of the exchange rate changes as the weights. The study made use of the multilateral trade model for primary exporting countries which is considered the most suitable model for Sri Lanka.

This in-house research project was carried out by Dr. D. S. Wijesinghe, Research Economist, The SEACEN Centre. He was responsible for designing the methodology, analyzing the simulated results and preparing the draft of the report. He was assisted by Mrs. Kanaengnid T. Quah, who took care of data collection and did most of the simulation work. The manuscript was entirely typed by Miss Rekha Priyadarshani Soysa of the Central Bank of Sri Lanka.

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Dr. Vicente B. Valdepenas, Jr.
Director
The SEACEN Centre

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Since the breakdown of the Bretton Wood system, major industrialised countries have been floating their exchange rates independently. As a reaction to this generalised floating of exchange rates, the developing countries also started adopting more flexible systems of exchange rates. Some of them have been following a system of managed floating while the others have been following a variety of systems including pegging to a basket of currencies. Under the present system, even if a country pegged its exchange rate to a single currency, its exchange rates against the rest of the currencies would be fluctuating with the movements of major currencies in the international markets. Hence, one of the main characteristics of the current exchange rate system is the day to day fluctuations in the exchange rates. The nature of these fluctuations are such that not all the exchange rates are changing towards the same direction at the same rate. A country's exchange rate may appreciate against one currency while depreciating against another. Hence it has become necessary to develop indicators to monitor the general movements of a country's exchange rate against all other currencies. For this purpose, indices of effective exchange rates have been developed. An index of effective exchange rate measures, in some sense, the average change of the country's exchange rate against all the other currencies.

Monitoring of the movements of exchange rates is quite important as changes in exchange rates have certain implications upon the level of exports and imports and hence on the balance of payments. Exchange rate movements should be monitored regularly to ascertain whether the country's exchange rate is appreciating or depreciating in general. Exchange rate adjustments have been widely suggested as a policy measure to correct balance of payments imbalances. The usual argument in support of this measure is that an overvalued (undervalued) exchange rate would make imports relatively cheaper (expensive) and hence encourage (discourage) imports while imposing a tax (subsidy) on exports. Hence, a persistent deficit (surplus) in the balance of payments has been considered as an indicator of an overvalued (undervalued) exchange rate. However, the payments imbalances could be a result of a number of reasons and in certain economies, exports and imports may

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not be quite responsive to the changes in exchange rates. Hence, the movements of exchange rates should be monitored with the objective of analysing their effects on the balance of payments. An indicator of effective exchange rates has to be constructed taking into account the effects of exchange rate changes on the balance of payments or at least on the trade balance.

The present project analyses the effects of exchange rate changes on the trade balance and construct an index of effective exchange rates, considering the effects of exchange rate changes on the trade balance. The report contains four sections. Section 1 reviews various indices of effective exchange rates, highlighting their uses and limitations. Section II presents a multilateral trade model appropriate to primary commodity exporting countries. The model is presented for the purpose of simulating the effects of exchange rate changes on the trade balance and deriving an index of effective exchange rates accordingly. A second version of the model is also presented to analyse the effects of real exchange rate changes on the trade balance. The main model and its second version are employed to analyse the effects of both the nominal and real exchange rate changes during 1971-1985 on the trade balance of Sri Lanka. The results are discussed in Section III. Section IV concludes the report highlighting the major observations, limitations and further research to be undertaken.

I. INDICES OF EFFECTIVE EXCHANGE RATES: A REVIEW

An index of effective exchange rates is a weighted average of the home country's exchange rate against the other currencies relative to a chosen base period. In the computation of such an index weights should reflect the comparative importance to the home country of each foreign country. The comparative importance has to be defined in terms of the contribution of the exchange rate movements to a specific result that is selected as deserving attention, i.e., to an objective of economic analysis or policy. Therefore, the choice of weights depends on the particular policy objective selected as the focal point of the index[1]. Hence, for different objectives, indices employing different weighting schemes would be appropriate.

Some of the widely employed indices of effective exchange rates are:

(i) **import weighted index:** the average of the exchange rates relative to a selected base period (exchange rate relatives) weighted by

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1. This is emphasised in Rhomberg (1976).

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partners' shares in total imports of the home country;

(ii) **bilateral export weighted index:** the average of the exchange rate relatives weighted by partners' shares in total exports of the home country;

(iii) **bilateral trade weighted index:** the average of the exchange rate relatives weighted by partners' shares in total trade (exports plus imports) of the home country; and,

(iv) **global export weighted index:** the average of the exchange rate relatives weighted by foreign countries' shares in total exports of the world market excluding the market of the home country.

A large number of central banks use trade (imports, exports or bilateral trade) weights for the computation of their effective exchange rate indices[1]. Even the developing countries like Sri Lanka use a bilateral trade weighted index for monitoring the exchange rate movements. Trade weighted indices are popular mainly because they can easily be computed and understood. However, their usefulness is rather limited as they can be used to analyse only certain aspects of exchange rate movements which may not be considered as the fundamental objective of an analysis of exchange rate movements. For example, under certain assumptions[2] an import weighted index can be used to examine the cost of imports in terms of domestic currency and hence in the evaluation of the potential influence of exchange rate changes on the objective of domestic price stability. Similarly, a bilateral export weighted index can be used to analyse the effect on the cost to the foreign customers of home country's exports. The effect of exchange rate changes that is most commonly considered as a policy objective is their influence on the balance of payments. Usually, trade weighted indices are used with the intention of approximating an index constructed with a trade balance objective in mind. However, such an approximation may not be quite appropriate as these indices do not take into account several important considerations which affect the trade balance.

As Rhomberg (1976) points out, the magnitude of the trade balance effect depends not only on the size of the trade flows between the two countries but also on:

(i) the extent of any competitive relation between them in the third market;

(ii) the price elasticities determining the response of these trade flows to exchange rate changes: and,

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1 For a survey of the indices used by the central banks in industrial countries, see Koch (1984).

2 It is required to assume that imported quantities and their prices in the countries of origin are not affected by exchange rate changes.

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(iii) the changes in prices of traded goods that are induced by exchange rate changes.

An index based on bilateral trade weights is an incomplete measure of competitiveness in export markets as third market effects are not taken into account. The widely cited example in this respect is Canada in the cases of Sweden and Finland. Trade between Canada and the other two countries is virtually of no importance, but all three countries compete in the third market with wood and paper products. In the case of Sri Lanka, her bilateral trade with countries like Malaysia, Indonesia and the Philippines is rather limited and hence a bilateral trade weighted index may ignore these countries. However, the depreciation of the currency of any of these countries could substantially affect the trade balance of Sri Lanka as these countries are some of her major competitors in the primary commodity markets. The consideration on the effect of the third market has led to the development of the global export weighted index of effective exchange rates which assigns weights on the basis of each country's share in total export to the world market. This index takes into account the third market effect completely but it ignores the bilateral trade relations which also are quite important. In order to overcome this problem, a double-weighting scheme has been developed. In this scheme, weight assigned to country B's currency in the effective exchange rate index of country A is determined by two components:

(i) Country B's share in the total imports of other countries included in A's index; and,

(ii) Country A's export share with respect to the same country[1]

Although this method would be preferable to the use of either bilateral trade weights or global export weights, it takes no account of the second and third points highlighted by Rhomberg.

As Rhomberg points out, effect of exchange rate changes on trade balance will also depend on the extent of the changes in the prices of traded goods as well as the price elasticities of demand and supply of exports and demand for imports. Indices based on the bilateral trade weights and an index derived with the trade balance objective would yield the same results only under very unrealistic assumptions on the price elasticities, i.e.,

(i) all price elasticities of supply of traded goods are infinite;

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1 OECD adopts such a scheme. Weights are derived by pre-multiplying a matrix of bilateral import shares for all the countries included in the index by a vector of A's export shares. See Durand (1986)

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(ii) all price elasticities of demand for a country's imports and exports are equal to one another; and,

(iii) all elasticities of demand for a country's exports with respect to price of exports of other countries are zero.

Price elasticities of demand and supply of different classes of traded goods are different and these differences have implications on the changes in the trade balance in response to changes in exchange rates. Depreciation of the currencies of major importers would lead to a reduction in the prices of exports of a country. However, the price reduction in the primary commodities would be less relative to that of manufactured goods due to the differences in the price elasticities of demand for these two categories of goods. Similarly, domestic supply responses to the price changes caused by exchange rate changes would be relatively lower than that of manufactured goods due to the difference in the price elasticities of supplies. In order to be a meaningful guide for policy decisions, the construction of an effective exchange rate index should take these differences into account. Similar considerations are applicable to imports as well. Depreciation of the currencies of the major exporters of essential goods would lead to an improvement in the trade balance of those countries whose imports are largely the essentials. However, depreciation of the currencies of major exporters of non-essential goods would lead to a deterioration of the balance of trade of those countries whose imports are largely the non-essentials. These differences are due to the differences in the price elasticity of demand for imports for different classes of goods. As Rhomberg points out, these considerations might lead to assigning weights which are substantially different from bilateral trade weights. In certain cases, weights might even be negative.

Therefore, it is very unlikely that an index based on bilateral trade weights would provide a reasonably good approximation to an index constructed with the trade balance objective. In terms of the trade balance objective, the change in the effective exchange rate is defined as the notional uniform proportionate change in the exchange rate of the home currency in terms of the foreign currencies that would have the same effect on the home country's trade balance as the set of actual changes in exchange rates[1]. In other words, it is the unilateral exchange rate change that would have the same effect on the country's trade balance as the set of actual exchange rate changes that have taken place. To calculate this unilateral exchange rate change, the actual changes in the exchange rate vis-a-vis each foreign currency must be weighted by

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1 This definition follows Artus and Rhomberg (1973).

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the effect on the home country's trade balance of an isolated change in the exchange rate of that country by a given proportion. The calculation of these trade balance effects needs the simulation of a trade model which reflects the multilateral structure of trade, its commodity composition, the price elasticities of trade flows and effects of exchange rate changes on prices. For this purpose, the International Monetary Fund has developed a general equilibrium model known as Multilateral Exchange Rate Model (MERM) and derived appropriate weights for the construction of effective exchange rate indices for industrial countries[1].

The International Monetary Fund's MERM is a large scale simulation model which distinguishes commodities not only by their kinds but also by the country of origin. It distinguishes six kinds of commodities with 20 countries. Hence, from the demand side alone, it contains 2,400 separate equations. In the case of developing countries, such an elaborate treatment may be formidable and may not be quite necessary considering the commodity structure of trade in these countries. A substantial portion of the exports of developing countries is primary commodities which could not be distinguished meaningfully by the country of origin. Hence, the commodity by commodity approach suggested by Ridler and Yandle (1972) would be quite sufficient in this case. Further, the effects of exchange rate changes on the prices of imports of developing countries can be approximated from the published results of MERM simulations. Therefore, for developing countries, certain modifications can be introduced and a much simpler simulation model of multilateral trade can be developed. The next section of the present report presents such a simplified model with the aim of analysing the trade balance effects of exchange rate changes and deriving the weights for the construction of effective exchange rate index accordingly. The application of such a model has certain limitations due to the aggregative nature of the import demand function and lack of readily available estimates on key parameters. Nevertheless, even a crude trade model would yield more appropriate weights than the assumption that exchange rate effects are proportional to bilateral trade shares[2].

II. THE MODEL

As the primary objective of the model is to analyse the trade balance effects of exchange rate changes, the model should be capable of

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1 For details, see Artus and Rhomberg (1973) and Artus and McGuirk (1981).
2 See Rhomberg (1976, p.94).

simulating the effects of a given set of exchange rate changes on exports and imports. Ridler and Yandle (1972) laid the ground work for analysing the effects of exchange rate changes on primary commodity exports. Belanger (1976) and Feltenstein et al (1979) adopted basically the same framework in their models for primary exporting countries. Both Belanger and Feltenstein et al combined the Ridler and Yandle framework with a simple income determination model to analyse the trade balance effects of exchange rate changes. These two models are basically the same apart from the emphasis placed by Feltenstein et al on the domestic rate of inflation and thus on the effects of real exchange rate changes. In other words, while Belanger examined the effects of exchange rate changes alone, Feltenstein et al examined the combined effects of exchange rate changes and domestic price changes. Belanger applied his model for Zaire and Zambia while Feltenstein et al analysed the cases of Chile and Peru in addition to Zaire and Zambia. The model presented below contains the basic features of their models. We will look into the effects of both nominal and real exchange rate changes on the trade balance. Hence, first the main core model which is designed to analyse the effects of pure exchange rate changes on the trade balance is presented. Then a second version of the model is presented by modifying the main model to analyse the effects of real exchange rate changes.

Exports

Exports of most of the developing countries are concentrated on a small number of commodities which cannot be distinguished by their places of origin. Hence, the price an exporter receives for his commodity depends basically on the conditions in the world market for that commodity. Therefore, the model adopts commodity by commodity approach to explain the changes in commodity prices. The approach uses a partial equilibrium model of commodity market for each commodity and exchange rate changes are considered as factors which shift the demand and supply schedules. Accordingly, the changes in commodity prices are estimated and considering the domestic supply responses changes in the export earnings are calculated.

The world trade in each commodity is presented by the following simplified model:

$$Q_{mi} = D(P_{mi}) \tag{1}$$
$$Q_{xi} = S(P_{xi}) \tag{2}$$
$$Q_{mi} = Q_{xi} \tag{3}$$
$$P_{mi}T_m = P_{xi}T_x = P_i \tag{4}$$

where,

Q_{mi} = Volume of world imports of the ith commodity

Q_{xi} = Volume of world exports of the ith commodity

P_{mi} = World price of the ith commodity in terms of the importers' currencies

P_{xi} = World price of the ith commodity in terms of the exporters' currencies

P_i = World price of the ith commodity in terms of the numeraire currency

T_m = Exchange rate of importers' currencies in terms of the numeraire currency

T_x = Exchange rate of exporters' currencies in terms of the numeraire currency

Equations (1) and (2) are the world demand and supply functions for trade in the ith commodity. Demand is a function of price expressed in the importers' currencies while supply a function of price expressed in exporters' currencies. Hence, exchange rate changes of importers' and exporters' currencies would shift the demand and supply schedules respectively. The shift factor ($\dot{R}$) in demand for a particular set of exchange rate changes is expressed as the average proportionate change in importers' exchange rates weighted by each importer's share in the total world imports of the commodity, i.e.,

$$\dot{R} = \sum_j V^j_{im} \dot{T}_{mj}$$

where $\dot{T}_{mj}$s' are the changes in importers' exchange rates in terms of the numeraire currency and V^j_{im}s' are the shares of each country in the total imports of commodity i.

Similarly, the shift factor ($\dot{K}$) in world supply is expressed as the average proportionate change in exporters' exchange rates weighted by the share of each exporter in the world market for commodity i, i.e.,

$$\dot{K} = \sum_j V^j_{ix} \dot{T}_{xj}$$

where $\dot{T}_{xj}$s' are the changes in exporters' exchange rates in terms of the numeraire currency and V^j_{ix}s' are the shares of each country in the world exports of the commodity i.

Equation (3) is the market clearing condition and equation (4) defines the relationship between prices that must be obtained at the equilibrium. For a given set of changes in the exchange rates of importers and exporters of the commodity, the following result is obtained by solving the above model for the proportionate change in the world price of the ith commodity in terms of the numeraire currency ($\dot{P}_i$).

$$\dot{P}_i = \frac{\eta_{si}\dot{K} - \eta_{di}\dot{R}}{\eta_{si} - \eta_{di}} \tag{5}$$

where η_{si} and η_{di} are the world price elasticities of supply and demand respectively for the ith commodity.

The proportionate change in a country's export earnings from a commodity depends not only on the world price changes but also on its own supply response to these price changes. Given $\dot{P}_i$ as expressed in equation (5), proportionate change in the commodity price in domestic currency is ($\dot{P}_i - \dot{T}_k$) where $\dot{T}_k$ is the proportionate change in the kth country's exchange rate and kth country is considered as the home country. Therèfore, the change in the home country's supply of the commodity in response to changes in a set of exchange rates is expressed as $[\eta_{si}^k (\dot{P}_i - \dot{T}_k)]$ where η_{si}^k is the home country's price elasticity of supply of commodity i. Hence, the proportionate change in the earnings from the exports of commodity i in numeraire currency ($\dot{X}_i^k$) is given by:

$$\dot{X}_i^k = \eta_{si}^k (\dot{P}_i - \dot{T}_k) + \dot{P}_i \tag{6}$$

Accordingly, by summing up the changes in export earnings of each commodity, the proportionate change in the total export earnings ($\dot{X}_k$) can be obtained.

$$\dot{X}_k = \sum_i W_{ix}^k [\eta_{si}^k (\dot{P}_i - \dot{T}_k) + \dot{P}_i] \tag{7}$$

where W_{ix}^k is the share of the ith commodity in the total exports of the home country.

Hence, the equations (5) and (7) can be used to evaluate the effects of a set of exchange rate changes on total export earnings of the home country.

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Imports

The proportionate change in the expenditure on imports has to be computed considering the effects of exchange rate changes on both the price and volume of imports.

Imports of developing countries are mostly from the industrialised countries. Hence, the proportionate change in the price of imports of a developing country as a result of a set of exchange rate changes can be approximated by the changes in the prices of exports of industrialised countries. Published results of the MERM simulations provide estimates of percentage change in the price of exports of selected industrialised countries induced by a given percentage change in their exchange rates. These results are used to approximate the proportionate change in the price of imports $(\dot{P}_m^k)$ for the home country.

$$\dot{P}_m^k = \sum_j s_j z_j \dot{T}_J \tag{8}$$

where z_j is the proportionate change in the price of exports of the jth country for a one percentage change in its exchange rate and s_j the share of the jth country in the total imports of the home country.

In addition to the change in import prices, exchange rate changes affect the demand for imports through their effects on exports and income. Hence, the full impact of exchange rate changes on imports is derived using the following simplified model of income determination:

National Income Identity

$$\dot{Y}_k = \alpha_d \dot{D}_k + \alpha_x (\dot{X}_k - \dot{T}_k) - \alpha_m (\dot{M}_k - \dot{T}_k) \tag{9}$$

This equation was derived simply from the usual national income identity. It expresses the proportionate change in income $(\dot{Y}_k)$ as the weighted average of the proportionate change in domestic expenditure $(\dot{D}_k)$ and exports $(\dot{X}_k - \dot{T}_k)$ and imports $(\dot{M}_k - \dot{T}_k)$ in domestic currency. The weights α_d, α_x and α_m are the ratio of domestic expenditure, exports and imports to the income respectively.

Domestic Expenditure Equation

The proportionate change in the domestic expenditure is the sum of proportionate change in real expenditure $\dot{DR}_k$ and domestic prices $(\dot{P}_k)$ i.e.,

$$\dot{D}_k \;=\; \dot{DR}_k + \dot{P}_k \tag{10}$$

Real expenditure (DR_k) is expressed as a function of real income, i.e.,

$$\ln DR_k \;=\; \eta_{dy} \ln(Y_k/P_k) \text{ hence,}$$

$$\dot{DR}_k \;=\; \eta_{dy}\dot{Y}_k - \eta_{dy}\dot{P}_k \tag{11}$$

where η_{dy} is the income elasticity of expenditure. By substituting (11) in (10), the equation for the proportionate change in expenditure is derived.

$$\dot{D}_k \;=\; \eta_{dy}\dot{Y}_k + (1 - \eta_{dy})\,\dot{P}_k \tag{12}$$

Import Equation

The proportionate change in the expenditure on imports is also the sum of the proportionate change in the volume imported $(\dot{MQ}_k)$ and the price of imports, i.e.,

$$\dot{M}_k - \dot{T}_k \;=\; (\dot{P}_m^k - \dot{T}_k) + \dot{MQ}_k \tag{13}$$

The volume of imports (MQ_k) is expressed as a log linear function of real expenditure and relative prices.

$$\ln MQ_k \;=\; \eta_{md}\ln(D_k/P_k) + \eta_{ms}\ln(P_m^k/T_k/P_k)$$

and hence,

$$\dot{MQ}_k \;=\; \eta_{md}(\dot{D}_k - \dot{P}_k) + \eta_{ms}(\dot{P}_m - \dot{T}_k - \dot{P}_k) \tag{14}$$

where η_{md} and η_{ms} are the elasticities of imports with respect to real expenditure and the price of imports relative to domestic prices.

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By substituting (14) in (13), the equation for the proportionate change in imports is derived.

$$\dot{M}_k - \dot{T}_k = (\dot{P}_m^k - \dot{T}_k) + \eta_{md}(\dot{D}_k - \dot{P}_k)$$
$$+ \eta_{ms}(\dot{P}_m^k - \dot{T}_k - \dot{P}_k) \tag{15}$$

Hence, this simple income determination model is consisted of equations 9, 12 and 15. Given the estimates for the model parameters and $\dot{X}_k$, $\dot{P}_m^k$ and $\dot{P}_k{}^1$, this income determination model can be solved for the proportionate change in the value of imports measured in numeraire currency $(\dot{M}_k)$.

Trade Balance

Given the estimated effects of exchange rate changes on exports and imports, the effect on the trade balance is simply expressed as:

$$\triangle B^k = X_o^k \dot{X}^k - M_o^k \dot{M}^k \tag{16}$$

where X_o^k and M_o^k are the levels of exports and imports in the reference period, expressed in numeraire currency.

This is the basic model and for a given set of actual exchange rate changes, it can be solved for the proportionate change in exports, imports and trade balance. Hence, the model is capable of analysing the trade balance effect of exchange rate changes. Given the estimated trade balance effect, the model can also be solved for the unilateral change in the home country's exchange rate that would have had the same effect on its trade balance, i.e., change in the effective exchange rate. Alternatively, the model can be simulated for a given percentage change in the exchange rate of each foreign currency to estimate the effect on the home country's trade balance. The index of effective exchange rate changes can then be constructed by computing the weighted average of all the exchange rate changes with each weight proportional to the simulated effect on the trade balance.

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1 Effects on the domestic rate of inflation is discussed on pages 13 – 14 under domestic rate of inflation.

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Domestic Rate of Inflation

An analysis of the trade balance effect of exchange rate changes would not be complete if their effects on the domestic rate of inflation were not taken into account as the domestic price changes might well offset the effects of exchange rate changes. In this respect, Belanger simply assumed the changes in domestic prices to be proportional to the changes in the price of imports, thus taking into account the effects of exchange rate changes through the price of imports. Hence, only the direct effect is considered. Feltenstein et al specified domestic rate of inflation as a function of excess money. Their objective was to analyse the trade balance effect of alternative combinations of exchange rate and money supply changes. However, they did not link the domestic price changes to exchange rate changes and hence it appears that they have ignored effects of exchange rate changes on domestic prices. On the other hand, they examined the trade balance effects of alternative combinations of exchange rate and money supply changes assuming them to be independent policy instruments. However, exchange rate changes would affect the trade balance and hence it has implications on money supply. Feltenstein et al have not taken into account these links among exchange rate changes, trade balance effects and money supply specifically.

The Fund's MERM estimated an impact of exchange rate changes under the assumption that authorities in each country adjust monetary and fiscal policy so as to hold the real output constant. Similarly, Belanger solved his model under the assumption of "Keynesian neutral" monetary and fiscal policy which means that authorities would undertake measures to neutralize the effect that changes in monetary and fiscal aggregates induced by exchange rate changes would have on economic activity and hence on external position. Belanger argues that this assumption was required to isolate the effect of exchange rate changes from other policy actions. However, the neutralization itself is a policy action and hence his simulated trade balance effects are results of exchange rate changes and monetary policy measures adopted by the authorities. In other words, the indirect impact of exchange rate changes on money supply and hence on domestic prices and expenditure has not really been taken into account. While recognizing this and further research possibilities we also follow the same neutralization hypothesis and accordingly express the proportionate change in domestic price as:

$$\dot{P}_k = \gamma_p \dot{P}_m^k + \gamma_t \dot{T}_k$$

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where Υ_p and Υ_t are respectively the effect of a one percentage change in import prices and home country exchange rate on domestic rate of inflation estimated under the assumption that the effects of $\dot{P}_m^k$ and $\dot{T}_k$ on the money supply are neutralized.

Real Exchange Rate Changes

The model as presented above is designed to examine the effects of only the exchange rate changes on the trade balance and hence it considers only the effect of nominal exchange rate changes. The model is based on the assumption that demand and supply of exports are functions of their absolute prices and hence domestic price changes would not have an impact on exports. Also as Rhomberg pointed out an index of effective exchange rates should reflect purely the effects of exchange rate changes. The loss of competitiveness due to the price differentials is a separate consideration and for this purpose separate indices should be constructed.

However, in an analysis of the effects of exchange rate changes over a historical period, nominal exchange rate changes alone may not reveal the true picture, particularly in a situation where rates of inflation are substantially different among the countries and demand and supply of exports are not merely the functions of absolute prices but relative prices. Hence, it would be rather useful to examine the joint effects of the changes in exchange rates and the general level of prices. For this purpose, the above model is modified to examine the effects of real exchange rate changes on the trade balance.

The main modifications introduced are related to the specification of demand and supply functions of exports. The basic structure of the model is quite the same as before, but the world price of exports in importers currency (P_{mi}) and exporters currency (P_{xj}) should now be read as the world real price of exports in importers' and exporters' currencies respectively as demand and supply functions are now specified as the functions of relative prices, i.e., price of exports in importers' currencies relative to the domestic prices of the importing countries and price of exports in exporters' currencies relative to the domestic prices of the exporting countries. Hence, the export side of the model is presented as follows:

$$Q_{mi} = D (P_{mi}^r) \tag{1}$$

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$$Q_{xi} = S(P^r_{xi}) \tag{2}$$

$$Q_{mi} = Q_{xi} \tag{3}$$

$$P^r_{mi}\, T_m = \sum_l \alpha^l_i \, (P^l_i T_l / P^l_d) = P^r_{iw} \tag{4}$$

$$P^r_{xi}\, T_x = \sum_j \beta^j_i \, (P^j_i T_j / P^j_d) = P^r_{iw} \tag{5}$$

where,

P^r_{mi} = the real price of commodity i in terms of importers' currencies

P^r_{xi} = the real price of commodity i in terms of exporters' currencies

P^l_i = the price of ith commodity in l^{th} country in domestic currency

P^j_i = the price of ith commodity in j^{th} country in domestic currency

α^l_i = the share of importer l in total imports of commodity i

P^l_d = the level of domestic prices in l^{th} country

P^j_d = the level of domestic prices in j^{th} country

P^r_{iw} = the real price of commodity i in terms of numeraire currency

β^j_i = the share of exporter j in total exports of commodity i

T_l = exchange rate of the lth country in terms of the numeraire currency.

T_j = exchange rate of the jth country in terms of the numeraire currency.

Hence, the basic difference is the introduction of relative prices and accordingly the definition of the shift factors $\dot{K}$ and $\dot{R}$ are changed as follows:

$\dot{K}$ = the average proportionate change of exporters' real exchange rates (exchange rate changes deflated by the domestic rate of inflation) weighted by their share in total world exports of commodity i.

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$\dot{R}$ = the average proportionate change of importers' real exchange rate weighted by their share in total world imports of commodity i.

Except for the above definitional changes the model and the derivation of $\dot{P}_i$ is quite the same.

Domestic supply of the commodity i is also now a function of the relative price, i.e., the price of commodity i relative to domestic price level ($\dot{P}_d$). Hence, the equation for the percentage change in the export earnings of commodity i is modified to read as follows:

$$\dot{X}_i^k = \dot{\eta}_{si}^k [\dot{P}_i - \dot{T}^k(1 + \dot{P}_d^k) - \dot{P}_d^k] + \dot{P}_i$$

In the import side of the model, changes in the price of imports induced by the exchange rate changes are now considered as resulting from the changes in the real exchange rates. The rest of the model remains unchanged as the demand for imports has already been specified as a function of relative prices.

The basic model contains an equation for changes in the domestic price level to capture the effect of exchange rate changes on the domestic rate of inflation. Now, as the modified model is designed to simulate the joint effect of changes in exchange rates and domestic prices such an equation is not required. Actual changes in the domestic prices are considered jointly with the exchange rate changes. These modifications formed a second version of the model which is used in Section III to examine the effects of real exchange rate changes on the trade balance.

III. APPLICATION OF THE MODEL FOR SRI LANKA

The basic model was applied for Sri Lanka to examine the implications of exchange rate changes during 1971-85 on Sri Lanka's trade balance and to derive weights for the construction of effective exchange rate index accordingly. Further, the modified model was employed to examine the effects of real exchange rate changes during the same period on the Sri Lanka's trade balance. Before analysing the simulated results, values assigned to the key parameters are presented.

Sri Lanka's exports can be classified into five major categories, i.e., tea, rubber, coconuts, manufacturing and others. Tea, rubber and coconuts

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are three of the major commodities traded in the international market and hence the commodity by commodity approach presented in the model is quite suited to analyse the price changes of these commodities. However, as this same approach is not suited to examine the price changes in manufacturing exports, it has to be handled in another way. In this respect estimates of price changes of manufacturing exports of developing countries resulting from exchange rate changes were obtained from the intermediate simulation results of the MERM.[1] In the present application "other" exports were simply ignored.

The relevant world demands and supply elasticities were obtained from published commodity studies and Sri Lankan supply elasticities were borrowed from other developing countries.[2] The assigned values of these parameters are given in Table 1.

Table 1
THE ASSIGNED PRICE ELASTICITIES OF EXPORTS

| | World | | Sri Lanka |
	Supply	Demand	Domestic Supply
Tea	0.32	–0.17	0.23
Rubber	0.40	–0.50	0.20
Coconuts	0.80	–0.80	0.30
Manufactures	–	–	1.74

For rubber, world price elasticities were directly obtained from Behrman (1978). Sri Lankan supply elasticity was borrowed from Malaysia as reported in Behrman (1969). The world price elasticities of tea were obtained from Adams and Behrman (1976) and the domestic supply elasticity was approximated by the estimates for developing countries given in the same source. The assigned value of elasticities for coconuts were the same as those used by Rana (1981). Domestic supply elasticity was borrowed from the Philippines. For manufactures world price elasticities were not required. The domestic supply elasticity employed was the same as used in Belenger (1976).

The elasticity parameters that link income, expenditure and demand for imports were derived from the model presented in Wijesinghe (1986). Accordingly, income elasticity of expenditure, expenditure elasticity of imports and relative price elasticity of imports were fixed at 0.7495, 1.259 and –0.5530 respectively.

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1 This is similar to the procedure adopted by Belenger (1976). Feltenstein et al (1979) ignored manufacturing exports in their application of the model.

2 The adopted estimates are long-term elasticities.

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The results of the application are discussed in the following sub-sections. The sub-section III.I presents the simulated effects of nominal exchange rate changes during 1971-85 under the assumption that monetary authorities implement policies to neutralize the effects of exchange rate adjustments on monetary aggregates. In order to be comparable with this neutralization assumption the coefficients of the domestic rate of inflation equation were derived by simulating the model presented in Wijesinghe (1986) for an isolated one percentage change in foreign currency price of imports and exchange rate of Sri Lanka. The sub-section III.II looks into the joint effect of exchange rate changes and price changes, i.e., real exchange rate changes. Weights for the construction of an index of effective exchange rate with the objective of trade balance effect are derived and the index is presented in sub-section III.III.

III.I Simulation Results: Effects of Nominal Exchange Rate Changes During 1971-1985

The model takes into account the exchange rate changes of major competitors and importers[1] of Sri Lankan exports and the major countries from which Sri Lanka imports. The model simulation results provide the estimated effects of exchange rate changes on Sri Lanka's exports, imports and trade balance. In the analysis of the simulation results, it should be noted that the model considers only the medium-term effects of exchange rate changes without regard for the time lags. Hence, the estimated effects may not have occurred in the period indicated.

Exports

The first step in the analysis of exchange rate changes on export earnings is the computation of the proportionate changes in the importers' and exporters' exchange rate (relative to US dollar) for tea, rubber and coconuts. Tables 2, 3 and 4 show the weighted average of the importers' and exporters' exchange rate changes together with the resulting changes in world prices and export earnings of these three commodities respectively. Effects of exchange rate changes on the price and earnings of manufacturing exports were computed using intermediate simulation results of the MERM and reported in Table 5.

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1 These major exporters and importers of the commodities considered in the study are given in the Appendix.

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The currencies of the major exporters of tea have depreciated throughout the period 1971-85, shifting the world supply curve to the right. Except in a few years, i.e., 1971, 1973 and 1978-1980, exchange rates of the major importers of tea also have depreciated relative to the US dollar, making downward shifts in the demand curve. Hence, during the period under study, net effects of the exchange rate changes have been the reductions in the world prices throughout the period except in 1979 and 1980 when appreciation of importers' exchange rate resulted in increasing the world price of tea. The effects of the price reductions on export earnings of Sri Lanka have been offset to a certain extent by the depreciation of Sri Lankan rupee against US dollar. In fact, in certain years, tea export earnings rose despite the decline in the world price. Except in 1971 and 1972, domestic currency price of tea recorded positive changes, thus increasing the volume of tea exported.[1] However, in most of the years, the rate of depreciation of the Sri Lankan rupee has not been substantial enough to completely offset the negative impact of reduced tea prices on export earnings. Another important factor is the inelastic nature of the domestic supply. The impact of this factor is particularly evident during the period 1981-1985 when the export earnings of tea declined markedly despite a substantial depreciation of the rupee.

During the period 1981-85, currencies of the major exporters and importers of rubber depreciated relative to the US dollar even though the rates of depreciation were relatively lower in general compared to those for tea. The world price of rubber therefore declined at lower rates than tea. The world price of rubber recorded increases only during 1972-73 and 1977-78. The price increases in 1972, 1973 and 1977 were contributed by the appreciation of both the exporters' and importers' exchange rates while the increase in 1978 was mainly the result of the substantial appreciation of importers' exchange rates. Except in 1971 and 1979, depreciation of the Sri Lankan rupee has had the effect of either converting negative changes in world prices into positive changes in domestic currency price of rubber or enhancing the rate of increase in domestic currency price when the changes in the world price were positive, thus increasing the volume exported. Hence, the rupee depreciation has moderated the effects of exporters' and importers' exchange rate changes on export earnings when those changes caused a reduction in the world price, while it has increased the effect on export earnings when the world price changes were positive.

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1 The sharp increase in the earnings in 1979 should be attributed to the substantial depreciation of Sri Lanka rupee with the liberalization of the economy in late 1977. The similar increases are observed in cases of all the other exports as well.

During the period under study, the exchange rates of the major exporters of coconuts have depreciated (relative to US dollar) in all the years except in 1973 and 1977. During 1971-80, major importers' exchange rates have appreciated in all the years, except in 1974 and 1976. Hence, during this period, there were some years when changes in the world price were positive. However, the period 1981-84 showed the general pattern of depreciation of both the exporters' and importers' exchange rates. Accordingly, the world price of coconut recorded reductions. Similar to the case of tea and rubber, depreciation of the Sri Lankan rupee has moderated the effects of the negative world price changes on export earnings and amplified the effects of world price increases. However, in 1984, the decline in the world price was so large that even the domestic currency price of coconuts declined thus reducing the export earnings by 13.60 per cent.

During 1971-79 the effects of the exchange rate changes on the price of manufactures were mixed; during 1974-76 and in 1971 exchange rate changes had induced price reductions while during the remaining years the effect on prices were positive. General pattern of exchange rate changes induced price reductions were common to the manufactures as well during 1980-85. Despite the declines in the world price in most of the years, domestic currency price of manufactures recorded increases in all the years except 1971 reflecting the depreciation of Sri Lankan rupee. Accordingly, export earnings recorded increases in all the years except 1971, 1982, 1984 and 1985. In the years 1982, 1984 and 1985, the rates of depreciation of Sri Lankan rupee were not large enough to induce a sufficient increase in the volume of exports to compensate for the reductions in the world prices.

Since 1979, the effect of exchange rate changes has been the decline in the world price of the major exports of Sri Lanka. This might have been largely caused by the appreciation of the US dollar against major currencies. As can be observed in the first column of Table 6 which shows the weighted average changes in the world prices for Sri Lankan major exports, there had been a few years before 1979 when exchange rate changes resulted in increases in the export prices but those increases were rather small. Particularly after 1973, the general trend of the effect of exchange rate changes seem to be the reductions in the world price of exports. The effect of these changes on export earnings has been moderated or more than compensated by the depreciation of the Sri Lanka rupee which induced the volume exported. However, as the price elasticities of supplies of tea, rubber and coconuts were relatively low, the rupee depreciation has not been substantial enough to offset the effects of their world price reductions on export earnings particu-

larly after 1980. In case of the export of manufactures, rupee deprecia-
tion has been substantial enough to make substantial increases in the
export earnings in most of the years as the price elasticity of supply of
manufactures assumed in the simulation of the model is relatively high.
As a whole, exchange rate changes of the exporters and importers of Sri
Lankan exports, together with the depreciation of Sri Lankan rupee has
resulted in increasing the export earnings during 1972-80. But since
1981 effect of the exchange rate changes has been the declines in the
export earnings.

Imports

The effect of exchange rate changes on the price of imports of Sri
Lanka was approximated using the MERM results on changes in the
export prices of those countries from which Sri Lanka imports. The
changes in the price of imports and expenditure on imports are also
shown in Table 6. In general, changes in the price of imports seem to
follow a similar trend to that of exports, i.e., when exchange rate
changes caused reductions in the price of exports, it has simultaneously
caused reductions in the price of imports as well, but the rates of reduc-
tion in the price of imports have been substantially lower than those of
exports. In general, the opposite of this has been true in case of price
increases: price increases of exports have been accompanied by rela-
tively higher rate of increases in the prices of imports. Hence, during
the period under study, the effect of exchange rate changes on the terms
of trade has not been in favour of Sri Lanka.

The total expenditure (in US dollar) on imports depends not only on
foreign currency price of imports, but also on its relative price and total
domestic expenditure. During the study period, although the import
price in US dollar exhibited a mixed trend, the price in domestic cur-
rency and consequently the relative price of imports recorded increases
throughout, except for a marginal decline in 1974 and 1979. The rela-
tive price of imports thus exerted a negative pressure on imports
throughout the period. Such an impact was particularly pronounced in
1974-76 and 1981-85, when the relative price effect either offset or
magnified the income effect caused by the changes in export earnings,
resulting in declines in the expenditure on imports during this period.
For the rest of the period, expenditure on imports recorded increases
throughout despite the negative impact of relative prices. This is due to
either an insufficient reduction in the volume of imports to offset the
higher foreign currency import price or the higher income and hence
import demand induced by increased export earnings. However, it

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should be emphasised that the increase in the expenditure on imports would have been higher had it not been for the depreciation of the rupee in this period.

Trade Balance

The trade balance effects are computed as the deviation of the trade balance from a reference period. Table 7 shows the effect of exchange rate changes on the trade balance in relation to the actual trade balance observed in the reference period of 1980. The calculated trade balance effects are not invariant to the choice of the reference period, unless the trade was balanced in the reference period. As the value of imports was nearly twice as much as that of exports in the reference period, a one percentage change in imports implicitly receives a weight which is twice in size of that given to a similar percentage change in exports in the computation of the trade balance effect. Elimination of this valuation effect is therefore quite important, particularly in the construction of an effective exchange rate index as the effective exchange rate index should reflect only the real effect of exchange rate changes on trade balance, i.e., the volume effect and terms of trade effect only.[1] Hence, to adjust for this valuation effect, the adjusted trade balance was derived by deflating the final trade balance (the trade balance resulting from a particular set of exchange rate changes) by the average change in the import and export prices (resulting from the same simulation) and substracting the initial trade balance.

As can be observed from Table 7, trade balance effect of the exchange rate changes has been favourable to Sri Lanka in most of the years of the period under study. Adjusted trade balance changes show deteriorations only in 1971, 1979 and 1984. During 1981-85, improvements in the trade balance were dominated by decreases in imports. During 1974-76 improvements were caused by both the increase in exports and decline in imports. During the rest of the period, improvements were caused by the increases in exports which were substantial enough to more than offset the increases in imports. As pointed out earlier, depreciation of the rupee has been largely responsible for improving exports and restraining the growth in imports. Hence, the trade balance effect should be evaluated against an index of effective exchange rate.

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1 See Artus and McGuirk (1981).

III.II Simulation Results: Effects of Real Exchange Rate Changes During 1971-85

Exports

Real exchange rate changes are computed as:

$$\dot{T}^j(1 + \dot{P}^j) + \dot{P}^j$$

where $\dot{T}^j$ and $\dot{P}^j$ are the nominal exchange rate change and domestic price change (i.e., domestic rate of inflation) in the jth country. The computed real exchange rate changes and their simulated effects on the prices and earnings of tea, rubber and coconuts are summarised in Table 8, 9 and 10. The impact on the prices and earnings of manufacturing exports are shown in Table 11.

Movements of real exchange rates appear to be substantially different from those of the nominal exchange rates. Real exchange rates of the major exporters of tea depreciated only in 1976, 1978, 1983 and 1985 despite the depreciation of nominal exchange rates throughout the period. Tea importers also had their exchange rates depreciated only during 1981-84. Hence, except for 1976 and 1982-85 effects of the real exchange rate changes of tea exporters and importers were the increases in the world price of tea. During 1982-85 and 1976 real exchange rate changes induced reductions in the world price of tea, but these reductions were much lower than those caused by the nominal exchange rate changes. The changes in tea export earnings also followed the same pattern. Export earnings recorded increases throughout the period except during 1982-85 and 1976.

Rubber exporters' real exchange rates depreciated only in 1983 and 1985 and recorded appreciations throughout the rest of the period signifying that high rates of inflation prevailed in the rubber producing countries during the period under study. Similarly, rubber importers' real exchange rates depreciated only during 1981-84. Hence, rubber prices and accordingly, rubber export earnings recorded increases throughout the period except during 1983-85. Hence, real exchange rate changes had induced favourable changes in the prices and earnings of rubber compared to those changes induced by the nominal exchange rate changes.

Effects of the real exchange rate changes of exporters and importers of coconut also were much better than those induced by nominal exchange rate changes. World price of coconut recorded increases throughout the period except in 1983-84. In case of manufacturing also

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real exchange rate changes induced price reductions only during 1982–1985. However, export earnings recorded declines during the period 1979–84 which includes three years in which price changes were positive. This is due to the reason that in the present model domestic supply of export responds to the relative prices. Despite the substantial increases in the domestic currency price of manufacturing, the relative prices recorded declines due to the high rate of inflation observed during this period. Hence, adverse change in the relative price coupled with the relatively high elasticity of supply caused declines in the export earnings of manufacturing. A somewhat similar situation was observed in certain years for other commodities as well. For example, the world price of rubber was increased by 3.19 per cent (3.03 per cent in SL RS.) in 1979 and 6.82 per cent (12.58 per cent in SL RS.) in 1980 but export earnings were increased only at a lower rate i.e., 1.65 per cent and 4.42 per cent respectively. Similar changes were observed in cases of tea and coconut as well. The reason for export earning to increase at a lower rate than price was the rate of domestic inflation which produced negative changes in the relative price of exports despite positive changes in the absolute price.

Appreciations of exporters exchange rate shift the supply schedule to the left while the appreciation of importers exchange rate shift the demand schedule to the right. This was the situation observed in most of the years before 1982 in case of all types of exports of Sri Lanka. Hence, as reported in Table 12 the average export prices recorded increases in all the years during the period except in 1976. However, since 1982 export prices have declined mainly due to the real depreciation of major currencies. Changes in the export earnings also show a similar trend. The export earnings recorded increases during the period prior to 1982 and declines thereafter. In certain years rate of increase in the earnings were lower than the rate at which price increased, due to high domestic rate of inflation which convert the positive changes in the absolute price of exports into negative changes in the relative prices.

Terms of Trade and Imports

As was noted earlier, despite the substantial depreciation of nominal exchange rates, real exchange rates have recorded substantial appreciations in most of the years under study. This difference in the changes in real and nominal exchange rates was reflected in the changes in the export and import prices shown in Table 12. Prior to 1982, real exchange rate changes had induced positive changes in both the export and import prices in all the years except 1976, in which price of export

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recorded a decline. One of the noteworthy observation is the changes in the price of imports relative to the price of exports. Despite the unfavourable changes in the terms of trade caused by the nominal exchange rate changes, terms of trade effect of the real exchange rate changes had been favourable in most of the years under study. Prior to 1982, real exchange rate changes have induced increases in the price of imports, but the rates of increases were substantially lower than the rates at which the price of exports increased. In 1982, price of exports declined only at a lower rate than the imports. However, this trend has been reversed after 1982. In 1983 the price of imports has increased while the price of exports declined. During 1984-85 price of imports has declined only at lower rates than the rates at which the price of exports declined. Hence, the effect of the real exchange rate changes on the terms of trade has not been uniform. However, since 1983 real exchange rate changes had induced unfavourable impact on the terms of trade of Sri Lanka. This should be attributed to high rates of nominal depreciation of exchange rates coupled with relatively low rates of inflation observed during this period.

As shown in Table 13, price of imports in domestic currency recorded substantially higher rates of increases than the US dollar price of imports due to depreciation of Sri Lankan rupee against US dollar. However, these positive changes in domestic currency price of imports did not reduce the volume of imports demanded due to the high rates of inflation prevailed in the country. As the domestic inflation was higher than the rate of increase in import price, the volume of imports have in fact increased throughout except in 1973, 1976-78 and 1985. Hence, the changes in relative prices had positive impact on the expenditure on imports in most of the period. Expenditure on imports was further increased due to increases in exports and corresponding increases in income. Hence, expenditure on imports recorded increases throughout the period except in 1976, 1978 and 1985 in which years relative price of imports recorded significant increases due to high rate of depreciation of the Sri Lankan rupee and/or low rate of domestic inflation.

Trade Balance

Despite the favourable impact of nominal exchange rate changes on the trade balance, the simulated effects of real exchange rate changes recorded deteriorations in the trade balance in most of the years. As shown in the fourth column (trade balance) of Table 14, the effects of the real exchange rate changes on the trade balance were favourable only during 1976-78 and 1985. 1978 was an exceptional year where as

a component of a policy package, Sri Lankan rupee was substantially devalued and hence rupee prices of Sri Lankan exports and relative price of imports were substantially increased. Hence, it only reflected the immediate impact of the rupee devaluation. Even in 1976, 1977 and 1985 rupee was depreciated though at lower rates. An added factor which contributed to the favourable effect on the trade balance in these years (except in 1978) was the low rate of inflation which stood below 1.5 per cent. During the rest of the period under study real exchange rate changes have caused deteriorations in the trade balance. This was despite the nominal depreciation of rupee throughout the period except in 1979 when rupee was appreciated marginally. Apparently the reason for this deterioration is the domestic inflation which cancelled off the effects of nominal depreciations by making imports cheaper and exports dearer. Hence, the result highlights the importance of keeping domestic rate of inflation under control. These adverse results suggest that actual rate of nominal depreciation during these years were not sufficient enough to offset the domestic rate of inflation or the high inflation that followed the rupee depreciation has eroded the depreciation in real terms. In any case it is important that the determinants of inflation are well understood. One of the main determinants is the excess money on which exchange rate depreciation has a positive impact. Hence, it is important that monetary policy measures are implemented as supplementary measures to exchange rate policy.

III.III   An Index of Effective Exchange Rate for Sri Lanka

As pointed out earlier, in the computation of an effective exchange rate index, weights should reflect the comparative importance of each country in terms of the contribution of the changes in its exchange rate to the trade balance of the home country. Hence, these trade balance effects were calculated by simulating the main model repeatedly for an isolated one per cent depreciation of exchange rate of each currency i.e., purely the exchange rate changes were considered. In case of the US dollar, its one per cent depreciation rate is equivalent to 1.01 per cent appreciation of all other currencies. These trade balance effects and the weights derived in proportion to them are reported in Table 15. For comparison, bilateral imports, exports and trade weights[1] are also shown in the table.

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1 Bilateral trade weights were computed in proportion to the average trade shares of Sri Lanka during 1979-81.

According to the simulated trade balance effect (adjusted), a one per cent depreciation of the US dollar would result in a deterioration of Sri Lanka's trade balance by US$ 0.5511 million and in comparison to the other countries, exchange rate changes of the US dollar has the highest effect on the trade balance of Sri Lanka. Accordingly, the US dollar receives the highest weight (0.2683) in the computation of the effective exchange rate index of Sri Lanka. This in fact is quite high compared to the bilateral trade weights. However, this high weight for the US dollar is justifiable considering its importance as the numeraire currency. Commodity prices are usually denominated in US dollars and most of the trade is transacted in US dollars. Trade balance effects of the exchange rate changes in India, Malaysia, Indonesia, the Philippines and Kenya highlight the importance of these countries as Sri Lanka's major export competitors in the commodity markets. Hence, these countries receive weights which are much higher than their bilateral trade shares.

One of the important points needed to be emphasised is the relatively low weights (compared to bilateral trade share) assigned to the United Kingdom, Japan and Australia. This is mainly due to the effects of their exchange rate changes on Sri Lanka's imports. A relatively high share of imports of Sri Lanka is originated in these countries. Depreciation of exchange rates of any of these countries result in a reduction in the price of imports which leads to a reduction in the expenditure on imports as the absolute size of price elasticity of imports assumed in the simulation of the model is substantially less than one. Hence, the impact of depreciation of the pound sterling on Sri Lanka's trade balance is considerably reduced since the reduction in export earnings is accompanied by the decreased expenditure on imports. For Japan, which has the single largest share in Sri Lanka's total imports but is a relatively less significant importer of Sri Lanka's exports, a one per cent depreciation of the yen results in deteriorating Sri Lanka's trade balance only by US$ 0.0198 million. Hence, Japan receives one of the lowest weight in the effective exchange rate index for Sri Lanka. Depreciation of Australian dollar affects only the price of imports and therefore results in an improvement in the trade balance of Sri Lanka. Hence, Australia receives a negative weight of 0.0036.

Hence, as well displayed in Chart 14 and 14A where different types of weights were plotted, it is quite clear that the weights derived from the simulated trade balance effects are substantially different from the bilateral trade shares. Some similarities are observed between the trade balance effect weights and bilateral trade weights only in the weights assigned to France, Pakistan, Korea and Italy. However, these similarities are not substantial enough to argue that an index

constructed with the trade balance objective could be approximated by using bilateral trade weights.

The computed nominal and real effective exchange rate indices are shown in Table 16 and 17 and Charts 15 through 16A. Bilateral trade weighted indices are also shown for comparisons. It is obvious from these tables and charts that trade balance effect weighted indices (both nominal and real) do not necessarily follow the movements of bilateral trade weighted indices.

Except for the years 1974 through 1977 and the year 1980 the movements of trade balance effect weighted nominal effective exchange rate index were quite different from the bilateral trade weighted indices. In certain years, differences in the rate of appreciation or depreciation recorded by these indices exceeded four percentage points. In the years 1971, 1979 and 1984 trade balance effect weighted index indicated appreciations in Sri Lanka rupee while bilateral trade weighted indices recorded depreciations. In 1982, bilateral trade weighted indices recorded appreciations while the trade balance effect weighted index recorded a depreciation. Some similarities were observed in the movements of effective exchange rate indices weighted by trade balance effects and bilateral trade shares only during 1974–1977. However, these similarities were coincidental. For instance, in 1974 if only the major currencies of US, Japan, UK and France were considered, trade balance effect weighted index would have recorded a depreciation of 0.7686 per cent against an appreciation of 0.3475 per cent that would have been recorded by the trade share weighted index. However, the magnitude of the exchange rate changes of the other currencies, particularly those which have significant weightage in the trade share weighted index brought down the rate of change recorded by both indices to a same value.

Similarly, differences were observed in the rates of changes recorded in the real indices weighted by trade balance effect and the bilateral trade shares. Some similarities were observed only in 1974, 1979, 1981 and 1984 which are of course due to the coincidental movements of the exchange rates of different currencies.

Chart 17 exhibits the close correlation between the movements of trade balance effect weighted nominal effective exchange rate index and the simulated adjusted trade balance effect of the exchange rate changes during 1971-1985. As observed in the chart the higher the rate of rupee depreciation, the higher was the improvement in the adjusted trade balance. Only the years 1971, 1979 and 1984 recorded appreciations in the trade balance effect weighted effective exchange rate. Corresponding adjusted trade balance effect recorded deteriorations in these three

years. During the rest of the years under study, the effective exchange rate index recorded depreciations while the adjusted trade balance indicated improvements. This in fact confirms our earlier observation that the improvements in the trade balance resulting from the exchange rate changes during the period under study were largely caused by the depreciation of Sri Lankan rupee. Hence, in general the movements of the trade balance effect weighted effective exchange rate reflect the effect of exchange rate changes on the trade balance.

The trade balance effect weighted real effective exchange rate index was computed by deflating the nominal effective exchange rate index by an index of general level of prices relative to the prices in the other countries. The index of relative price level was constructed using the same weights applied in the computation of trade balance effect weighted index of nominal effective exchange rates. The alternative would have been to derive weights from the second version of the model and construct the index of real effective exchange rates directly by applying these weights to the real exchange rate changes against each currency. However, deriving weights from the second version of the model is not quite realistic due to the treatment of domestic rate of inflation as an exogenous variable. Effects of one per cent change in real exchange rate of each country could still be simulated but its impact on the domestic rate of inflation will not be captured. Due to the same reason, the weights derived from the two versions will not be the same. Hence, the simulated adjusted trade balance effects reported in Table 14 are not necessarily comparable with the movements of the trade balance effect weighted real effective exchange rate index.

However, as shown in Chart 18 movements of the trade balance effects weighted real effective exchange rate index also seem to be closely associated with the simulated adjusted trade balance effects of the real exchange rate changes. Except for the years 1971, 1974 and 1981, whenever the index of real effective exchange rate recorded depreciation (appreciation) of rupee the corresponding simulation results indicated deteriorations (improvements) in the adjusted trade balance. Hence, in general, the movements of trade balance effect weighted real effective exchange rate index indicates the effects of real exchange rate changes on the trade balance.

IV. CONCLUDING REMARKS

The present project highlighted the importance of analysing the effects of exchange rate changes on the trade balance and constructing an index

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of effective exchange rates that would facilitate such an analysis. Using a multilateral trade model for primary commodity exporting countries effects of the exchange rate (nominal) changes during 1971-85 on the trade balance of Sri Lanka were analysed and the weights required for the construction of a trade balance effect weighted effective exchange rate index were derived. Further, a modified version of the model was used to simulate the joint effects of the exchange rate changes and inflation, i.e., real exchange rate changes on the trade balance.

According to the simulation results, nominal exchange rate changes during the period under study has induced improvements in the Sri Lankan trade balance in most of the years. These improvements were largely contributed by the depreciation of the Sri Lankan rupee. However, the trade balance effect of real exchange rate changes had not been so impressive due to the high rates of inflation which prevailed in Sri Lanka in most of the years.

The general trend of the impact of nominal exchange rate changes during the period has been the decline in the export prices. However, the effect of the unfavourable price changes on export earnings were moderated or more than compensated for by the depreciation of the Sri Lankan rupee which induced increases in the export volume. However, after 1980, the rate of depreciation of the rupee has not been substantial enough to offset the negative effects of reduced prices as the price elasticities of supplies of commodities are relatively quite low, resulting in a decline in export earnings of tea, rubber and coconuts. On the other hand, despite the decreases in the world prices in certain years, earnings from the export of manufactures recorded reasonable increases in most of the years as the assumed price elasticity of supply is substantially high. However, even the manufacturing export earnings recorded decreases in 1982, 1984 and 1985 as the world price declines were so sharp that the rupee depreciations in these years were not substantial enough to induce sufficient increases in the volume despite the high price elasticity of supply.

In contrast to the substantial depreciation of nominal exchange rates of the exporters and importers of Sri Lanka exports, real exchange rates recorded appreciations in most of the years before 1982 mainly due to the high rates of inflation prevailed in these countries. As a result of this real appreciation of the currencies, the average price of Sri Lankan export recorded increases in all the years except 1976. Even the price declines record since 1982 were rather moderate. Hence, the general trend of effects of the real exchange rate changes during the period has been the increases in the real export prices. Following a similar pattern, export earnings recorded increases before 1982 and declines thereafter.

In certain years, the rates of increase in the export earnings were lower than the rate at which price increased due to the high rate of domestic inflation which transformed the positive changes in the absolute price of export into negative changes in the relative price.

Changes in export and import prices induced by nominal exchange rate changes exhibited a similar pattern. However, when exchange rate changes caused a decline in the price of imports, the price of exports declined at a higher rate while the increases in the export price were accompanied by higher rates of increases in import price. Hence, the effect of the exchange rate changes on the terms of trade has not been in favour of Sri Lanka. However, the terms of trade effect of the real exchange rate changes has not been uniformed throughout the period. Prior to 1983, in all the years except 1976 real exchange rate changes have induced increases in the price of exports at a higher rate than the rate at which price of imports increased, thus causing favourable changes in the terms of trade of Sri Lanka. However, this pattern has been reversed since 1983 causing unfavourable impact on the terms of trade of Sri Lanka mainly due to the high rate of nominal depreciation coupled with relatively low rates of inflation observed during this period.

Despite the decreases in the import prices induced by nominal exchange rate changes in certain years, domestic currency price of imports recorded increases in most of the years. Hence, relative price changes had a negative impact on imports. However, in most of the years, expenditure on imports recorded increases either because the rupee depreciation has not been substantial enough to make a sufficient reduction in the volume of imports or income increases induced by the exchange rate changes has increased the demand for imports. If the rupee were not depreciated during the period, expenditure on imports would have increased at a much higher rate.

In case of real exchange rate changes, the price of imports recorded increases in most of the years. Sri Lankan rupee depreciation has augmented the size of these price increases while converting the price declines recorded in a few years also into increase. Despite these substantial price increases, the relative price effect on the expenditure on import has been positive in most of the years due to the high rates of inflation prevailed in the country. Hence expenditure on imports recorded increases in all the years, except in 1976, 1978 and 1985 in which domestic currency price of import increased at a substantially higher rate than the domestic rate of inflation.

The movement of the index of nominal effective exchange rate computed with the trade balance objective closely reflected the effect of

exchange rate changes on Sri Lanka's trade balance. Accordingly, depreciation of the rupee has been instrumental in making a favourable impact on the trade balance during the study period except for the years 1971, 1979 and 1985 in which effective exchange rate index recorded appreciations and the simulated adjusted trade balance recorded deteriorations. Though not strictly comparable movements of the trade balance effect weighted real effective exchange rate index were also closely associated with the simulated trade balance effect of the real exchange rate changes.

The trade balance effect weights derived by simulating the model repeatedly for the construction of effective exchange rate index were substantially different from the bilateral trade shares. It also reflected the importance of a number of Sri Lankan export competitors which are ignored in a bilateral trade share weighted index. A comparison of the trade balance effect weighted index with the indices weighted by bilateral trade shares revealed that the use of a bilateral trade share weighted index as an approximation to the trade balance effect weighted index could well be misleading. Hence as a policy guide it is important that an index of effective exchange rates weighted by the trade balance effects of the exchange rate changes should be constructed and monitored.

A noteworthy feature of the simulation results was the marked difference between the trade balance effect of nominal and real exchange rate changes. Nominal exchange rate changes had induced improvements during most of the years under study. However, during the 1980's inadequacy of the rate of rupee depreciation was noted. The main model captured changes in the domestic price level that was induced by the exchange rate change only. Hence, the adequacy of the rupee depreciation considering the differences in the rates of inflation among the countries was not considered. This was taken into account in the second version of the model where joint effects of the exchange rate changes and the domestic rate of inflation were simulated. The simulated results showed that in most of the years under study, real exchange rate changes had induced deteriorations in the trade balance. This was despite the favourable changes in the world prices of exports induced by real exchange rate changes. High rates of domestic inflation have made the exports less profitable while encouraging more imports. Hence, it is clear that for the exchange rate policy to be successful, domestic rate of inflation should be kept under control as the domestic price changes could easily erode the benefits of any exchange rate depreciation. In this respect the importance of monetary policy should be recognized. For the exchange rates policy to be successful it is important that supplementary monetary policy measures are implemented. The

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APPENDIX

Commodity \ Country	World major exporters	World major importers
Rubber	Indonesia Malaysia Sri Lanka Thailand	Federal Republic of Germany France Japan Republic of Korea United Kingdom USA
Tea	India Indonesia Kenya Sri Lanka	Federal Republic of Germany France Japan Pakistan Saudi Arabia United Kingdom USA
Coconut	Malaysia Philippines Indonesia Sri Lanka	Federal Republic of Germany France Japan United Kingdom USA

Sources: The World Bank, *Commodity Trade and Price Funds.*
Food and Agriculture Organization, *Trade Yearbook.*

tigations indicated that the coefficient of the exchange rate variable of the rate of inflation equation could be much higher than that estimated under the neutralization assumption. However, during the medium-term the coefficients of the price of imports (in foreign currency) in the inflation equation could well be much lower due to the contractionary effect of the high import prices (i.e., due to the deterioration in the trade balance) on the monetary aggregates. Hence, further research into this area would be useful and would shed more light into the importance of monetary policy measures in the implementation of an effective exchange rate policy.

possible impact of fiscal policy measures on monetary aggregates and hence on the domestic rate of inflation should also be noted.

We hope that the results presented in this report shed some light into the effects of exchange rate policy and showed an effective way of monitoring exchange rate changes. However, to be more useful, certain limitations in the application of the model should be noted and if necessary rectified. It will also require further research in certain areas.

In the application of the model, exports other than tea, rubber, coconuts and manufactures were ignored due to the lack of estimates of required parameters. Even the estimates of the elasticities employed in the model were borrowed from various sources and domestic supply elasticities were not directly estimated for Sri Lanka. It would be quite useful to have a fresh look into these key parameters. The sensitivity of the results to the changes in the assumed values of the key parameters also should be examined.

The present model does not disaggregate imports into different categories and hence differences between price elasticities of imports of different types of goods are ignored. The limitation imposed by this is not very serious if Sri Lanka's imports from each country consist of a mix of all types of goods such that aggregate import function provides a reasonably good approximation. However, this may not be the nature of Sri Lankan imports, particularly from certain countries like Japan. Imports from Japan may be quite responsive to the price changes while those from others may not be so. Hence, attempts should be made to disaggregate imports and take these differences in the price elasticities into account.

The present model simulated the effects of exchange rate changes on the merchandise trade. The trade in services has also become quite important in both developed and developing countries. Hence, it would be worth considering the ways in which the model could be augmented to simulate the effects of exchange rate changes on the trade in services as well.

Finally, it would be very useful to undertake further research into the effects of exchange rate changes under different monetary policy measures. In the present application of the main model coefficients of the equation for domestic rate of inflation were estimated under the neutralization assumption i.e., effects of the exchange rate changes on the monetary aggregates are sterilized. It was meant to isolate the effects of only the exchange rate changes. However, it would be rewarding to examine the joint effects of exchange rate and monetary policy and hence to remove the neutralization assumption and examine the effects of exchange rate changes on the trade balance. Our preliminary inves-

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Table 2
NOMINAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF TEA
(Percentage changes over the previous year)

	Importers' Exchange Rates*	Exporters' Exchange Rates#	World Price Expressed in US$	World Price Expressed in SLRS	Export Earnings in US$
1971	0.53	−0.34	−0.04	−0.34	−0.12
1972	−0.67	−0.72	−0.71	−0.11	−0.73
1973	0.48	−1.60	−0.88	5.87	0.47
1974	−0.91	−2.05	−1.66	2.06	−1.18
1975	−0.63	−2.07	−1.57	3.55	−0.75
1976	−3.96	−5.91	−5.23	11.44	−2.60
1977	−0.15	−0.21	−0.19	5.03	9.97
1978	3.52	−6.00	−2.70	40.43	6.60
1979	2.41	−0.98	0.20	0.04	0.21
1980	1.87	−0.15	0.55	6.31	2.00
1981	−3.56	−6.66	−5.58	8.47	−3.64
1982	−4.47	−5.39	−5.07	2.62	−4.47
1983	−3.45	−6.80	−5.64	5.82	−4.30
1984	−3.33	−5.65	−4.85	2.68	−4.23
1985	−1.47	−4.79	−3.64	2.72	−3.01

* Weighted average of the changes in the exchange rate of major importers of tea
\# Weighted average of the changes in the exchange rate of major exporters of tea

Table 3
NOMINAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF RUBBER
(Percentage changes over the previous year)

	Importers' Exchange Rates*	Exporters' Exchange Rates #	World Price Expressed in US$	World Price Expressed in SLRS	Export Earnings in US$
1971	0.31	−1.76	−0.61	−0.91	−0.79
1972	2.75	2.67	2.71	3.30	3.37
1973	3.18	7.42	5.06	11.81	7.43
1974	−1.34	0.77	−0.40	3.31	0.26
1975	−0.01	−0.09	−0.04	5.08	0.97
1976	−1.51	−3.37	−2.34	14.34	0.53
1977	1.48	1.39	1.44	6.66	2.77
1978	5.29	−0.10	2.89	46.02	12.10
1979	0.83	−4.49	−1.53	−1.69	−1.87
1980	−0.68	−0.18	−0.46	5.30	0.60
1981	−3.02	−4.31	−3.60	10.46	−1.50
1982	−3.63	−2.79	−3.26	4.43	−2.37
1983	−1.27	−6.94	−3.79	7.67	−2.25
1984	−1.97	−4.12	−2.93	4.60	−2.00
1985	−0.80	−6.69	−3.42	2.94	−2.83

* Weighted average of the changes in the exchange rates of major importers of rubber
\# Weighted average of the changes in the exchange rates of major exporters of rubber

Table 4
NOMINAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF COCONUT
(Percentage changes over the previous year)

	Importers' Exchange Rates*	Exporters' Exchange Rates #	World Price Expressed in US$	World Price Expressed in SLRS	Export Earnings in US$
1971	0.87	−5.37	−2.25	−2.55	−3.01
1972	2.80	−1.91	0.44	1.04	0.75
1973	3.93	0.00	1.97	8.71	4.58
1974	−0.57	−0.27	−0.42	3.29	0.57
1975	1.16	−4.13	−1.48	3.63	−0.39
1976	−1.62	−2.25	−1.93	14.74	2.49
1977	1.41	0.44	0.92	6.13	2.76
1978	4.50	−0.09	2.21	45.33	15.80
1979	1.81	−0.28	0.76	0.60	0.95
1980	0.33	−1.21	−0.44	5.32	1.15
1981	−4.26	−3.71	−3.98	10.07	−0.96
1982	−3.08	−5.08	−4.08	3.61	−2.99
1983	−1.72	−15.46	−8.59	2.87	−7.73
1984	−2.58	−21.82	−12.20	−4.67	−13.60
1985	−0.74	−7.13	−3.94	2.42	−3.21

* Weighted average of the changes in the exchange rates of major importers of coconut
# Weighted average of the changes in the exchange rates of major exporters of coconut

Table 5
NOMINAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF MANUFACTURING
(Percentage changes over the previous year)

	World Prices Expressed in US$	World Prices Expressed in SLRS	Export Earnings in US$
1971	−0.21	−0.51	−1.08
1972	1.20	1.79	4.32
1973	3.55	10.30	21.47
1974	−1.53	2.18	2.27
1975	−0.65	4.47	7.12
1976	−3.97	12.71	18.13
1977	1.05	6.26	11.95
1978	3.81	46.93	85.47
1979	0.42	0.26	0.89
1980	−0.83	4.93	7.76
1981	−6.05	8.00	7.87
1982	−6.29	1.40	−3.86
1983	−5.11	6.35	5.94
1984	−5.38	2.15	−1.65
1985	−4.12	2.24	−0.22

Table 6
EFFECTS OF NOMINAL EXCHANGE RATE CHANGES ON PRICES AND VALUES OF EXPORTS AND IMPORTS
(Percentage changes over the previous year)

	Export Prices Expressed in US$*	Export Earnings Expressed in US$	Import Prices Expressed in US$	Import Expenditure Expressed in US$
1971	−0.32	−0.57	0.25	− 0.17
1972	0.38	0.98	1.23	0.87
1973	1.16	4.97	1.28	2.24
1974	−0.89	0.04	−0.47	−0.57
1975	−0.76	0.96	−0.07	−0.12
1976	−2.90	2.22	−0.48	−0.95
1977	0.39	2.82	0.60	1.07
1978	0.28	18.60	2.11	5.38
1979	−0.03	0.01	0.09	0.05
1980	−0.05	2.07	0.01	0.41
1981	−3.69	−0.31	−0.48	−1.95
1982	−3.52	−2.72	−1.20	−2.71
1983	−3.97	−1.50	−0.19	−2.16
1984	−3.91	−3.09	−0.51	−2.64
1985	−2.70	−1.74	−0.39	−1.77

* Weighted average of the percentage changes of the prices of tea, rubber, coconut and manufacturing exports

Table 7
NOTIONAL CHANGES IN THE BALANCE OF TRADE*

(US$ million)

	Exports	Imports	Trade Balance	Adjusted Trade Balance
1971	−6.06	−3.50	−2.57	−2.89
1972	10.45	17.91	−7.46	0.49
1973	52.89	45.97	6.92	18.75
1974	0.38	−11.78	12.16	5.47
1975	10.25	−2.45	12.69	8.59
1976	23.58	−19.45	43.03	26.76
1977	30.04	21.92	8.13	12.93
1978	198.05	110.51	87.54	98.19
1979	0.10	1.13	−1.02	−0.73
1980	22.03	8.37	13.66	13.48
1981	−3.33	−40.03	36.69	16.38
1982	−28.90	−55.67	26.77	3.52
1983	−15.95	−44.32	28.37	7.97
1984	−32.93	−54.26	21.33	−0.52
1985	−18.48	−36.29	17.81	2.53

* Changes from the reference period, 1980.

Table 8
REAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF TEA
(Percentage changes over the previous year)

	Importers' Exchange Rates*	Exporters' Exchange Rate#	World Price Expressed in US$	Relative Price in Domestic Currency	Export Earnings in US$
1971	3.40	1.53	2.18	−0.88	1.97
1972	1.57	2.79	2.37	−3.77	1.51
1973	4.65	7.08	6.23	3.74	7.24
1974	5.27	10.87	8.92	0.32	9.10
1975	6.82	3.15	4.42	2.86	5.16
1976	0.59	−5.75	−3.55	11.85	−0.78
1977	4.27	4.16	4.20	8.3	6.12
1978	6.01	−2.01	0.77	31.66	9.27
1979	6.30	4.19	4.93	−5.98	3.54
1980	7.13	9.76	8.85	−11.49	6.55
1981	−0.30	0.83	0.44	−3.41	0.23
1982	−2.31	0.34	−0.58	−3.75	−1.25
1983	−2.03	−0.27	−0.88	−3.42	−1.30
1984	−1.92	0.49	−0.34	−9.45	−2.23
1985	0.11	−1.96	−1.24	3.68	−0.38

* Weighted average of the changes in the real exchange rates of major importers of tea
\# Weighted average of the changes in the real exchange rates of major exporters of tea

Table 9
REAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF RUBBER
(Percentage changes over the previous year)

	Importers' Exchange Rate*	Exporters' Exchange Rate#	World Price Expressed in US$	Relative Price in Domestic Currency	Export Earnings in US$
1971	2.56	0.10	1.47	−1.59	1.15
1972	4.82	7.01	5.80	−0.34	5.74
1973	6.26	23.59	13.96	11.47	16.38
1974	4.18	23.75	12.88	4.28	13.83
1975	4.30	7.82	5.86	4.3	6.79
1976	1.53	3.48	2.40	17.8	6.00
1977	4.35	7.67	5.82	9.92	7.82
1978	7.57	5.86	6.81	37.7	15.41
1979	3.48	2.84	3.19	−7.72	1.65
1980	3.04	11.54	6.82	−13.52	4.42
1981	−0.36	5.55	2.27	−1.58	2.45
1982	−1.92	3.42	0.45	−2.72	0.08
1983	−0.09	−1.94	−0.91	−3.45	−1.28
1984	−0.92	0.80	−0.16	−9.27	−1.76
1985	0.25	−5.08	−2.12	2.8	−1.54

* Weighted average of the changes in the real exchange rates of major importers of rubber
\# Weighted average of the changes in the real exchange rates of major exporters of rubber

Table 10
REAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF COCONUT
(Percentage changes over the previous year)

	Importers' Exchange Rate*	Exporters' Exchange Rate#	World Price Expressed in US$	Relative Price in Domestic Currency	Export Earnings in US$
1971	2.61	3.66	3.13	0.07	3.15
1972	4.58	4.85	4.71	−1.43	4.30
1973	6.57	10.15	8.36	5.87	10.30
1974	2.95	23.18	13.06	4.46	14.54
1975	4.28	1.46	2.87	1.31	3.37
1976	0.48	2.13	1.30	16.7	6.38
1977	3.52	6.03	4.78	8.88	7.46
1978	6.13	5.38	5.75	36.64	18.33
1979	3.84	11.57	7.70	−3.21	6.73
1980	3.01	11.36	7.18	−13.16	3.69
1981	−2.30	5.28	1.49	−2.36	1.53
1982	−1.43	1.61	0.09	−3.08	−0.58
1983	−0.55	−9.95	−5.25	−7.79	−7.11
1984	−2.61	0.30	−0.66	−9.77	−3.21
1985	0.25	6.26	3.25	8.17	5.73

* Weighted average of the changes in the real exchange rates of major importers of coconut
\# Weighted average of the changes in the real exchange rates of major exporters of coconut

Table 11
REAL EXCHANGE RATE CHANGES AND CHANGES
IN WORLD PRICE AND EARNINGS OF MANUFACTURING
(Percentage changes over the previous year)

	World Prices Expressed in US$	Relative Price in Domestic Currency	Export Earnings in US$
1971	3.41	0.35	3.99
1972	5.14	−1	3.48
1973	12.34	9.85	30.54
1974	12.19	3.59	19.23
1975	7.36	5.8	18.05
1976	1.09	16.49	30.14
1977	6.83	10.93	25.95
1978	8.82	39.71	87.11
1979	6.55	−4.36	−1.07
1980	8.20	−12.14	−10.31
1981	0.67	−3.18	−0.50
1982	−1.48	−4.65	−8.10
1983	−1.09	−3.63	−4.63
1984	−0.87	−9.98	−16.06
1985	−0.99	3.93	6.01

Table 12
EFFECTS OF REAL EXCHANGE RATE CHANGES ON PRICES
AND VALUES OF EXPORTS AND IMPORTS
(Percentage changes over the previous year)

	Export Prices Expressed in US$*	Export Earnings Expressed in US$	Import Prices Expressed in US$	Import Expenditure Expressed in US$
1971	1.74	1.72	0.94	2.17
1972	2.84	2.25	1.88	3.73
1973	6.78	10.47	2.91	6.65
1974	7.89	9.31	1.96	8.34
1975	3.75	5.84	1.41	3.75
1976	–0.58	5.83	0.51	–2.95
1977	3.74	7.88	1.67	2.61
1978	3.11	20.46	2.75	–1.25
1979	3.79	1.83	0.81	5.28
1980	5.87	1.58	1.17	8.86
1981	0.71	0.49	0.36	1.79
1982	–0.35	–1.72	–0.65	0.29
1983	–1.03	–1.93	0.28	0.02
1984	–0.33	–3.78	–0.11	1.60
1985	–0.63	1.04	–0.05	–1.39

* Weighted average of the percentage changes in the prices of tea, rubber, coconut and manufacturing exports

Table 13
EFFECTS OF REAL EXCHANGE RATE CHANGES ON
IMPORT PRICES
(Percentage changes over the previous year)

	Import Prices Expressed in US$	Sri Lankan Rupee Exchange Rate	Import Prices Expressed in SLRS	Domestic Prices	Relative Price of Imports
1971	0.94	0.30	0.64	2.76	–2.12
1972	1.88	–0.59	2.47	6.73	–4.26
1973	2.91	–6.75	9.66	9.24	0.42
1974	1.96	–3.71	5.67	12.31	–6.64
1975	1.41	–5.12	6.53	6.68	–0.15
1976	0.51	–16.68	17.19	1.28	15.91
1977	1.67	–5.21	6.88	1.11	5.77
1978	2.75	–43.12	45.87	12.23	33.64
1979	0.81	0.16	0.65	10.75	–10.10
1980	1.17	–5.76	6.93	26.10	–19.17
1981	0.36	–14.05	14.41	17.90	–3.49
1982	–0.65	–7.69	7.04	10.86	–3.82
1983	0.28	–11.46	11.74	14.00	–2.26
1984	–0.11	–7.53	7.42	16.64	–9.22
1985	–0.05	–6.36	6.31	1.44	4.87

Table 14
EFFECTS OF REAL EXCHANGE RATE CHANGES ON THE
BALANCE OF TRADE*

(US$ million)

	Exports	Imports	Trade Balance	Adjusted Trade Balance
1971	18.28	44.55	−26.27	−12.82
1972	23.97	76.63	−52.66	−28.61
1973	111.41	136.47	−25.06	21.78
1974	99.10	171.27	−72.17	−22.32
1975	62.15	77.05	−14.90	10.34
1976	62.01	−60.69	122.70	122.40
1977	83.85	53.75	30.10	55.33
1978	217.82	−25.60	243.41	264.61
1979	19.46	108.37	−88.91	−64.66
1980	16.78	181.96	−165.18	−125.90
1981	5.19	36.73	−31.54	−26.09
1982	−18.32	5.88	−24.20	−29.31
1983	−20.51	0.51	−21.02	−24.84
1984	−40.20	32.83	−73.03	−75.38
1985	11.10	−28.51	39.61	36.37

* Changes from the reference period, 1980.

Table 15
SIMULATED TRADE BALANCE EFFECT AND THE WEIGHTS
FOR EFFECTIVE EXCHANGE RATE INDICES OF SRI LANKA

	Adjusted Trade Balance Effect*	Trade Balance Effect Weights	Export Weights	Import Weights	Trade Weights
USA	−0.5511	0.2683	0.2256	0.0764	0.1200
India	−0.3010	0.1466	0.0478	0.0793	0.0701
Malaysia	−0.2017	0.0982	0.0196	0.0114	0.0138
Indonesia	−0.1719	0.0837	0.0005	0.0034	0.0026
Philippines	−0.1583	0.0771	0.0022	0.0073	0.0058
UK	−0.1372	0.0668	0.1365	0.1083	0.1165
Kenya	−0.1237	0.0602	0.0021	0.0130	0.0098
Germany, FR	−0.0963	0.0469	0.1079	0.0609	0.0746
Thailand	−0.0757	0.0369	0.0005	0.0091	0.0066
France	−0.0667	0.0325	0.0299	0.0377	0.0354
Pakistan	−0.0593	0.0289	0.0831	0.0194	0.0380
Korea	−0.0432	0.0210	0.0010	0.0366	0.0262
Italy	−0.0364	0.0177	0.0399	0.0109	0.0193
Japan	−0.0198	0.0097	0.0814	0.1806	0.1517
Saudi Arabia	−0.0118	0.0057	0.0603	0.1621	0.1324
Singapore	−0.0065	0.0032	0.0297	0.0704	0.0585
Iran	−0.0004	0.0002	0.0487	0.0720	0.0652
Australia	0.0073	−0.0036	0.0833	0.0412	0.0535
	−2.0537	1.0000	1.0000	1.0000	1.0000

* Effect of one percent depreciation of each country on Sri Lanka's trade balance adjusted for the valuation effect.

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Table 16
## INDICES OF NOMINAL EFFECTIVE EXCHANGE RATES
FOR SRI LANKA
(1980=100)

	Weighted by							
	Trade Balance Effect	% Change	Export Share	% Change	Import Share	% Change	Trade Share	% Change
1970	281.6		319.9		343.3	0.0	336.5	
1971	283.7	0.7	316.0	−1.2	340.4	−0.8	333.3	−1.0
1972	280.0	−1.3	307.1	−2.8	318.7	−6.4	315.3	−5.4
1973	253.5	−9.5	269.5	−12.2	274.1	−14.0	272.8	−13.5
1974	246.9	−2.6	261.9	−2.8	267.3	−2.5	265.7	−2.6
1975	236.7	−4.1	249.8	−4.6	256.2	−4.2	254.3	−4.3
1976	207.6	−12.3	220.3	−11.8	223.7	−12.7	222.7	−12.4
1977	194.8	−6.2	207.6	−5.8	208.0	−7.0	207.9	−6.6
1978	106.5	−45.3	110.4	−46.8	108.3	−47.9	108.9	−47.6
1979	106.7	0.2	107.6	−2.5	106.5	−1.7	106.8	−1.9
1980	100.0	−6.3	100.0	−7.1	100.0	−6.1	100.0	−6.4
1981	92.8	−7.2	92.6	−7.4	91.7	−8.3	91.9	−8.1
1982	92.1	−0.8	93.5	1.0	92.1	0.4	92.5	0.7
1983	90.2	−2.1	88.2	−5.7	85.6	−7.1	86.3	−6.7
1984	93.0	3.1	87.3	−1.0	84.3	−1.5	85.2	−1.3
1985	92.9	−0.1	86.5	−0.9	82.7	−1.9	83.8	−1.6

Table 17
INDICES OF REAL EFFECTIVE EXCHANGE RATES
FOR SRI LANKA
(1980=100)

	Weighted by							
	Trade Balance Effect	% Change	Export Share	% Change	Import Share	% Change	Trade Share	% Change
1970	299.0		339.4		379.7		367.6	
1971	295.8	−1.1	327.5	−3.5	368.2	−3.0	356.0	−3.2
1972	296.7	0.3	323.7	−1.2	350.2	−4.9	342.3	−3.8
1973	263.4	−11.2	281.0	−13.2	293.6	−16.2	289.8	−15.3
1974	241.5	−8.3	264.4	−5.9	269.4	−8.2	268.0	−7.5
1975	224.5	−7.0	238.3	−9.9	241.2	−10.5	240.4	−10.3
1976	189.7	−15.5	195.6	−17.9	193.0	−20.0	193.8	−19.4
1977	166.2	−12.4	170.1	−13.0	165.0	−14.5	166.5	−14.1
1978	95.4	−42.6	95.8	−43.7	92.0	−44.2	93.1	−44.1
1979	96.1	0.7	95.5	−0.3	93.8	2.0	94.3	1.3
1980	100.0	4.1	100.0	4.7	100.0	6.6	100.0	6.0
1981	98.1	−1.9	98.9	−1.1	98.5	−1.5	98.6	−1.4
1982	99.8	1.7	102.9	4.0	102.7	4.3	102.7	4.2
1983	104.1	4.3	104.2	1.3	102.7	0.0	103.1	0.4
1984	114.1	9.6	114.3	9.7	112.5	9.5	113.0	9.6
1985	108.3	−5.1	110.2	−3.6	108.2	−3.8	108.8	−3.7

Chart 1

NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON TEA PRICES AND EARNINGS
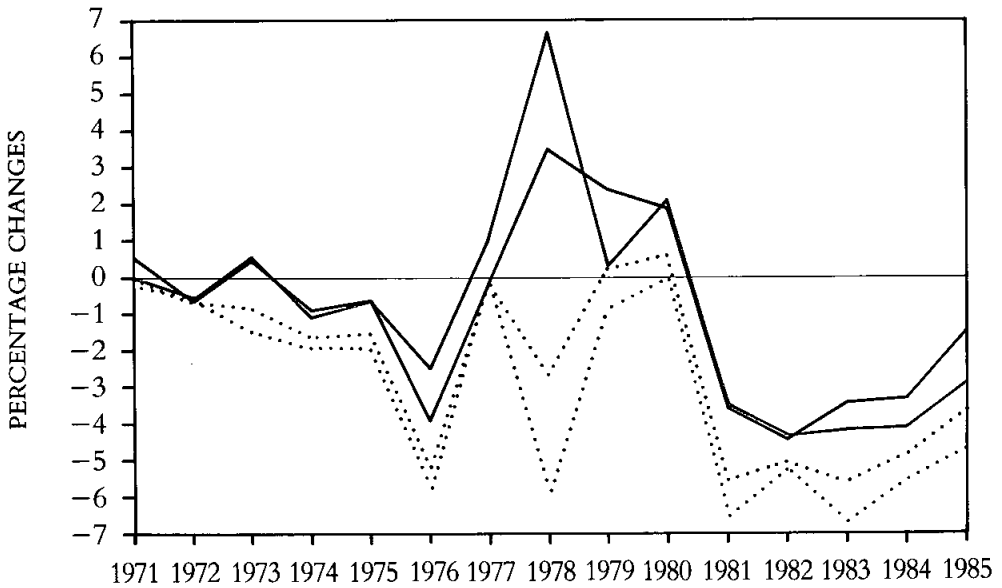
——— Importers' exchange rates
········ Exporters' exchange rates
········ World price expressed in US$
——— Export earnings expressed in US$

Chart 2

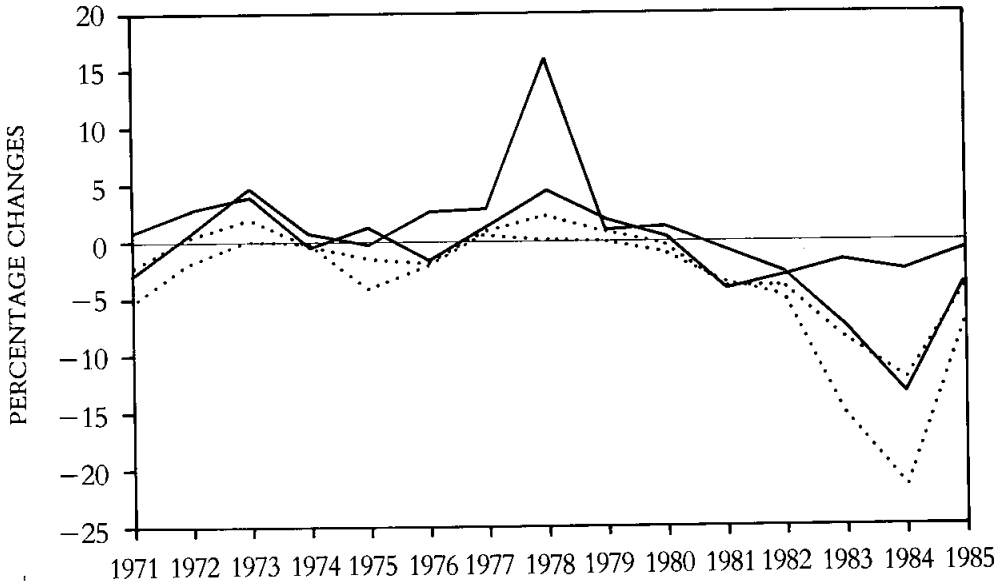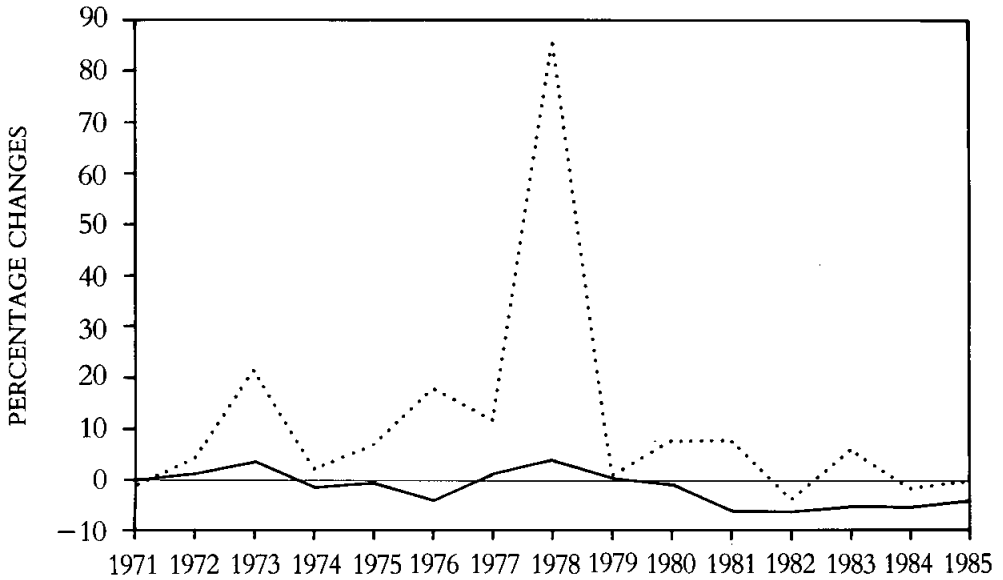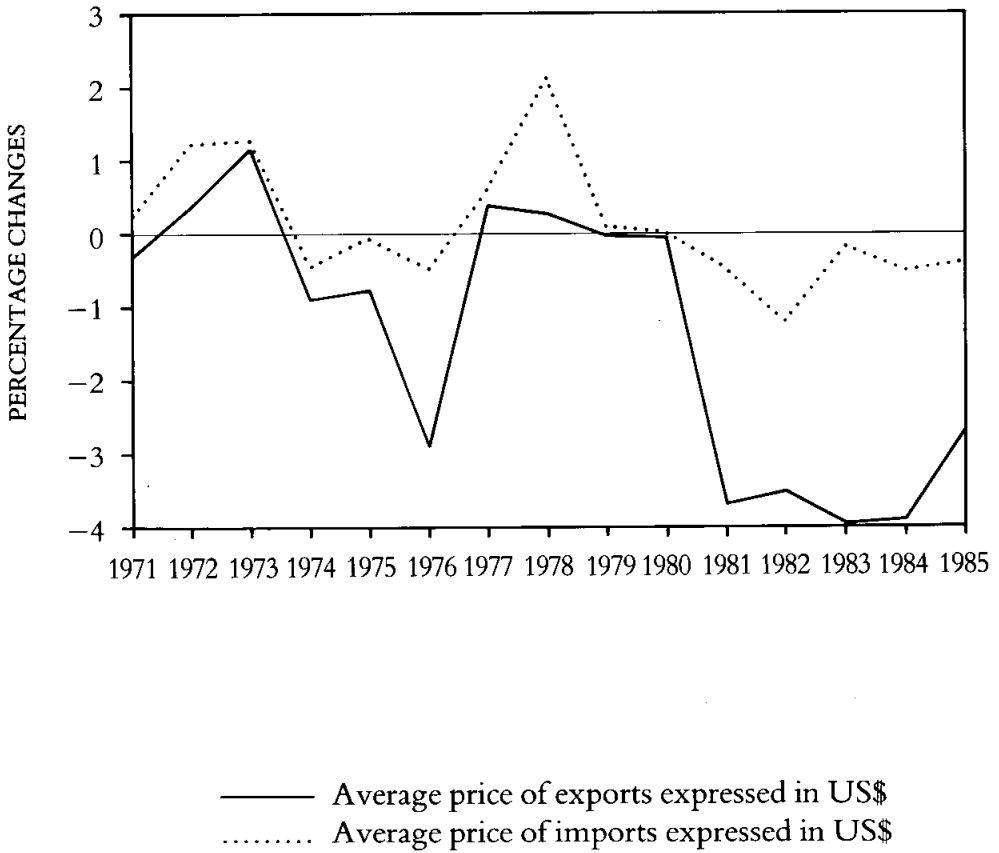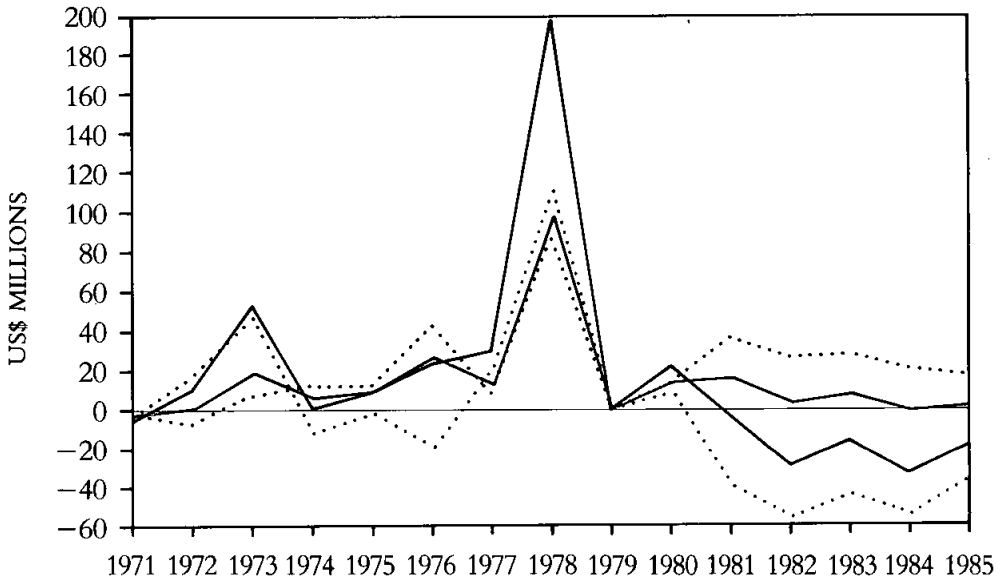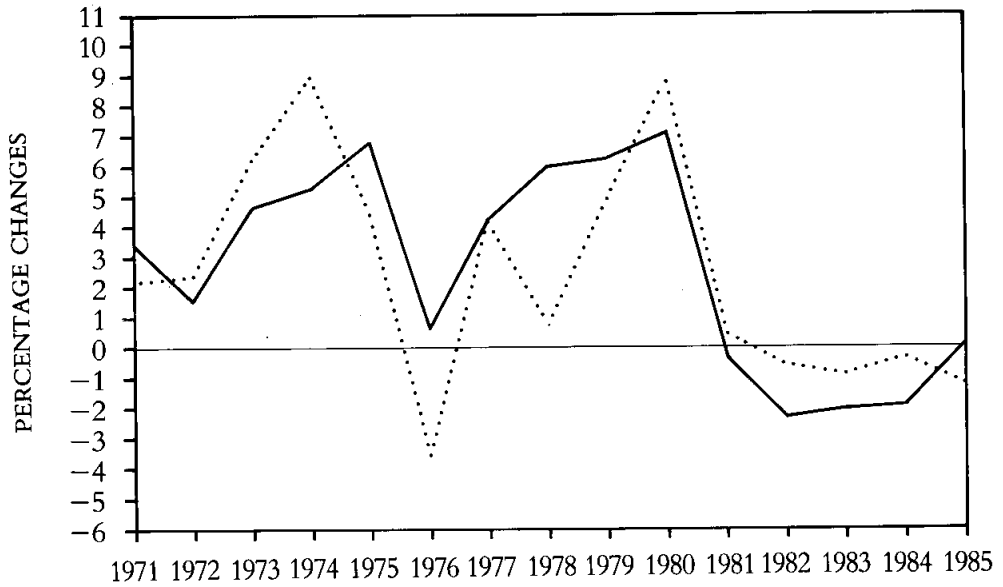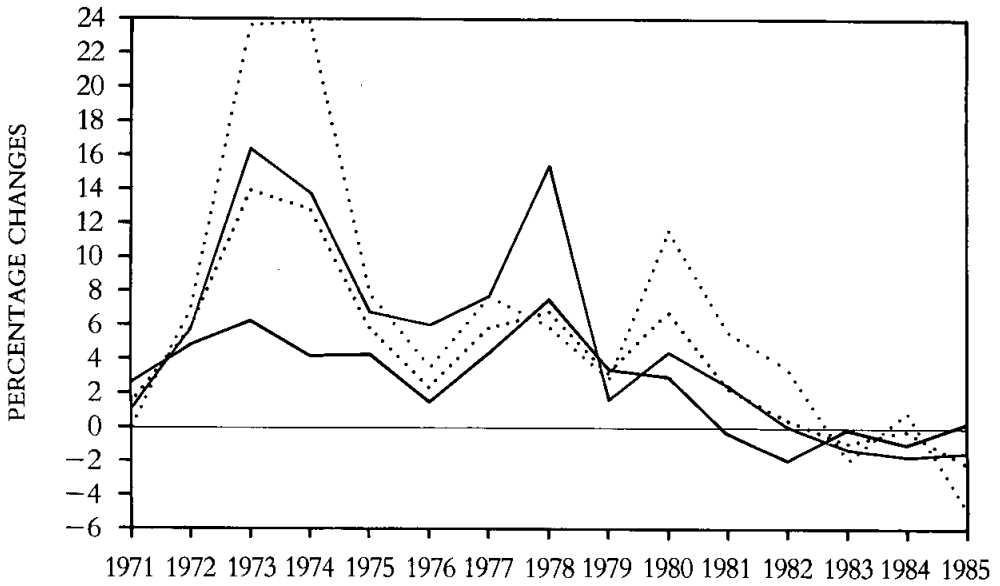# NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON RUBBER PRICES AND EARNINGS
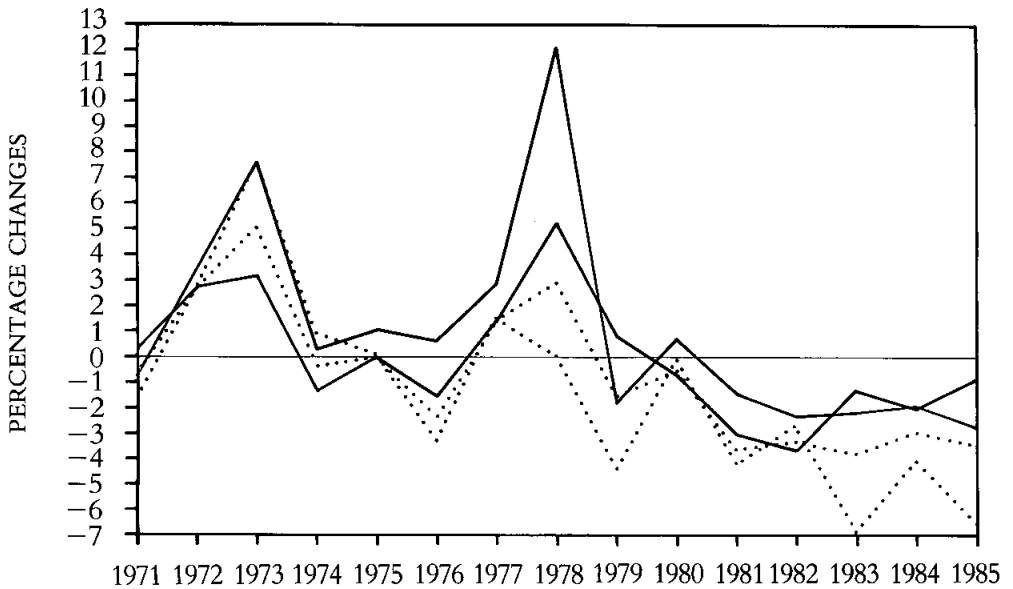
——— Importers' exchange rates
·········· Exporters' exchange rates
·········· World price expressed in US$
——— Export earnings expressed in US$

Chart 3

NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON COCONUT PRICES AND EARNINGS

Legend:
——— Importers' exchange rates
········ Exporters' exchange rates
········ World price expressed in US$
——— Export earnings expressed in US$

Chart 4

NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON MANUFACTURING: PRICES AND EARNINGS

——— World price expressed in US$
········ Export earnings expressed in US$
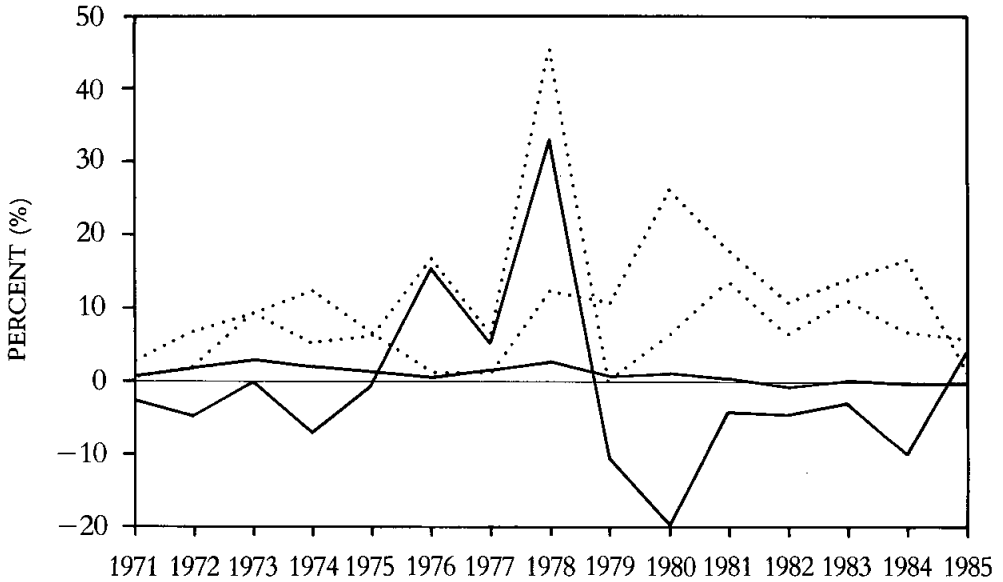
Chart 5

NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON EXPORT AND IMPORT PRICES

——— Average price of exports expressed in US$
········· Average price of imports expressed in US$

Chart 6

NOMINAL EXCHANGE RATE CHANGES
EFFECTS ON THE TRADE BALANCE

Exports —————
Imports ··········
Trade Balance ··········
Adjusted Trade Balance —————

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Chart 7

REAL EXCHANGE RATE CHANGES
EFFECTS ON TEA PRICES AND EARNINGS

——— Importers' real exchange rates
Exporters' real exchange rates
········ World price expressed in US$
Export earnings in US$

Chart 8

REAL EXCHANGE RATE CHANGES
EFFECTS ON RUBBER PRICES AND EARNINGS

——— Importers' real exchange rates
········ Exporters' real exchange rates
········ World price expressed in US$
——— Export earnings in US$

Chart 9

REAL EXCHANGE RATE CHANGES
EFFECTS ON COCONUT PRICES AND EARNINGS
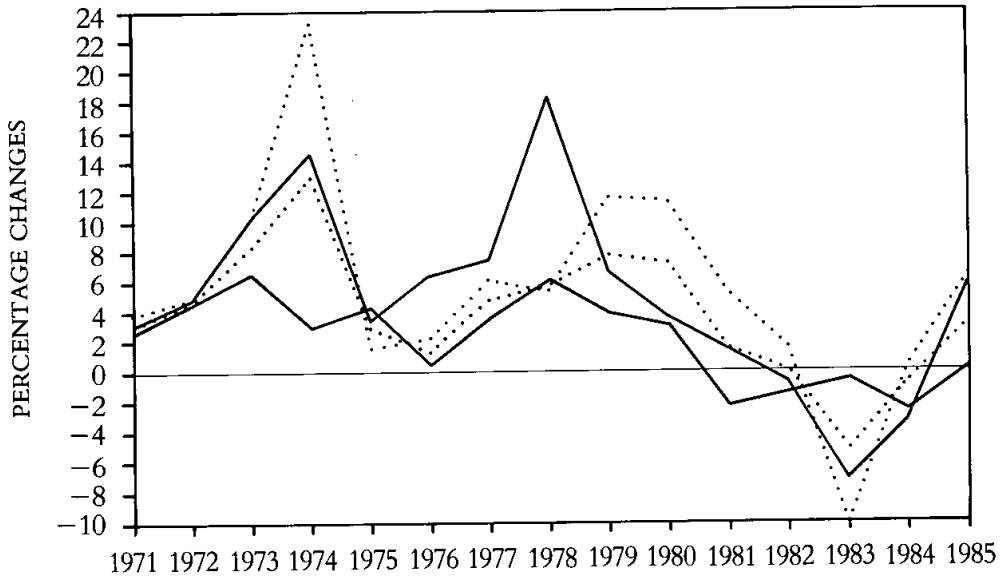
——— Importers' real exchange rates
········ Exporters' real exchange rates
········ World price expressed in US$
——— Export earnings in US$

Chart 10

REAL EXCHANGE RATE CHANGES
EFFECTS ON MANUFACTURING: PRICES AND EARNINGS
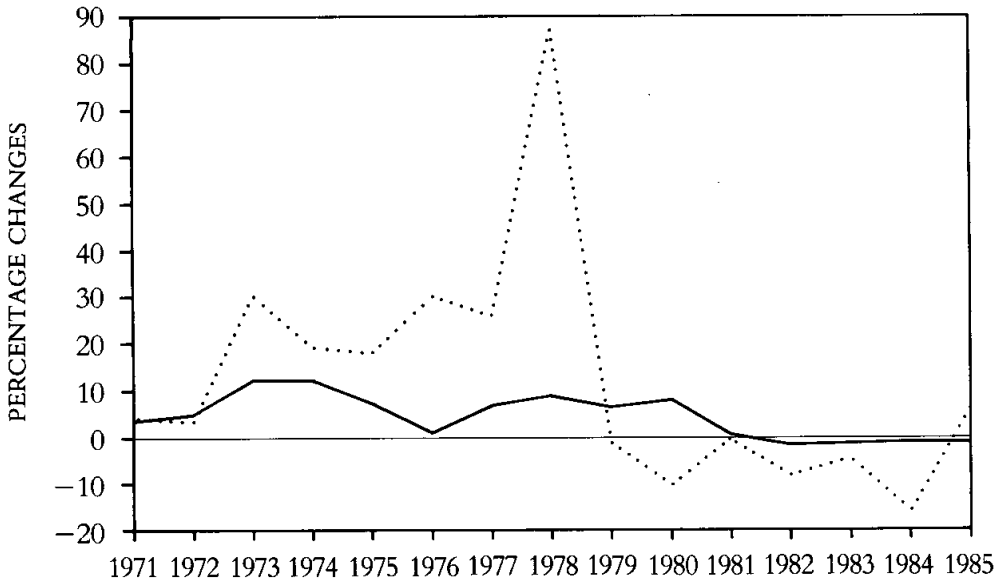
——— World price expressed in US$

········ Export earnings in US$

Chart 11

REAL EXCHANGE RATE CHANGES
EFFECTS ON EXPORT AND IMPORT PRICES
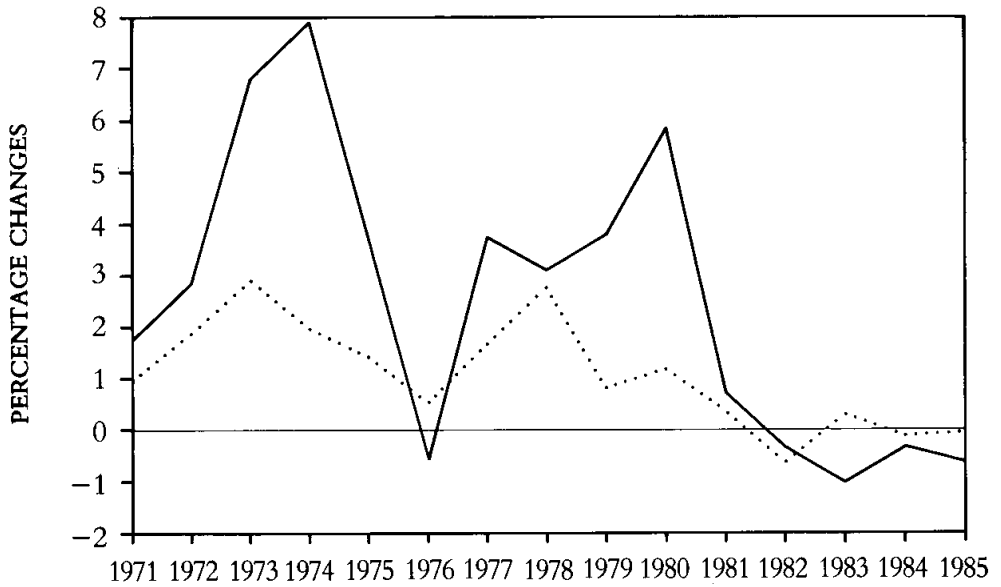
——— Average price of exports expressed in US$

········· Average price of imports expressed in US$

Chart 12

REAL EXCHANGE RATE CHANGES
PIRCE OF IMPORTS

——— Price of imports expressed in US$
·········· Price of imports expressed in Sri Lanka Rupee
·········· Domestic Price
——— Relative price of imports

REAL EXCHANGE RATE CHANGES
EFFECTS ON RELATIVE PRICE OF IMPORTS

——— Price of imports in domestic currency
········· Price of imports relative to the level of
domestic price
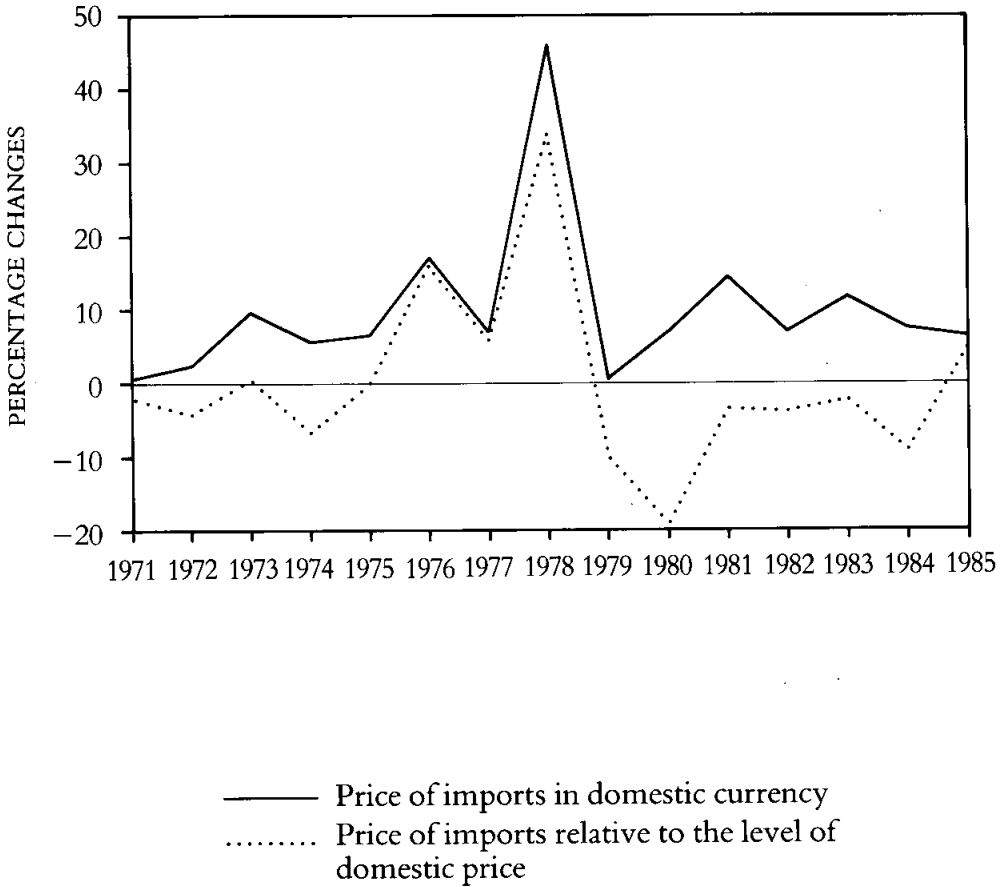
Chart 13

REAL EXCHANGE RATE CHANGES
EFFECTS ON THE TRADE BALANCE
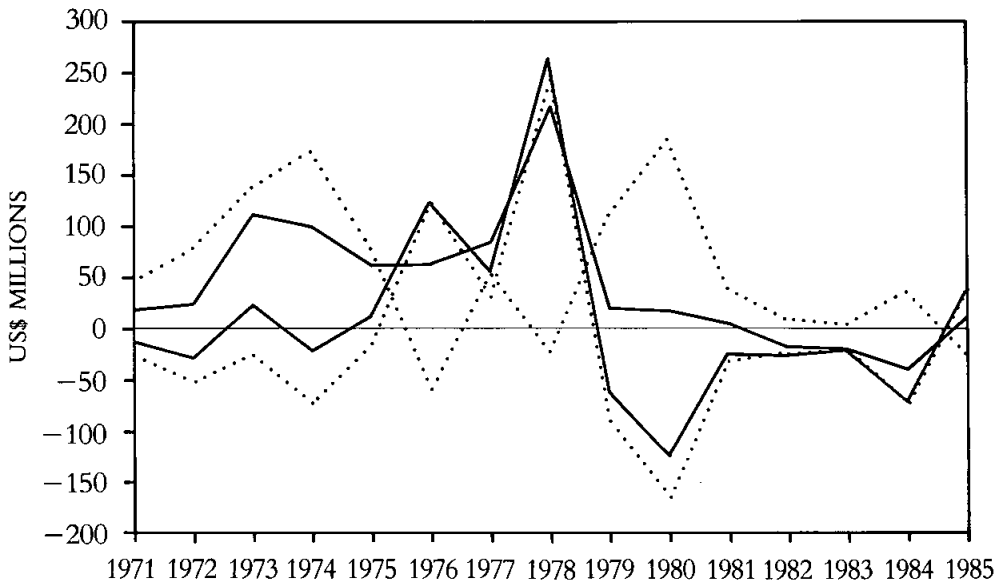
Exports
Imports
Trade Balance
Adjusted Trade Balance

Chart 14

THE WEIGHTS FOR DIFFERENT TYPES OF
EFFECTIVE EXCHANGE RATE INDICES

――――― Trade balance effect weights
·········· Export weights
·········· Import weights
――――― Trade weights

TRADE BALANCE EFFECT WEIGHTS AND
TRADE SHARE WEIGHTS
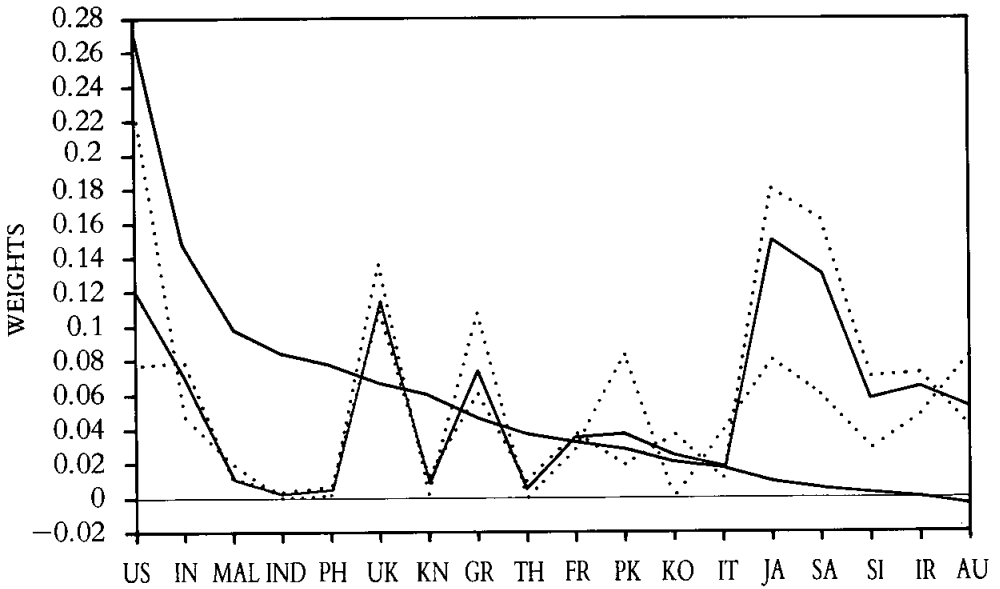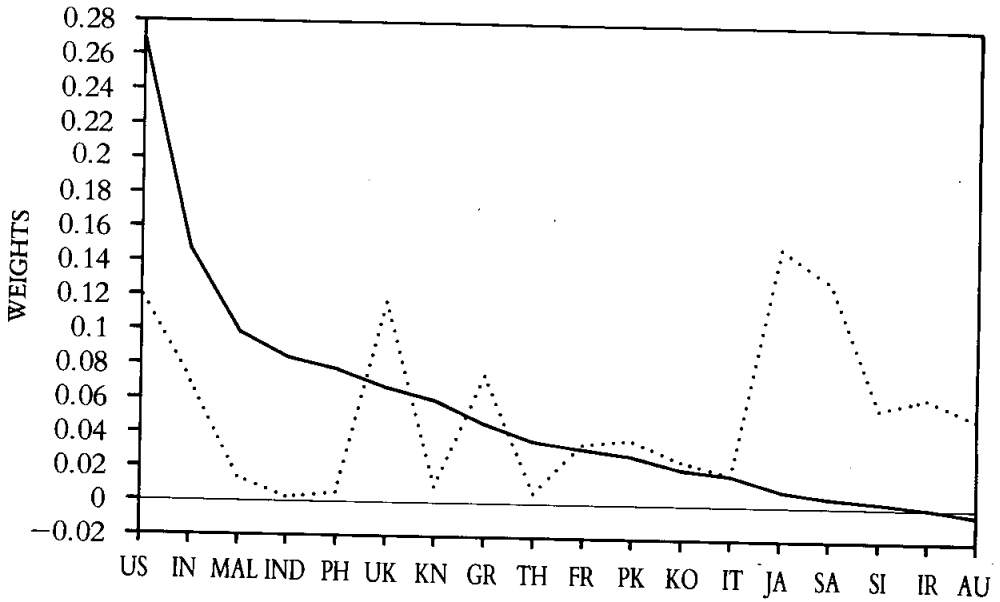
———— Trade balance effect weights

········· Trade weights

Chart 15

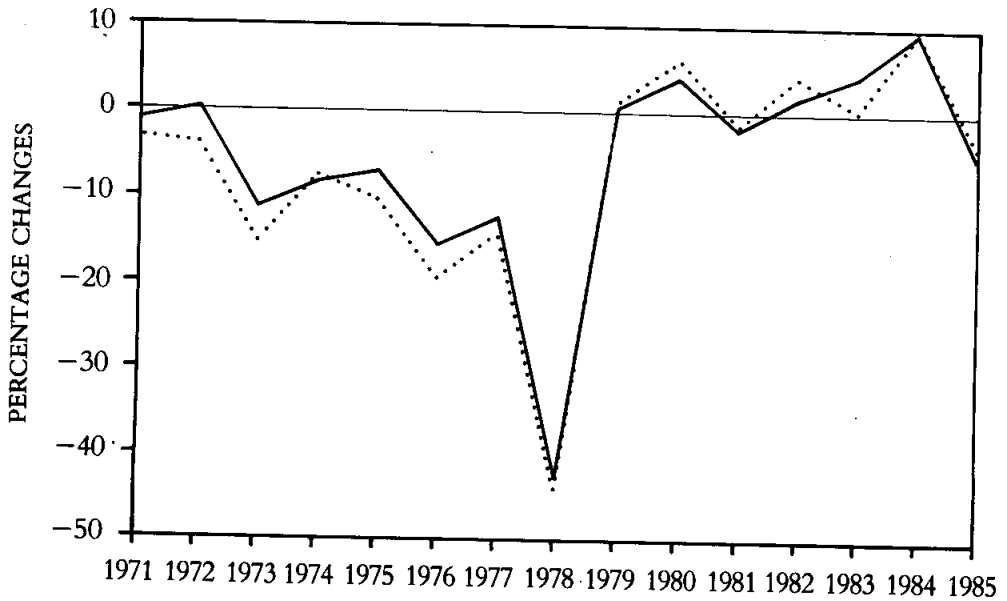## NOMINAL EFFECTIVE EXCHANGE RATE INDICES
SRI LANKA (1980 = 100% CHANGES)

——— Trade balance effect weighted index
········· Export weighted index
········· Import weighted index
——— Trade weighted index
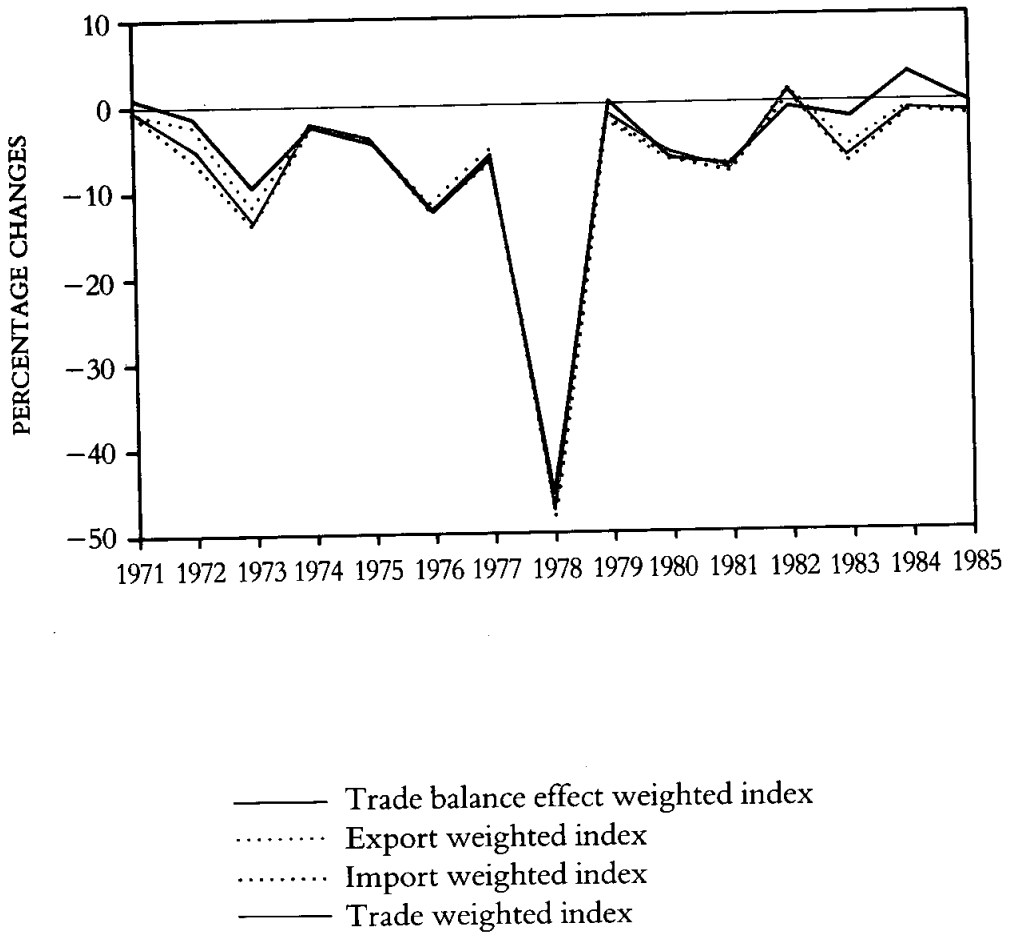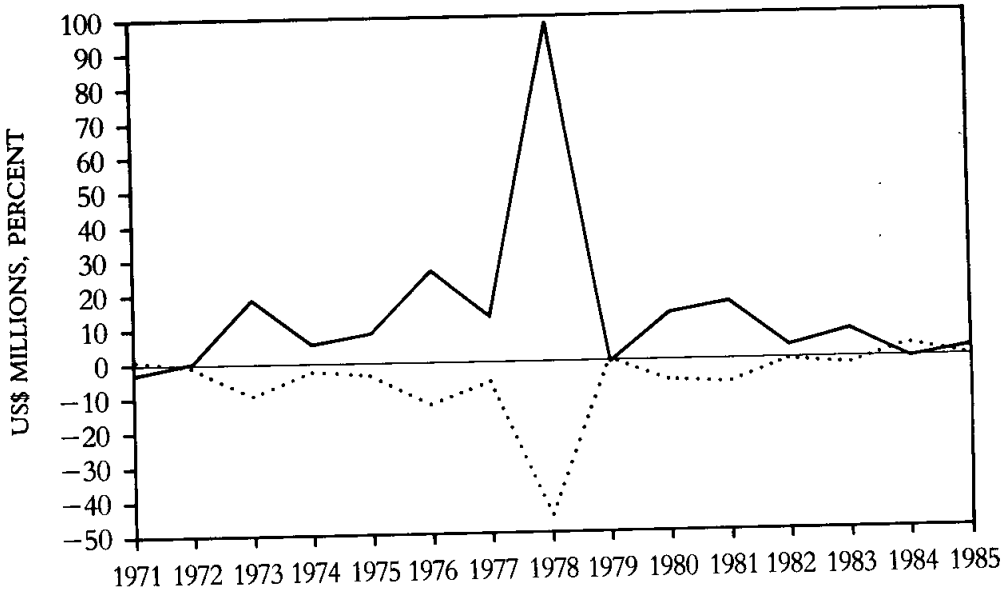
Chart 15a

NOMINAL EFFECTIVE EXCHANGE RATE INDICES
SRI LANKA (1980 = 100% CHANGES)
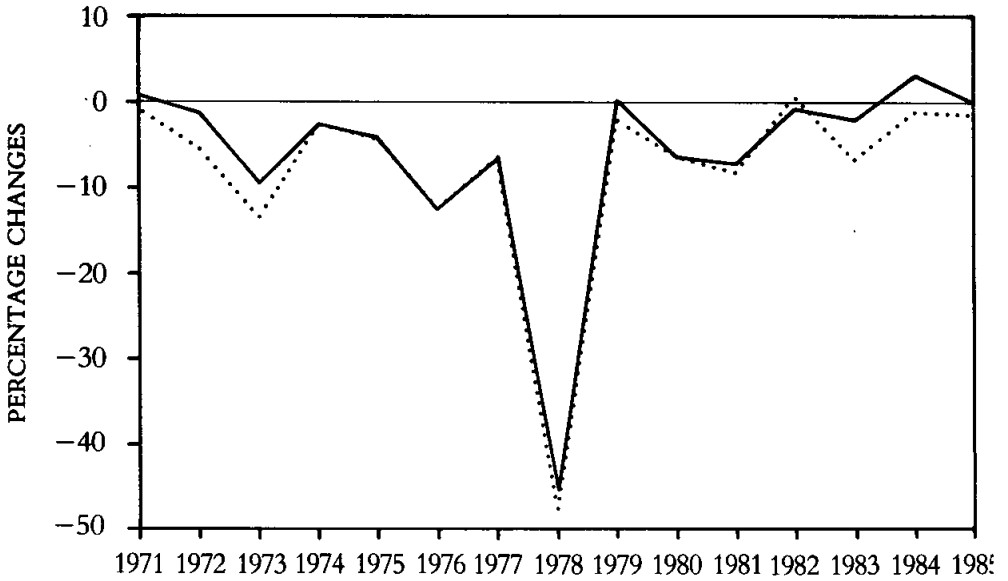
——— Trade balance effect weighted index

········ Trade weighted index

Chart 16

REAL EFFECTIVE EXCHANGE RATE INDICES
SRI LANKA (1980 = 100% CHANGES)
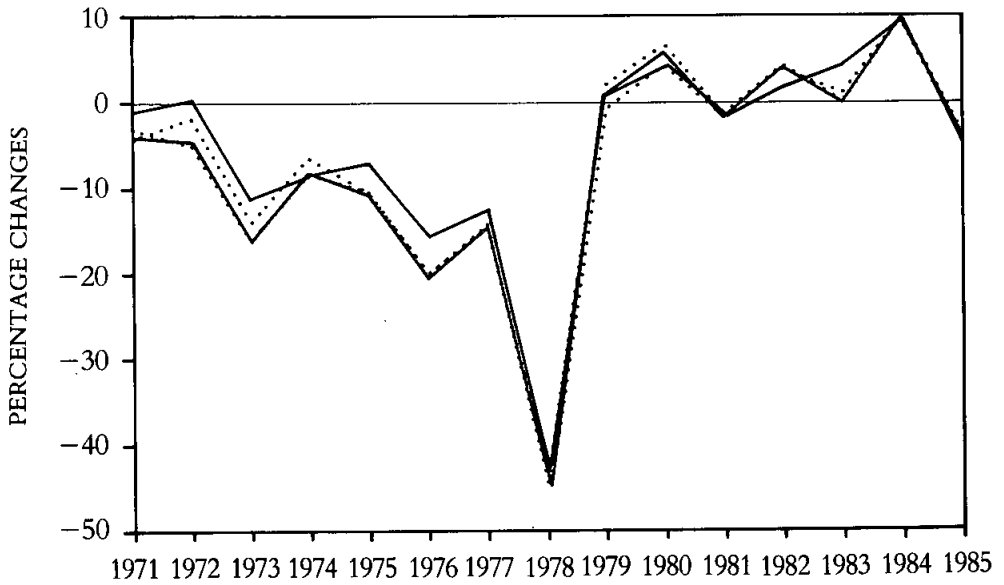
——— Trade balance effect weighted index
········· Export weighted index
········· Import weighted index
——— Trade weighted index

REAL EFFECTIVE EXCHANGE RATE INDICES
SRI LANKA (1980 = 100% CHANGES)

PERCENTAGE CHANGES

——— Trade balance effect weighted index
.... Trade weighted index

Chart 17

TRADE EFFECTS & NEER CHANGES

——— Adjusted trade balance effect

········· Percentage changes in the trade balance effect
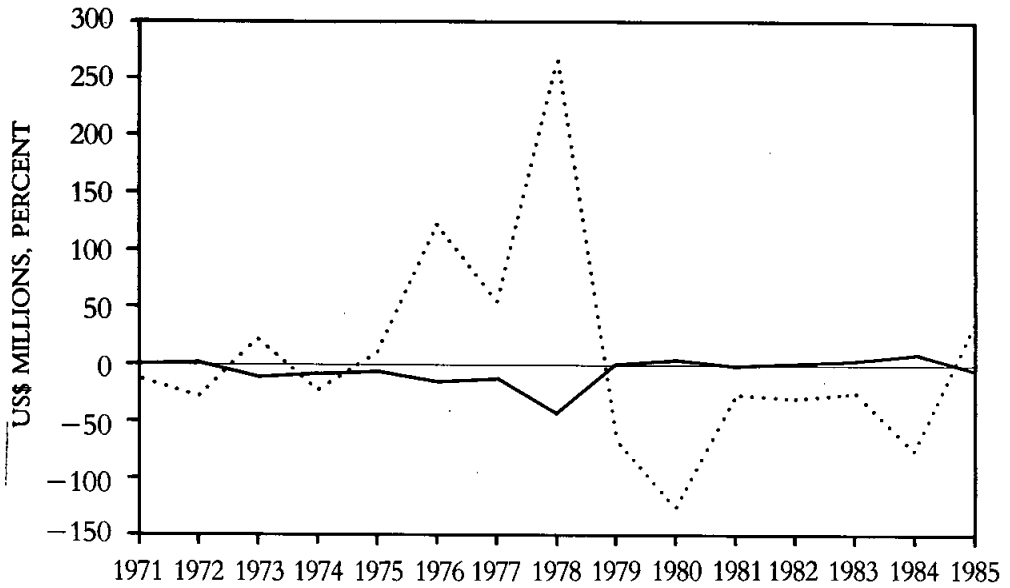weighted Nominal Effective Exchange Rate
(NEER) index

Chart 18

TRADE EFFECTS & REER CHANGES

——— Adjusted trade balance effect

.... Percentage changes in the trade balance effect
weighted Real Effective Exchange Rate
(REER) index