Adjustment of Exchange Rate and its Impact on Sri Lanka's Agriculture under Policy Reforms

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Abstract

This paper empirically evaluates the performance of the Sri Lanka's agricultural sector under policy reforms with respect to the exchange rate implications. Under the policy reforms, the exchange rate reforms made considerable impact on the agriculture exports, input and food imports and economic development. In our analysis which used general equilibrium growth accounting approach, the real contributions of agricultural exports, food imports and fertilizer price reveals that without the exchange rate reform the contributions would have been really detrimental to the agricultural production and economy of Sri Lanka. Therefore, policy reform had a positive effect on Sri Lanka Economy through the exchange rate reform, though it had negative impact on domestic food production sector and related small farmers.

Keywords: Agricultural Sector, General equilibrium growth accounting approach, Exchange rate, Domestic food production sector, Policy reform and Sri Lanka's economy.

JEL Classification: O11, O13, O41, Q18

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1.0 Introduction:

Sri Lanka was one of the first among the developing countries which implemented a far reaching program of economic policy reforms as early as 1977, mainly under the structural adjustment policy packages designed and introduced by the World Bank. Consequently the major economic policy reforms implemented in Sri Lanka includes following aspects such as reduction of protection provided to the import competing sectors, provision of incentives to export oriented sectors, exchange rate adjustments, fiscal and monetary reforms, liberalization of domestic factor and product markets from Government intervention thus allowing free play of market forces and privatization of Government owned enterprises (Central Bank of Sri Lanka Annual Reports, Various Years). Athukorala and Jayasuriya in 1994, Bandara and Gunawardana in 1989 mainly studied the historical process of economic reforms in Sri Lanka, particularly in relation to macroeconomic effects. The impact of such policy reforms on the domestic food sector was not evaluated having understood its importance in terms of contribution to the national income and employment. It is also important to study the relevant periods in which various economic policy packages were implemented.

In 1977 the new government which came to power introduced structural adjustment policy programs to resuscitate the Sri Lankan economy. Agricultural sector also faced with many policy changes under policy reforms through trade policy, fiscal and monetary policies and privatization programs. In this paper, we give more emphasis on agricultural exports as well as food imports and fertilizer price changes in relation to exchange rate reforms. We use General Equilibrium Growth Accounting approach to evaluate the impact of these exogenous variables on endogenous variables and following sections deal with these aspects in detail.

2.0 Macroeconomic Developments in Sri Lanka in relation to Exchange Rate Reforms:

This section describes what actually has been done under the Macroeconomic reforms and the Structural Adjustment Policies (SAP) adopted since 1977. The experience of Sri Lanka may be conveniently understood in terms of periodizing the era in which major policy reform events took place.

During the phase from 1977 to 1978 is considered as the initial sage of these reforms. First the Foreign Exchange Entitlement Certificate (FEEC) scheme was abolished and the exchange rate was unified at a depreciated level. The Convertible Rupee Accounts (CRA), introduced in 1973 to grant import entitlement facilities to non-traditional exporters was withdrawn. Measures were also taken to revise the

export and import duty structure entirely. Quantitative Restrictions and Exchange Control restrictions on most goods and services were also abolished.

During the period of 1979 to 1981, subsidies in wheat flour, fertilizer, milk product and petroleum products were reduced. Sri Lankan currency Rupee was substantially devalued (by 46%) and exchange rate unified. Amendments to the Finance Act were introduced to enable foreign banks operate in Sri Lanka. Universal food subsidies were removed and replaced by a food stamp scheme. An attractive package for Foreign Direct Investment (FDI) including the creation of a Free Trade Zone (FTZ), relaxation of import licensing requirement, and offer of tax holidays was introduced. In response, the IMF gave Sri Lanka and External fund Facility (EFF) for the period 1979 to 1981 to help reduction of unemployment, maintain an average annual rate of GDP growth of 6 %, and to contain inflation.

The process of liberalization was accelerated since 1989. A number of restrictions on imports, travel abroad and foreign education were relaxed. In order to attract foreign capital, restrictions on foreign participation at the Colombo Stock Exchange by foreigners were eased off. Extended facilities were also granted to foreigners for making investment under Board of Investment (BOI). Furthermore, following measures were taken.

- Reduction of the maximum nominal tariff on imports from 100% to 50% and the introduction of a four band tariff.
- Tax reforms to reduce income and corporate taxes and the abolition of wealth and capital gains taxes to stimulate the capital market.
- The progressive elimination of export duties on traditional crops, further devaluation of the rupee and major drive towards export-led growth.
- Further liberalization of the commodity market: prices of certain key commodity (wheat and fertilizer) were aligned with the world market price.
- Liberalization of exchange controls on the current account of the balance of payment and the abolition of the compulsory currency surrender requirements for exports.
- A high interest rate policy to bring the level of inflation to a single digit figure.
- A program of privatization with the objective of reducing the fiscal burden on the Government.

In 1992, the management of state owned plantation sector was put in private hands and attempts were made to restructure the two state owned banks. Following the removal of exchange control restrictions on current account transactions, in March 1994 Sri Lanka accepted Article VIII status of the IMF. Accordingly, Sri Lanka agreed not to impose and restrictions on import and export of goods and services.

The actions described above have been taken in terms of macroeconomic and structural adjustment to which the government committed itself. The two processes are related, but it must be understood that there are important conceptual differences

between them. Macroeconomic reforms aim at stabilization in the short and medium term where as structural adjustment was oriented to the long term adjustment towards opening the market. The former included the aim of rapid restoration of macroeconomic balance through the adoption of policies to reduce both the level and composition of aggregate demand. That is it concentrated on demand reducing and expenditure switching policies. The SAP on the other hand had the long term goals of improving the efficiency and growth rate of the economy including its flexibility and adaptability through liberalization of trade and domestic pricing policies and institutional reform through the structural and sectional adjustment loans.

The principal SAPs included those relating to fiscal, exchange rate, pricing, trade, income, credit, and institutional reforms. The details of these components and the policy tools Sri Lanka's SAPs are briefly reviewed below.

(1) **Fiscal Policies:** A major objective of the stabilization program has been to reduce the budget deficit both via reductions in government spending and increase in tax revenue. Government spending may be cut on recurrent expenditure (e.g. reduction in public sector wages, food subsidies) and public sector investment and lending to the private sector. Its major aim was the reduction of government intervention, the privatization of the economy and the reduction of the size of the public administration.

(2) **Exchange Rate Policies:** Since this was one of the key aspect under the SAP, we analyzed this effect on the Sri Lanka7s agriculture under these policy reforms in this paper. Devaluation of the exchange rate to make the currency realistic was central to the structural adjustment. This measure though could have inflationary impact, but it could also increase the volume of exports. The monetary and fiscal instruments are demand reducing but do not necessarily ensure that simultaneous balance is achieved on both the government budget deficit and the balance of payments. To ensure this additional instruments to change the composition of demand from foreign to domestic goods and to increase incentives for production of exports and or import substituting goods are needed.

(3) **Pricing Policies:** Since the price mechanism was believed to be the best system for the allocation of resources, price controls were removed and the market was allowed to work so that the economy was able to produce all those goods and services for which it had comparative advantage. Price control and subsidies have frequently been used in developing countries both to stabilize the markets and to achieve income support for the poorer groups in the society. From the point of view of WB and IMF, they regarded these as a major domestic distortion and source of economic rigidity. Dismantling of agricultural input subsidies and food subsidies were therefore recommended.

(4) **Trade Policies:** Under this, the external trade liberalization aimed to improve resource allocation, reducing protection for some commodities due to comparative advantage and to increase aggregate supply eliminating inflationary pressures.

(5) **Income Policies:** Wage control was one of the most important measures of stabilization policies but it was also used in the SAPs too. The objective was to reduce the domestic demand (consumption) so the pressure on the demand side will decrease. This was considered to eliminate the cost push on production costs so that there would be less inflation.

(6) **Credit Policies (Financial Liberalization):** IMF had two main instruments such as credit ceilings and higher interest rates. The objectives were to reduce inflation, to increase real savings, and to rationalize the use of domestic credit/savings. These measures could also bring negative impacts such as inflation associated with high interest rates. Hence lifting interest rate controls was suggested to increase savings and improve resource allocation and more investments.

(7) **Institutional Reforms:** In order to get the positive impact of the SAP, through supply response, non-price measures should be combines with the trade and domestic pricing reforms. Under this, in addition to the pricing policies, varying degrees of institutional reforms and privatization programs were considered. This included institutional reforms on infrastructure development, stimulation of technological innovation (in agriculture) and extension services. It also included the privatization of state owned estate sector.

These policy reforms, in terms of positive relationship among above mentioned variables, aimed economic growth. Though theoretically it may be correct, we intended to analyze the impact of this on Sri Lanka's agriculture sector. Here we used the agriculture production, food consumption, GDP growth and agriculture input variables as proxies to see the exchange rate effect on these. The following sections deal with the model description and empirical results and their interpretation.

3.0 Performance of Major Exogenous and Endogenous Variables of the study in Sri Lankan Context

In this paper we have mainly considered the exogenous variables of agricultural exports, food imports, fertilizer price and agriculture and non-agriculture technical changes and used them as the principle variables to see the impact of the policy. Agriculture exports really changed under the policy reforms in Sri Lanka and considered to be the engine of foreign exchange earning. The policy reforms also

addressed this issue. Food imports become open under the policy reforms and its impact is also widely felt by the domestic food sector. Further, fertilizer continued to play an important role under the reforms. Gradually the subsidies were removed and surprisingly the usage and the price increase were always increasing. So this impact is found to be imperative to monitor. Agriculture and Non-agriculture technical changes contributed to the push-pull effect of agriculture development. So in this paper we tried to see this impact on the agriculture sector using the exogenous variables in relation to the exchange rate variable. Following Table shows the trend of major exogenous and endogenous variables in relation to exchange rate variable.

Table 1: Change of Exogenous and Endogenous variables

Endogenous Variable	(I) 1970-1974	(II) 1975-1979	(III) 1980-1984	(IV) 1985-1989	(V) 1990-1996
GR(X1)	0.43	2.26	- 0.53	- 4.93	- 1.11
GR(X2)	4.02	8.72	2.89	- 0.92	10.45
GR(X3)	3.76	6.89	1.12	0.78	8.73
GR(XA)	2.52	14.15	0.45	- 2.31	7.35
GR(Cf)	1.35	4.23	- 4.01	5.87	2.45
GR(P1)	- 11.61	1.66	17.79	- 2.51	- 40.93
GR(P2)	12.01	14.24	30.72	4.26	32.61
GR(P3)	10.92	20.67	22.34	9.45	27.52
GR(GDP)	2.92	6.29	0.61	1.82	3.63
Exogenous Variable	**(I) 1970-1974**	**(II) 1975-1979**	**(III) 1980-1984**	**(IV) 1985-1989**	**(V) 1990-1996**
(1) GR(E1)	0.31	26.94	0.09	- 7.38	- 2.41
(2) GR(M2)	- 11.68	- 6.94	- 25.89	10.76	- 1.87
(3) GR(PF)	5.73	- 3.43	16.78	10.43	- 3.62
GR(PN)	16.63	12.98	27.11	16.65	20.34
(4) GR(TA)	0.16	4.23	- 0.44	- 3.40	5.30
(5) GR(TN)	0.36	- 0.25	- 0.06	0.28	2.00
Devaluation Variable	**(I) 1970-1974**	**(II) 1975-1979**	**(III) 1980-1984**	**(IV) 1985-1989**	**(V) 1990-1996**
(6) GR(ER)	2.86	21.32	10.38	7.27	6.37
(1)-(6) GRE1'	- 2.55	5.62	- 10.29	- 14.65	- 8.78
(2)+(6) GR(M2')	- 8.82	14.38	- 15.51	18.03	4.50
(3)-(6) GR(PF')	2.87	- 24.75	6.40	3.16	- 9.99

Note: The analysis and results in this paper are based on these highlighted variables

These trends quite clearly show the structure of the economy and its performance. The ethnic conflict in 1983 and also the internal unrest in 1987 and 1988 also contributed to the decreasing trend of exports and food imports. Further the devaluation of the local currency under policy reforms also contributed to increase agriculture exports.

With this brief introduction of policy reforms scenario, we used the following analytical framework to evaluate the major impacts of this reform on agriculture sector.

4.0 Empirical Framework and Structure:

In our analytical framework, the following assumptions are made. First, we assume that agriculture will produce three products (or sectors) such as exportable (sector 1), import substitute (sector 2) and the final one is both domestically produced and consumed (sector 3). Second, we assume that aggregate agricultural production will depend on factors that are fixed in the short term such as land and capital as well as variable factors such as labor and imported input fertilizer. Here the fertilizer price which is considered as an important policy actor in this study, is given for agriculture and will change under adjustment. Third, we also assume that another important policy actor, the price of the nonagricultural sector will be determined by factors largely outside agriculture in order to see the effect of it on endogenous variables.

In our model, three sub-sectors model with GRM approach is used to find the major policy effects[3]. Here the economy was assumed to be of two sectors such as agriculture and non-agriculture. In order to evaluate the impact of plantation sector, the agricultural sector has been further divided into three sub-sectors. The basic framework of the model was developed using the initial work done by Sarris in 1990. In our static model, we have 23 equations which include agricultural and nonagricultural 2 production functions, 3 consumption functions, equations for income and equations for labor allocation in both sectors[4].

Here, we start to explain our model which is a wide extension of Sarris model. The Aggregate production function for agriculture will be of the form

$$X_A = T_A L_A^a X_F^b \qquad a,b>0 \quad a+b<1 \tag{A-1}$$

The aggregate supply of agriculture will be given by maximization of agricultural value added V_A

$$\text{Max } V_A = P_A X_A - P_F X_F \tag{A-2}$$

The solution for the demand of fertilizer X_F is given by equation (3)

$$X_F = (T_A L_A^a)^{1/1-b} (P_A / P_F)^{1/1-b} b^{1/1-b} \tag{A-3}$$

The aggregate agricultural supply is given by equation (4)

$$X_A = (T_A L_A^a)^{1/1-b} (P_A / P_F)^{b/1-b} b^{b/1-b} \tag{A-4}$$

Hence the Agricultural value added is given by equation (A-5)

$$V_A = (T_A L_A^a)^{1/1-b} P_A^{1/1-b} P_F^{(1-b)/b} (1-b) b^{1/1-b} \tag{A-5}$$

We assume that the agricultural sector produces three products. In order to allocate X_A, let us specify X_A as CET[5] index of the quantities X_1, X_2 and X_3 of the three

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[3] For the detailed information about the model variable please see discussion paper 0407 of Yamaguchi, M and SriGowri Sanker (2004).

[4] Please see the discussion paper 0407, Yamaguchi and SriGowri Sanker for full description of the model, the variables and their effects.

[5] For further analysis on CET function, refer Powell and Gruen, 1968.

produced products.

$$X_A = (\sum_{i=1}^{3} \alpha_i^{-\tau} X_i^{(1-\tau)/\tau})^{\tau/(1-\tau)} \quad \text{(A-6)}$$

where τ is the positive elasticity of transformation and α_i are positive parameters. Given the prices P_i of three agricultural sub-sectors, allocation of X_A to the three sectors is done by maximizing the total value of agricultural output.

$$\text{Max} \sum_{i=1}^{3} P_i X_i \quad \text{(A-7)}$$

The above maximization yields the following allocation functions.

$$X_i = \alpha_i^{-\tau} X_A (P_i / P_A)^{\tau} \qquad i = 1,2,3 \quad \text{(A-8)}$$

where the price index P_A turns out to be the following

$$P_A = (\sum_{i=1}^{3} \alpha_i^{-\tau} P_i^{1+\tau})^{1/(1+\tau)} \quad \text{(A-9)}$$

The supply utilization accounts (namely the commodity balance equations) for the three agricultural products are given as follows.

$$X_1 = E_1 + C_1 \quad \text{(A-10)}$$

$$X_2 + M_2 = C_2 \quad \text{(A-11)}$$

$$X_3 = C_3 \quad \text{(A-12)}$$

where E_1 denotes the exports of agricultural sector 1 and some percentages (C_1) are consumed locally. M_2 denotes the imports of basic cereals that are perfect or near perfect substitutes for locally produced cereals. C_2 and C_3 denote the quantities of the two different types of food that are demanded domestically. The equations (A-10), (A-11) and (A-12) are the equilibrium relations in the model.

We define an index of a consumed commodity to be called food that a CES function of the quantities of the two domestically consumed agricultural food products.

$$C_f = (\beta_2 C_2^{(\sigma-1)/\sigma} + \beta_3 C_3^{(\sigma-1)/\sigma})^{\sigma/(\sigma-1)} \quad \text{(A-13)}$$

where σ is the elasticity of substitution β_i are positive parameters. $i = 2, 3$

Given C_f the quantities of C_2 and C_3 will be found as if consumers act by minimizing the cost of purchasing the given quantity.

$$\text{Min } (P_2 C_2 + P_3 C_3) \quad \text{(A-14)}$$

Based on equations (A-13) and (A-14), the allocation functions will be as follows.

$$C_i = C_f \beta_i^{\sigma} (P_i / P_f)^{-\sigma} \qquad i = 2,3 \quad \text{(A-15)}$$

where P_f is the domestic food price index and given as follows.

$$P_f = (\sum_{i=2}^{3} \beta_i^{\sigma} P_i^{1-\sigma})^{1/(1-\sigma)} \qquad \text{(A-16)}$$

The quantity of total domestically consumed food C_f is found as a function of domestic income, and the prices of food and non-food products.

$$C_f = f(N,\ Y,\ P_f,\ P_N) = eN(Y/P_N)^{\eta}(P_f/P_N)^{-\varepsilon} \quad (e\text{: demand shifter}) \qquad \text{(A-17)}$$

Y is the domestic nominal income and the sources of this are from both agriculture and non-agriculture and given as follows.

$$Y = (P_A X_A - P_F X_F) + P_N X_N \Rightarrow Y = V_A + P_N X_N \qquad \text{(A-18)}$$

Please note that from (A-17) & (A-18) that we have abstracted from the savings behavior of income earners as well as taxation. This is done for simplicity and to focus on the agricultural sector only. The assumption on supply side link between agriculture and non-agriculture is that the available agricultural labor L_A is a negative function of the quantity of non-agricultural production.

$$L_A = g(T_A,\ T_N,\ L) = L_{A0} T_A^{\gamma_1} T_N^{\gamma_2} L^{\gamma_3} \quad \gamma_1, \gamma_2 < 0 \quad \gamma_3 > 0 \qquad \text{(A-19)}^6$$

$$L = L_A + L_N \qquad \text{(A-20)}$$

$$X_N = T_N L_N^{\xi} \qquad \text{(A-21)}$$

$$C_1 = dNP^{\eta}E^{\eta} \qquad (d\text{: demand shifter}) \qquad \text{(A-22)}$$

$$E = GDP / N \qquad \text{(A-23)}$$

Equation (A-19) comes from the push effect of agricultural technical change and the pull effect of nonagricultural technical change (Yamaguchi and Kennedy (1984)). Equation (A-20) is the equation of sectoral allocation of labor, and equation (A-21) is the production function of nonagricultural sector. Equation (A-22) is the domestic demand function of exportable goods. Finally, Equation (A-23) is the definition of per capita income.

From these 23 equations, we obtained the dynamic model which is reduced to 21

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6 This equation (A-19) comes from our earlier papers (Yamaguchi (1982), Yamaguchi and Binswanger (1975), Yamaguchi and Kennedy (1984)). These papers show the effect of several exogenous variables such as T_A, T_N, L, K, Q, and others on 8 endogenous variables (L_A is one of them). Here the reduced form $L_A = L_{A0} T_A^{\gamma_1} T_N^{\gamma_2} L^{\alpha} K^{\beta} Q^{\delta}$ could be derived from the original model and from there we picked up only T_A, T_N, and L for this study. Further, we have the condition that the marginal product of labor in both sectors is equal to the wage rate and the marginal product of capital in both sectors is equal to the interest rate as shown in above three papers. Equation (A-19) comes from these models which includes labor and capital markets.

equations as shown in Table 2. Here the model uses the General Equilibrium Growth Accounting Approaches[7] to find the impact of 11 exogenous variables on 21 endogenous variables.

Table 2: Dynamic Matrix form of the Model

	X1	X2	X3	XA	C1	C2	C3	Cf	P1	P2	P3	Pf	PA	CPI	DEF	LA	Y	GDP	E	XN	LN			
(1)	1	0	0	0	$-s_1$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$\hat{X}_1$	=	$(1-s_1)\hat{E}_1$
(2)	0	s_2	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$\hat{X}_2$		$(s_2-1)\hat{M}_2$
(3)	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	$\hat{X}_3$		0
(4)	0	0	0	0	0	0	0	0	ν_1	ν_2	ν_3	0	-1	0	0	0	0	0	0	0	0	$\hat{X}_A$		0
(5)	0	0	0	0	1	0	0	0	n	0	0	0	0	0	0	0	0	0	$-q$	0	0	$\hat{C}_1$		$\hat{d} + \hat{N}$
(6)	0	0	0	-1	0	0	0	0	0	0	0	0	$b/(1-b)$	0	0	$a/(1-b)$	0	0	0	0	0	$\hat{C}_2$		$\frac{1}{b-1}\hat{T}_A + \frac{b}{1-b}\hat{P}_F$
(7)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	$\hat{C}_3$		$\gamma_1\hat{T}_A+\gamma_2\hat{T}_N+\gamma_3\hat{L}+\hat{L}_{A0}$
(8)	0	0	0	0	0	1	0	-1	0	σ	0	$-\sigma$	0	0	0	0	0	0	0	0	0	$\hat{C}_f$		0
(9)	0	0	0	0	0	0	1	-1	0	0	σ	$-\sigma$	0	0	0	0	0	0	0	0	0	$\hat{P}_1$		0
(10)	0	0	0	0	0	0	0	0	0	λ_2	$1-\lambda_2$	-1	0	0	0	0	0	0	0	0	0	$\hat{P}_2$		0
(11)	0	0	0	0	0	0	0	-1	0	0	0	$-\varepsilon$	0	0	0	0	η	0	0	0	0	$\hat{P}_3$		$\eta\hat{P}_N-\varepsilon\hat{P}_N-\hat{e}-\hat{N}$
(12)	0	0	0	0	0	0	0	0	0	0	0	0	$\mu_A/(1-b)$	0	0	$a\mu_A/(1-b)$	-1	0	0	$1-\mu_A$	0	$\hat{P}_f$		$\frac{\mu_A}{b-1}\hat{T}_A+\frac{b\mu_A}{1-b}\hat{P}_F+(\mu_A-1)\hat{P}_N$
(13)	0	0	0	0	0	0	0	0	0	0	0	ν_f	0	-1	0	0	0	0	0	0	0	$\hat{P}_A$		$(\nu_f-1)\hat{P}_N$
(14)	0	0	0	0	0	0	0	0	0	0	0	0	μ_A	0	-1	0	0	0	0	0	0	$\hat{CPI}$		$(\mu_A-1)\hat{P}_N$
(15)	0	0	0	0	0	0	0	0	0	0	0	0	$b\mu_A/(1-b)$	0	0	$a\mu_A/(1-b)$	0	-1	0	$1-\mu_A$	0	$\hat{DEF}$		$\frac{\mu_A}{b-1}\hat{T}_A+\frac{b\mu_A}{1-b}\hat{P}_F$
(16)	-1	0	0	1	0	0	0	0	τ	0	0	0	$-\tau$	0	0	0	0	0	0	0	0	$\hat{L}_A$		0
(17)	0	-1	0	1	0	0	0	0	0	τ	0	0	$-\tau$	0	0	0	0	0	0	0	0	$\hat{Y}$		0
(18)	0	0	-1	1	0	0	0	0	0	0	τ	0	$-\tau$	0	0	0	0	0	0	0	0	$\hat{GDP}$		0
(19)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-1	0	0	$\hat{E}$		$\hat{N}$
(20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	$-\xi$	$\hat{X}_N$		$\hat{T}_N$
(21)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	l_A	0	0	0	0	l_N	$\hat{L}_N$		$\hat{L}$

[**Note:** Equation (1) ($\hat{X}_1 = (1-S_1)\hat{E}_1 + S_1\hat{C}_1$ (where $S_1=X_1/C_1$)) in Matrix A in Table 2 came from equation (A-10) above. Equation (2) came from equation (A-11) above where $S_2=X_2/C_2$. Equation (3) came from from equation (A-12). Equation (4) came from equations (A-8) and (A-9) where $\upsilon_i = P_1X_1/(P_1X_1+P_2X_2+P_3X_3)$. Equation (5) came from equation (A-22). Equation (6) came from equation (A-4). Equation (7) came from equation (A-19). Equation (8) came from equation (A-15). Equation (9) came from equation (A-15). Equation (10) came from equations (A-13 and A-16), where,

$\lambda_2= P_2X_2/(P_2C_2+P_3C_3)$. Equation (11) came from equation (A-17). Equation (12) came from equations (A-5) and (A-18), where μ_A = share of agriculture in GDP. Equation (13) and (14) came from definitions. Equation (15) came from equations (6) and (20) in Table 2.

[7] Papers among these studies are Yamaguchi and Binswanger (1975), Yamaguchi (1982) & Yamaguchi and Kennedy (1983).

Equation (16), (17) and (18) came from equation (A-8). Equation (19) came from equation (A-23). Equation (20) came from equation (A-21). Equation (21) came from equation (A-20) where $l_A=L_A/L$, $l_N=L_N/L$.]

In the dynamic model, it has the general form $Ax=b$ where A is a matrix of order (21 X 21) of structural parameters, x is the column vector of rates of change of 21 endogenous variables ($X_1, X_2, X_3, X_A, C_1, C_2, C_3, C_f, P_1, P_2, P_3, P_f, P_A, CPI, DEF, L_A, Y, GDP, E, X_N, L_N$) and b is the column vector of rates of change of 11 exogenous variables (E_1, M_2, d, e, T_A, T_N, P_F, P_N, L, N , L_{A0})[8]. Please see the following portion for details of the variables.

Endogenous Variables (21 variables):

X_i :Agricultural output of sector i, where i =1, 2, 3

X_A : Aggregate output of agricultural sector (sector 1, sector 2, and sector 3).

C_1 : Domestic Consumption of sector 1.

C_2 : Domestic Consumption of sector 2.

C_3 : Domestic Consumption of sector 3.

C_f : Food consumption from sectors 2 and 3.

Pi : Agricultural prices of three sub-sectors, where i = 1,2, 3

P_f : Price of food consumption (sectors 2 and 3).

P_A : Agricultural price.

CPI : Consumer Price Index.

DEF : Deflator.

L_A : Total agricultural labor force.

Y : Nominal GDP

GDP: Real GDP

E : Per capita income

X_N : Non-agricultural output.

L_N : Non-agricultural labor force.

Exogenous Variable (11 variables):

E_1: Exports of agricultural sector 1

M_2: Food imports such as basic cereals that are perfect or near perfect substitutes.

d : Demand shifter of consumption (sector 1).

e : Demand shifter of consumption (food, sectors 2 and 3).

T_A : Technical change in agriculture

[8] Detail description of the exogenous and endogenous variable could be seen from the Discussion paper 0407 of Yamaguchi, M and SriGowri Sanker, M.S.

T_N : Technical change in non-agriculture.

P_F : Fertilizer price.

P_N : Non-agricultural price.

L : Total labor.

N : Population

L_{A0} : Initial value of agricultural labor.

The inverse of A displays the ***Growth Rate Multipliers*** (***GRM***)[9]. As an example, $(A^{-1})_{8,2}$ element is $\partial \hat{C}_f \big/ \partial \hat{M}_2$ (We write this as C_fM_2) which indicates by how much the rate of change of aggregate consumption of food C_f changes (effects) due to an increase or decrease in the growth rate of import substitute M_2. Similarly we could attribute to other exogenous variables. As said earlier, GRMs are obtained by calculating the inverse of above matrix of structural parameters.

Further these GRMs will be used to find out influence of the exogenous variables on endogenous. In addition the contribution of exogenous variables to the endogenous ones could be calculated by multiplying the GRM of each year interval by the corresponding rates of change of the exogenous variables. For example, $CX_1M_2 = (\frac{\partial \hat{X}_1}{\partial \hat{M}_2})\hat{M}_2$, where CX_1M_2 is the contribution of the agricultural food imports M_2 to the agricultural production for exports X_1, and $(\frac{\partial \hat{X}_1}{\partial \hat{M}_2})$ $=(X_1M_2)$ is the relevant GRM which shows how many percentage (%) of X_1 would increase when M_2 increases by 1%. As our attention here is focused on the exchange rate impact, only these major results which are influenced by the exchange rate reform are discussed here.

So far, we treated E_1 and M_2 as exogenous variables in order to see the effect of E_1, M_2 and P_F on 21 endogenous variables. This comes from the fact that the elimination of the external disparity was the primary focus of adjustment and we wanted to see the effect of E_1, M_2 and P_F (not E_1', M_2' and P_F') in this paper. Therefore what we have to do is to see the effect of SAP on E_1, M_2 and P_F in order to observe the overall effect of SAP, and we try to treat them as if they were endogenous variables for SAP. In order to see the effect of exchange rate, we define $GR(E_1')$, $GR(M_2')$ and $GR(P_F')$as follows:

[9] For further details of the application of GRM, see Yamaguchi (1982), Yamaguchi and Kennedy (1984), Yamaguchi and Binswanger(1975) .

$GR(E_1')=GR(E_1)-GR(ER)$,

$GR(M_2')=GR(M_2)+GR(ER)$,

$GR(P_F')=GR(P_F)-GR(ER)$.

Here, $GR(E_1')$ is the growth rate of a real export which is obtained by subtracting the growth rate of the devaluation of Rupee ($GR(ER)$) from the growth rate of E_1 ($GR(E_1)$). Therefore, E_1' shows how much is the growth rate of exportable goods in case that we remove the effect of devaluation of Rupee. Similarly, we get the results for Fertilizer Price P_F' after subtracting the devaluation effect. Results for Food imports M_2' are obtained by adding the effect of the devaluation of Sri Lankan currency, *Rupee*.

5.0 Empirical Results and Discussion on Results

Contribution of Real E_1 (E_1'), Real M_2 (M_2'), and Real P_F (P_F') to X_A, C_I and GDP and Exchange rate effect:

So far, we treated E_1, M_2 and P_F as exogenous variables in order to see the effect of E_1 M_2 and P_F on 21 endogenous variables. This comes from the fact that the elimination of the external disparity was the primary focus of the policy reform in Sri Lanka and we did comprehensive analysis to see these effects in our previous studies. Since the exchange rate was one of the primary factors that played a crucial role under the policy reform through devaluation of local currency, it is of paramount importance to see the effect of contribution of devaluation (exchange rate effect) on the target variables. Hence the following analysis focuses only on the performance of exchange rate and its contribution on policy variables and the effect on the target variables. In order to see the effect of exchange rate, we define $GR(E_1')$, $GR(M_2')$ and $GR(P_F')$ as follows: $GR(E_1')=GR(E_1)-GR(ER)$, $GR(M_2')=GR(M_2)+GR(ER)$ and $GR(P_F')=GR(P_F)-GR(ER)$. Here, $GR(E_1')$ is the growth rate of a real export which is obtained by subtracting the growth rate of the devaluation of Rupee ($GR(ER)$) from the growth rate of E_1 ($GR(E_1)$), $GR(M_2')$ is the growth rate of real food imports which is obtained by adding the growth rate of the devaluation of Rupee ($GR(ER)$) to the growth rate of M_2 ($GR(M_2)$), and $GR(P_F')$ is the growth rate of real fertilizer price which is obtained by subtracting the growth rate of the devaluation of Rupee ($GR(ER)$) from the growth rate of P_F ($GR(P_F)$). Therefore, E_1' shows how much is the growth rate of exportable goods in case that we remove the effect of devaluation of Rupee. Similarly we can understand the other real variables mentioned here. Table 1

above shows how to calculate the values of E_1', M_2' and P_F'.

The following Table 3 shows the comparative version of growth rates of E_1', M_2' and P_F' with E_1, M_2 and P_F and their contributions, removing the exchange rate effect, to X_A, C_f and GDP.

Table 3: The growth rate of real export (E_1'), real food import (M_2) and real fertilizer price (P_F') and their contributions to X_A, C_f, and GDP

Year	GR(E1')	GR(M2')	GR (PF')	CXAE1'	CXAM2'	CXAPF'	CCfE1'	CCfM2'	CCfPF'	CGDPE1'	CGDPM2'	CGDPPF'
	GR(E1)	GR(M2)	GR (PF)	CXAE1	CXAM2	CXAPF	CCfE1	CCfM2	CCfPF	CGDPE1	CGDPM2	CGDPPF
I 1970-74	- 2.55	- 8.82	2.87	- 0.82	0.00	- 0.17	0.05	- 1.50	- 0.24	- 0.23	0.00	- 0.05
	(0.31)	(- 11.68)	(5.73)	(0.10)	(0.04)	(- 0.35)	(- 0.01)	(- 1.98)	(- 0.47)	(0.03)	(0.01)	(- 0.10)
II 1975-79	5.62	14.38	- 24.75	2.92	- 0.14	1.31	0.84	2.01	2.32	0.84	0.00	0.39
	(26.94)	(- 6.94)	(- 3.43)	(13.89)	(0.05)	(0.18)	(3.94)	(- 0.99)	(0.32)	(4.10)	(0.01)	(0.05)
III 1980-84	- 10.29	- 15.51	6.40	- 5.35	0.31	- 0.40	- 2.26	- 1.85	- 0.59	- 1.44	0.00	- 0.11
	(0.09)	(- 25.89)	(16.78)	(0.05)	(0.40)	(- 1.06)	(0.02)	(- 4.75)	(- 1.54)	(0.01)	(0.11)	(- 0.29)
IV 1985-89	- 14.65	18.03	3.16	- 6.45	- 0.72	- 0.29	- 2.34	7.03	- 0.24	- 1.76	- 0.18	- 0.08
	(- 7.38)	(10.76)	(10.43)	(- 3.28)	(- 0.48)	(- 0.95)	(- 1.17)	(4.22)	(- 0.80)	(- 0.88)	(- 0.13)	(- 0.26)
V 1990-96	- 8.78	4.50	- 9.99	- 3.42	- 0.50	1.18	- 0.70	3.02	0.45	- 0.88	- 0.14	0.28
	(- 2.41)	(- 1.87)	(- 3.62)	(- 1.13)	(0.22)	(0.43)	(- 0.23)	(- 1.35)	(0.16)	(- 0.28)	(0.05)	0.10

Accordingly, the growth rate of E_1' was positive only in IInd period. This is very different from the growth rate of E_1 because E_1 was positive in three periods (Ist, IInd and IIIrd). On the other hand, the values of M_2' increased fairly much as compared with that of M_2. The growth rates of M_2' were positive in IInd, IVth and Vth periods (Growth rate of M_2 was positive only in IVth period). Further the growth rates of P_F' were positive in the Ist, IIIrd and IVth periods and negative in the IInd and Vth periods. Therefore, we can understand that the growth rate of export decreased and that of import increased fairly much in case that we removed the effect of devaluation of Rupee. In addition growth rate of fertilizer prices decreased once we removed the effect of devaluation of rupee. This shows that exchange rate contributed to the increase of fertilizer prices.

From these values, we can calculate the contribution of E_1', M_2' and P_F' to all (21) endogenous variables. However, here we focus only 3 endogenous variables X_A, C_f and GDP. The following Tables 4 shows the contributions of exchange rate to these variables as discussed below.

Table 4: Contributions of Exchange Rate to E_1, M_2 and P_F

Contribution of Exchange Rate to E1

Year	CX1E1-CX1E1'	CX2E1-CX2E1'	CX3E1-CX3E1'	CXAE1-CXAE1'	CPfE1-CPfE1'	CCfE1-CCfE1'	CGDPE1-CGDPE1'	CYE1-CYE1'
1970-74	2.156	-0.066	-0.064	0.913	1.692	-0.053	0.260	2.601
1975-79	-2.187	3.781	3.647	10.996	14.075	3.119	3.243	21.620
1980-84	7.636	2.920	2.791	5.401	4.983	2.248	1.496	7.482
1985-89	5.131	2.103	1.992	3.234	2.613	1.157	0.865	3.458
1990-96	3.845	1.675	1.572	2.298	2.276	0.461	0.567	2.047

Contribution of Exchange Rate to M2

Year	CX1M2-CX1M2'	CX2M2-CX2M2'	CX3M2 -CX3M2'	CXAM2 -CXAM2'	CPfM2-CPfM2'	CCfM2-CCfM2'	CGDPM2-CGDPM2'	CYM2-CYM2'
1970-74	0.000	0.066	-0.011	0.011	0.626	-0.485	0.003	0.031
1975-79	0.004	0.831	0.049	0.148	4.599	-3.045	0.044	0.291
1980-84	0.008	0.627	0.141	0.160	3.436	-1.907	0.044	0.222
1985-89	0.022	0.767	0.341	0.322	5.652	-2.851	0.086	0.344
1990-96	0.062	1.228	0.768	0.679	9.454	-4.170	0.168	0.572

Contribution of Exchange Rate to PF

Year	CX1PF-CX1PF'	CX2PF-CX2PF'	CX3PF -CX3PF'	CXAPF -CXAPF'	CPfPF-CPfPF'	CCfPF-CCfPF'	CGDPPF-CGDPPF'	CYPF-CYPF'
1970-74	-0.029	-0.292	-0.284	-0.173	0.496	-0.237	-0.049	0.320
1975-79	-0.287	-2.423	-2.337	-1.129	6.326	-1.999	-0.336	4.049
1980-84	-0.170	-1.240	-1.185	-0.654	3.890	-0.955	-0.181	1.971
1985-89	-0.154	-1.017	-0.963	-0.663	2.697	-0.559	-0.178	1.232
1990-96	-0.180	-1.046	-0.981	-0.753	2.110	-0.288	-0.181	0.959

For the contribution to X_A, the values of contribution of E_1‘ to X_A decreased fairly much as compared with the contribution of E_1 to X_A. The contribution of E_1’to X_A was positive only in IInd period although the contributions of E1 were positive in Ist, IInd and IIIrd periods. The contribution of M_2’ to X_A was also smaller than M_2 and M_2’ contributed positively to X_A only in Ist and IIIrd periods although M_2 contributed positively in 4 periods (Ist, IInd, IIIrd and Vth periods). The contribution of P_F’ to X_A increased fairly much compared to that of P_F to X_A and it was positive in the IInd and Vth period and negative in other three periods.

For the contribution to C_f, the contribution of E_1’to C_f decreased fairly much as compared with the contribution of E_1 to C_f. However, the contribution of M_2’ to C_f rather increased as compared with the contribution of M_2 to C_f. The contribution of M_2’is positive in 3 periods (IInd, IVth and Vth) although M_2 contributed positively only

in IVthperiod. The contribution of P_F' to C_f increased in comparison to P_F contribution to C_f and it was positive in the IInd and Vth periods and negative in other three periods.

The contribution of E_1' and M_2' to GDP also decreased. The contribution of E_1 to GDP was positive in 3 periods (Ist, IInd and IIIrd). However, the contribution of E_1' to GDP is positive only in one period (IInd period). The contribution of M_2' had no positive contribution in 5 periods although the contribution of M_2 was positive in 4 periods (Ist, IInd, IIIrd and Vth). It can also be seen that contribution of P_F' to GDP increased in comparison to contribution of P_F to GDP. This was positive in the IInd and Vth periods and negative in other three periods.

The following Table 5 shows the total contribution of exchange rate to the variables of X_A, C_f and GDP. Here, we would consider theoretically the effect of exchange rate on economic development of Sri Lanka. The devaluation of Rupee would increase export and fertilizer price and decrease import. The increase of export of agricultural exportable goods (E_1) increases the agricultural output (X_A), GDP (real) and food consumption (C_f). The decrease of food import increases the agricultural output X_A and GDP (real), but decreases food consumption (C_f). The increase of fertilizer price (P_F) decreases all the variables (agricultural output (X_A), GDP (real) and food consumption (C_f)). Therefore, we can calculate total impact (contribution) by adding these positive and negative values together.

Table 5: Total contribution of Exchange Rate to X_A, C_f, GDP and Overall Development

Contribution of Exchange Rate to Agricultural Output XA

Period	XA			Sub Total 1
	E1	M2	PF	
(I) 1970-1974	0.913	0.011	- 0.173	0.751
(II) 1975-1979	10.996	0.148	- 1.129	10.015
(III) 1980-1984	5.401	0.160	- 0.654	4.908
(IV) 1985-1989	3.234	0.322	- 0.663	2.893
(V) 1990-1996	2.298	0.679	- 0.753	2.224

Contribution of Exchange Rate to Overall Development GDP

Period	GDP			Sub Total 2
	E1	M2	PF	
(I) 1970-1974	0.260	0.003	- 0.049	0.214
(II) 1975-1979	3.243	0.044	- 0.336	2.951
(III) 1980-1984	1.496	0.044	- 0.181	1.360
(IV) 1985-1989	0.865	0.086	- 0.178	0.773
(V) 1990-1996	0.567	0.168	- 0.181	0.553

Contribution of Exchange Rate to Food Consumption Cf

Period	Cf			Sub Total 3
	E1	M2	PF	
(I) 1970-1974	- 0.053	- 0.485	- 0.237	- 0.775
(II) 1975-1979	3.119	- 3.045	- 1.999	- 1.925
(III) 1980-1984	2.248	- 1.907	- 0.955	- 0.614
(IV) 1985-1989	1.157	- 2.851	- 0.559	- 2.254
(V) 1990-1996	0.461	- 4.170	- 0.288	- 3.997

Overall Contribution of Exchange Rate

Period	Aggregate Total			Grand Total
	Sub Total 1	Sub Total 2	Sub Total 3	
(I) 1970-1974	0.751	0.214	- 0.775	0.190
(II) 1975-1979	10.015	2.951	- 1.925	11.042
(III) 1980-1984	4.908	1.360	- 0.614	5.654
(IV) 1985-1989	2.893	0.773	- 2.254	1.412
(V) 1990-1996	2.224	0.553	- 3.997	- 1.219

From these both positive and negative contributions of exchange rate, we can aggregate these three contributions to see the total contribution of exchange rate. For agricultural output X_A, the total contributions are calculated and shown in the Sub Total 1 column (total for the agricultural output X_A) of Table 5. The values range from 0.751 to 10.015. For *GDP* (real) too, the total contributions are calculated and shown

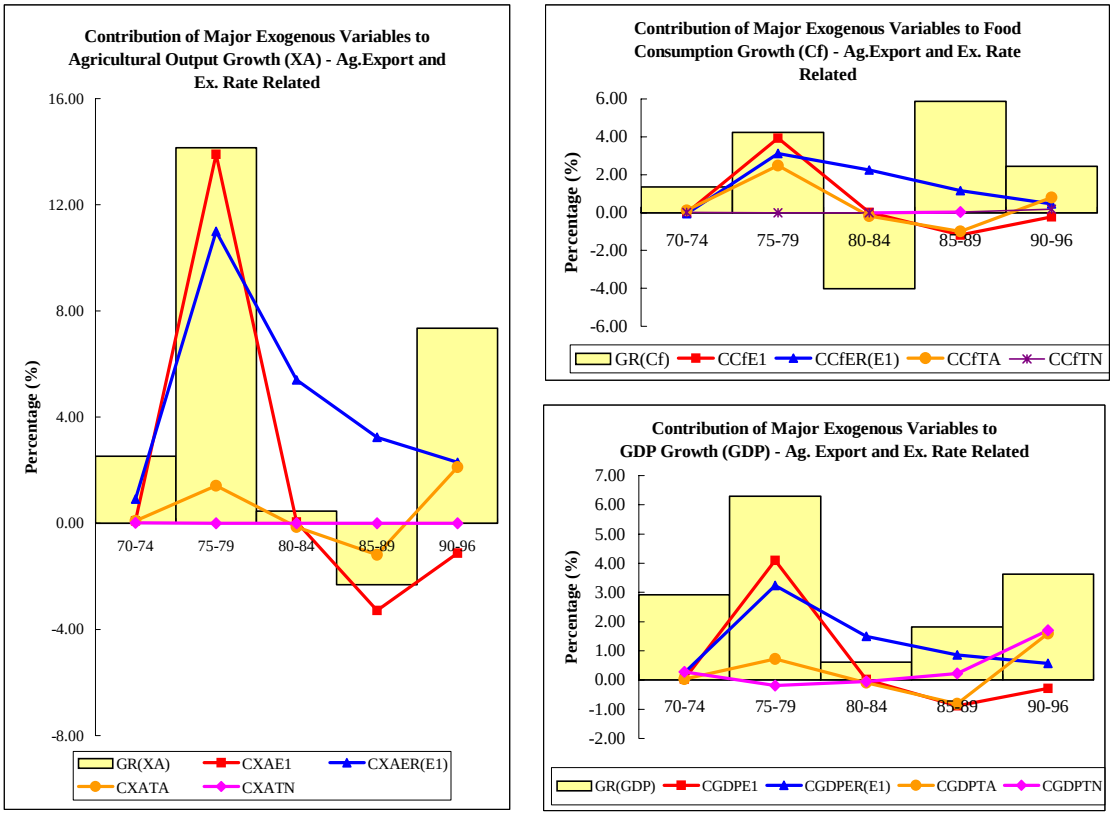
in the Sub Total 2 column (total for *GDP* (real)). The values range from 0.214 to 1.359. For food consumption (C_f), the total contributions are calculated and shown in the Sub Total 3 column (total for food consumption (C_f)). The values range from –3.997 to –0.614. If we aggregate all these three total contribution, we can calculate three total contributions of exchange rate (devaluation of Rupee). The Grand Total column in the above Table 5 shows these values. The values range from –1.219 in Vth period to 11.042 in IInd period. All are positive except Vth period. Therefore, we can say that the devaluation of Rupee contributed Sri Lanka economy very much.

These observations show the positive implications of currency devaluation to the Sri Lanka's economy under the policy reform. But it is important now to see how much did exchange rate growth contribute to these three variables. Following discussion reveals the amount of contribution of exchange rate on X_A, C_f and *GDP*.

Figures 1 to 3 show how exogenous (policy) variables such as agricultural exportable goods (E_1), food import (M_2), fertilizer price (P_F), technical change in agriculture (T_A), non-agriculture (T_N) and exchange rate (ER) contribute to 21 endogenous (target) variables. These Figures show the calculated results of the impact of exchange rate. The height of histogram in each variable shows how many % increased in each period. For example, the height of X_A in Ist period (1970-74) in all Figures shows 2.52. This means that the average growth rate of X_A in Ist period was 2.52%. Figure 1 shows that the contribution of agricultural exportable goods E_1 was 0.10. In the same way, the height of X_A in IInd period (1975-79) shows 14.15. This means that the average growth rate of X_A in IInd period was 14.15%. Figure 1 also shows that the contribution of export of agricultural exportable goods E_1 in IInd period was 13.89.

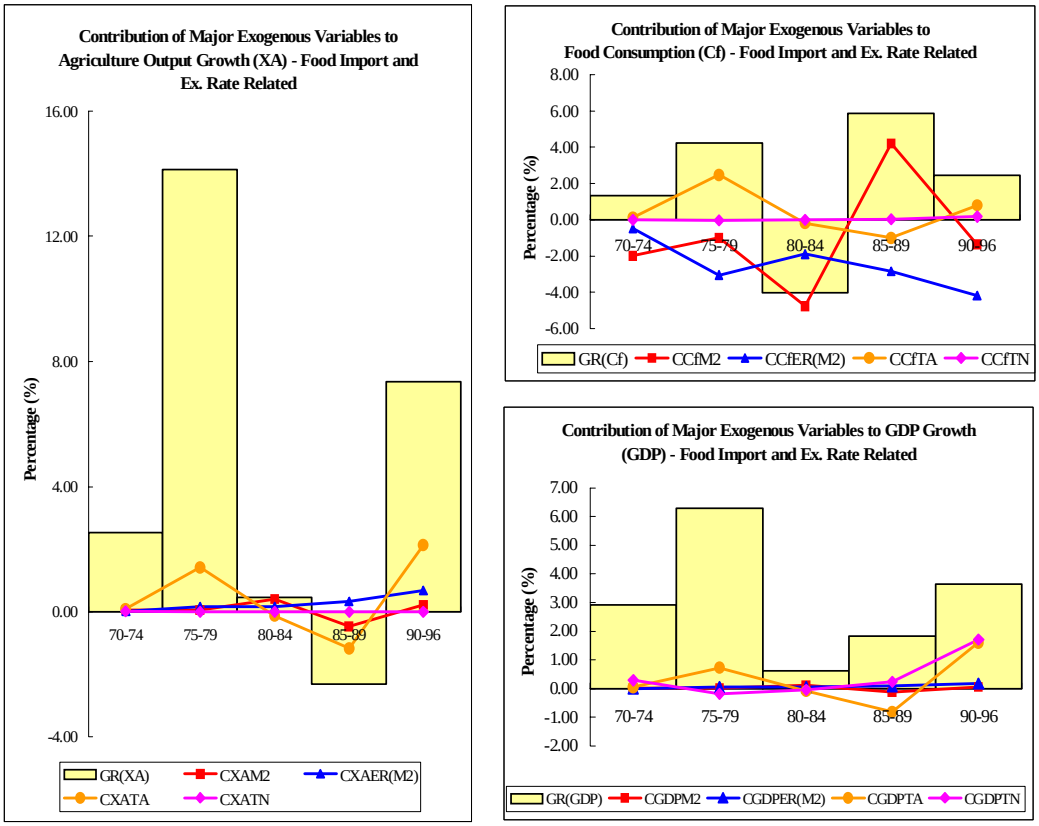
Figure 1: Contributions of major exogenous variables to X_A, C_f and *GDP*

(E_1 and Exchange Rate Related)



As Figure 1 shows above, the contributions of exchange rate (devaluation of Rupee) through the export of agricultural exportable goods are all positive and very large for three target (endogenous) variables (X_A , C_f and GDP). For example, the contribution of export of agricultural exportable goods E_1 in IInd period was 13.89 as we showed above. However, the contribution of exchange rate (devaluation of Rupee) through the export of agricultural exportable goods was 10.996. This means that 79.16 (10.996/13.89) % of the contribution of export of agricultural exportable goods E_1 comes from the devaluation of Rupee. Therefore, the contribution of export of agricultural exportable goods E_1 were only 2.894 (=13.89-10.996), i.e., only 20.835(=2.894/13.89) % if there were no devaluation of Rupee. From Figure 1, we can calculate the growth rate of agricultural output X_A in case no devaluation of Rupee by deducting the value of contribution of exchange rate (such as 10.996) from the value of height of histogram (such as 13.89). In same way, we can calculate all values of other periods.

Figure 2: Contributions of major exogenous variables to X_A, C_f and GDP (M_2 and Exchange Rate Related)

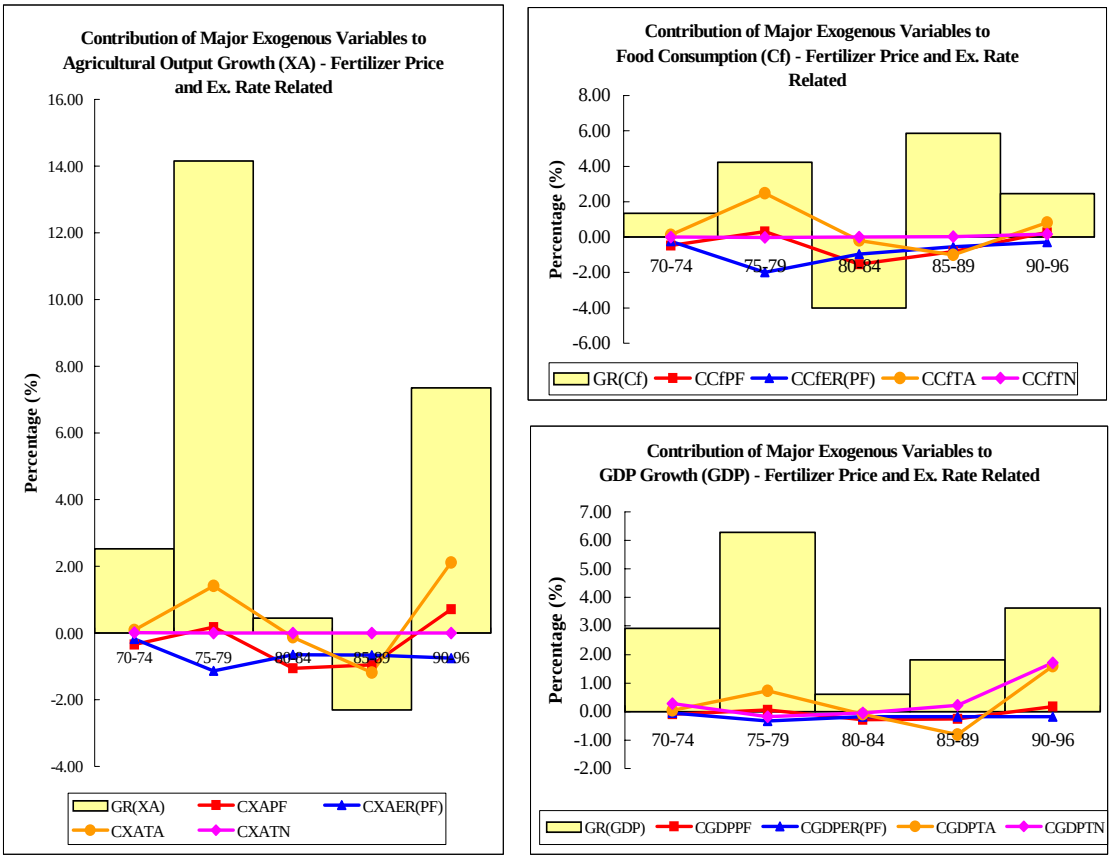


As shown in Figure 2, almost same things (i.e., positive contributions) happen to the growth of agricultural output X_A and GDP (real) by the contributions of exchange rate (devaluation of Rupee) through the agricultural import M_2. However, these contributions are very small as compared with the export of exportable goods (E_1) case. Therefore, we can understand that the growth rate of both growth rate of agricultural output X_A and GDP (real) would become only a little bit smaller than the real growth by the contributions of exchange rate (devaluation of Rupee) through the agricultural import M_2 if there were no devaluation of exchange rate. Also, the contributions of exchange rate (devaluation of Rupee) through the import of agricultural goods to food consumption C_f are not positive but negative and fairly large. In other words, we can say that the food consumption C_f would have been larger if there were no devaluation of Rupee.

However, completely different phenomena are seen in the case of fertilizer price

as shown in Figure 3.

Figure 3: Contributions of major exogenous variables to X_A, C_f and GDP (P_F and Exchange Rate Related)



The contributions of exchange rate (devaluation of Rupee) through the fertilizer price are all negative and fairly large for three target (endogenous) variables (X_A and C_f. For GDP, the values are not so large as compared with above stated two variables). For example, the contribution of fertilizer price P_F in IInd period was 0.182. However, the contribution of exchange rate (devaluation of Rupee) through the fertilizer price was –1.129. This means that -620.330 (-1.129/0.182) % of the contribution of fertilizer price P_F comes from the devaluation of Rupee. Therefore, the contribution of fertilizer price P_F was 1.310(=0.182-(-1.129))% if there was no devaluation of Rupee. From Figure 3, we can calculate the growth rate of agricultural output X_A, in case no devaluation of Rupee, by deducting the value of contribution of exchange rate from the value of height of histogram.

<u>Contribution of Technical Change (T_A) in Agriculture and Non-Agriculture (T_N)</u>

Table 6: Contribution of Agriculture and Non-Agriculture Technical Change

Contribution of Agricultural Technical Change (TA)

Contribution (TA)	GR (TA)	CXATA	CP1TA	CP2TA	CP3TA	CCfTA	CGDPTA	CLATA	CLNTA
(I) 1970-74	0.160	0.094	-1.211	-0.268	-0.296	0.128	0.037	-0.008	0.021
(II) 1975-79	4.230	1.409	-25.057	-7.403	-8.112	2.486	0.720	-0.423	0.899
(III) 1980-84	-0.440	-0.131	2.085	0.666	0.739	-0.191	-0.094	0.066	-0.128
(IV) 1985-89	-3.400	-1.183	14.285	4.111	4.749	-0.995	-0.811	0.680	-1.109
(V) 1990-96	5.300	2.121	-20.735	-4.615	-5.825	0.809	1.595	-1.325	1.988

Contribution of Non-Agricultural Technical Change (TN)

Contribution (TN)	GR (TN)	CXATN	CP1TN	CP2TN	CP3TN	CCfTN	CGDPTN	CLATN	CLNTN
(I) 1970-74	0.360	0.008	0.218	0.203	0.202	0.005	0.276	-0.018	0.046
(II) 1975-79	-0.250	-0.003	-0.099	-0.174	-0.169	-0.015	-0.189	0.013	-0.027
(III) 1980-84	-0.060	0.000	-0.011	-0.054	-0.052	-0.007	-0.047	0.003	-0.006
(IV) 1985-89	0.280	0.001	-0.028	0.294	0.272	0.034	0.227	-0.014	0.023
(V) 1990-96	2.000	0.002	-1.006	2.532	2.258	0.183	1.705	-0.100	0.150

Table 6 shows that technical change in agriculture T_A contributed fairly much for both the growths of agricultural output X_A and *GDP* except the IVth (1985-89) period in which internal unrest (1987-88) occurred. On the other hand, the contribution of technical change in non-agriculture T_N was very small to three target variables. However, the contribution of technical change in non-agriculture to the growths of *GDP* became gradually large and finally contributed very large for the Vth (1990-96) period. This comes from the push-pull effects of technical change in both sectors. As we have shown before (Yamaguchi and Binswanger [1975] Yamaguchi and Kennedy [1984]), technical change in both sectors has a non-symmetrical effect on agricultural labour. In other words, technical change in agriculture pushes agricultural labour to non-agricultural sector. However, technical change in non-agriculture does not push non-agricultural labour to agricultural sector but pulls agricultural labour to non-agricultural sector. This non-symmetrical effect comes from the low income and price elasticities of agricultural goods. The labour pulled by non-agricultural labour contributed positively to non-agricultural output and this led to the growth of *GDP*.

6.0 Overall Conclusion

Let us now summarize the content of this paper as follows.

(1)The contributions of M_2 and P_F were negative but the positive contribution of E_1 was larger than these two negative effects. Further the real contributions of these three variables such as E_1', M_2' and P_F' (excluding the exchange rate effect) pointed out that without the exchange rate reform the contributions would have been really detrimental to the agricultural production and economy of Sri Lanka. Therefore, policy reform had a positive effect on Sri Lanka Economy through the exchange rate reform, though it had negative impact on sector 2 and sector 3 which involve with domestic food production and small farmers.

(2)As we saw, many policies such as trade policy, fiscal and monetary policy, and privatization affected in such a way to either increase or decrease E_1, M_2 and P_F. However, the effect of devaluation of Sri Lankan currency (Sri Lanka Rupee) was very large and increased E_1 and P_F, and decreased M_2 respectively. These increased E_1 and P_F and decreased M_2 contributed very much for the growth of X_A and GDP in Ist, IInd and IIIrd periods although the decrease of M_2 contributed negatively to consumer. Increase of P_F due to devaluation of currency (exchange rate increase) negatively contributed to X_A and GDP. But the overall contribution to X_A and GDP was positive.

(3) However, internal conflicts in 1983 and 1987/1988 decreased E_1 and increased M_2 in IIIrd and IVth periods respectively. Therefore, the contribution of E_1 and M_2 to X_A and GDP were negative and fairly large in IIIrd, IVth and Vth periods. Only one exception was the positive contribution of increased M_2 to the consumption increase in IVth period.

(4) The increase of P_F contributed negatively not only to the agricultural producer but also to consumer and GDP (X_A, C_f and GDP).

It could be seen from this study that devaluation of currency helped to reduce the real food imports, increase the agricultural exports although it increased the fertilizer prices. Consequently these impacted positively on agricultural production and GDP. Hence, this could also be attributed as positive outcome of the reforms.

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