PERFORMANCE AND PROSPECTS OF A DEVELOPING ECONOMY ANALYSED IN THE FRAMEWORK OF KEYNES -LEONTIF AND KLEIN

Partha Pratim Ghosh[a] , Arpita Dhar[b], Debesh Chakraborty[c]

[a]Senior Lecturer (Selection Grade) in Economics, St. Xavier's College,

30, Park Street, Kolkata 700 016, India.

Email: rana_prof2001@rediffmail.com

[b]Professor of Economics, Jadavpur University,

Kolkata 700 032, India

Email: dhararpita@yahoo.co.in

[c]Former Professor of Economics, Jadavpur University,

Kolkata 700 032, India

Email: debesh_chakraborty@hotmail.com

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PARTHA PRATIM GHOSH
DEPARTMENT OF ECONOMICS
ST. XAVIER'S COLLEGE,
KOLKATA 700 016, INDIA.
Email: rana_prof2001@rediffmail.com

ARPITA DHAR
DEPARTMENT OF ECONOMICS
JADAVPUR UNIVERSITY,
KOLKATA 700 032, INDIA
Email: dhararpita@yahoo.co.in

DEBESH CHAKRABORTY
DEPARTMENT OF ECONOMICS
JADAVPUR UNIVERSITY
KOLKATA 700 032, INDIA
Email: debesh_chakraborty@hotmail.com

ABSTRACT

The paper analyzes the performance of the Sri Lankan Economy, a developing country, during the years 1975-2000 and makes future projections up to the year 2015 by using an integrated Macroeconometric and Input-output Model following the ideas of Keynes-Leontief-Klein. Result shows mainly traditional and service-oriented Key Sectors of the economy. Simulation exercises show that a mix of private and government investment together with foreign direct investment would help the economy to achieve faster growth, reduce government's budget deficits, ease out the problem of escalating public debt and contain the inflationary pressures. A study of the future growth prospects of the economy reveals that while under the 'Business As Usual' scenario the economy would achieve an annual GDP growth rate between six and seven per cent, the scenario obtained by implementing the 'Government's Policy' measures would step up the growth rate to around eight per cent per annum. By reducing the growth of government transfers to the private sector with the government's policies, a third scenario could improve the growth performance. The number of high growth sectors gradually increase in the second and third scenarios over the first scenario.

Keywords: Keynes-Leontief-Klein, Sri Lanka, Performance, Projection.

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PARTHA PRATIM GHOSH
DEPARTMENT OF ECONOMICS
ST. XAVIER'S COLLEGE,
KOLKATA 700 016, INDIA.
Email: rana_prof2001@rediffmail.com

ARPITA DHAR
DEPARTMENT OF ECONOMICS
JADAVPUR UNIVERSITY,
KOLKATA 700 032, INDIA
Email: dhararpita@yahoo.co.in

DEBESH CHAKRABORTY
DEPARTMENT OF ECONOMICS
JADAVPUR UNIVERSITY
KOLKATA 700 032, INDIA
Email:debesh_chakraborty@hotmail.com

1. INTRODUCTION

This paper analyses the performance and prospects of the developing economy of Sri Lanka. The particular choice of the Sri Lankan economy is mainly due two reasons. First, this country was ahead of most of its Asian neighbors in respect of its Gr oss Domestic Product and Economic Growth at the time of its independence in 1948 (Tambiah, 1982). Over the following decades, it has lost its position of pre -eminence. Second, in direct contrast to its growth performance, economy has out-performed even many of the developed nations in the social sectors of health and education. Together, these two features make a paradox of sorts. This naturally attracts one's attention towards the Sri Lankan economy.

Independent democratic Sri Lanka targeted a socialisti c pattern of economic development up until the end of the 1960-s. Not happy with their growth performance under the government-regulated regime, they initiated a change in perspective from the early 1970-s and the country began to gradually liberalize its economy. A decade-and-a-half later, from the middle of the 1980-s, the country began to experience violent ethnic conflicts that are yet to be resolved. The country has traveled a long way from a predominantly agriculture-oriented economy to a more modern one with a perceptible increase in the

share of manufacturing and services in its Gross Domestic Product. It has always been a highly open economy. The composition of the export basket has changed considerably from an agriculture-dominated one to a more industrially oriented type. Today, more than thirty years after the onset of the liberalization program in Sri Lanka in the 1970-s, the economy is facing the dangers of a debt-crisis, high inflation and unemployment along with low growth rate of its Gross Domestic product. These issues have been addressed in the recent official policy documents (*Regaining Sri Lanka* 2002, *Mahinda Chintana* 2006) and the emphasis on private-sector-led growth is more than ever before. Recently, the Millennium Development Goals (2000) set for the country also emphasizes high economic growth as one of the crucial targets to be achieved and maintained from the year 2008 through 2015. These salient features of the Sri Lankan economy motivated the authors to analyze its performance and prospects.

The organization of the paper is as follows. Section 2 discusses the objectives of the study. Sections 3 outlines the methodology including the model while Section 4 gives the data base. Section 5 presents the structural analysis of Sri Lanka and Section 6 discusses the econometric estimates. Section 7 contains some results of simulation in historical time. Forecasts of the Sri Lankan economy in the New Millennium are discussed in Section 8. Section 9 summarizes and concludes the paper.

2. OBJECTIVES OF THE STUDY

The objective of this study is to undertake a quantitative analysis of the performance and prospects of the Sri Lankan Economy. We want to develop a clear picture of how the

structure of the Sri Lankan Economy has changed over time and explain why it has evolved so. We also intend making future projections of the aggregative or Macroeconomic performance with reference to the official documents (*Mahinda Chintan*a 2006 and *Millennium Development Goals* 2000), that have laid down various targets for the economy. Our interest also lies in forecasting how the pattern of sector-level growth rates of the economy will evolve by the year 2015, the terminal year for achieving the Millennium Development Goals (2008). In short, the focus of the study is on the Structural Change and Growth of the economy.

3. METHODOLOGY

Our objective is of a specialized nature – that of a dual enquiry – involving both structural analysis as also economic growth. We want to develop a framework for understanding the behavior of the economy at the aggregate as also the sector-level detail and to empirically test the performance of the economy at both levels. Quantitative models have been used for either of the purposes. Nevertheless, relatively less amount of research has gone into combining the two methodologies of Macroeconometric Modeling and Input-Output Techniques.

In the area of structural analysis of sector-level interdependencies and linkages, Input-Output techniques are a very strong and useful tool. Not much is known about models for structural analysis of Sri Lanka, except for a few studies in the 1970's by Chakraborty and others. On the other hand, models for structural analysis have been developed for many advanced countries like Norway, Italy, UK, USA, Canada and Japan, emerging

economies such as India, China and Korea, as also for developing economies like Egypt, Morocco, Algeria and Ghana.

Econometric modeling is widely used for assessing various growth-related aspects of an economy. Colombage (1992) developed one of the early Macroeconometric Models for Sri Lanka. Various other types of Econometric models have been developed for Sri Lanka (Dasanayake, 2000), although many of these are unpublished. These have been mainly of the Chenery-Strout Two-Gap type or Monetary Models or even the conventional Keynesian type sometimes with supply constraints. In India, the five-year plan models have used both econometric and input-output techniques. However, such models were essentially plan-models with an entirely different focus. In general, economy-wide quantitative modeling has developed in five basic areas, namely - Input-output techniques, Macroeconometric Modeling, Computable General Equilibrium Models, Macroeconometric & Input-output Models and Inter-industry-Macroeconometric Models. The more relevant types for purposes of comparison in the context of our study are the Computable General Equilibrium Models and Inter-industry-Macroeconometric (IM) Models. Recently, a lot of work has been done on computable general equilibrium modeling of the Sri Lankan economy. CGE models are essentially small and compact versions of an economy in the abstract, used for policy simulations.

We now come to Macroeconometric-IO models that are a combination of Input-output techniques and Macroeconometric models. Klein (1978) suggested that the two techniques may be combined to give macroeconometric models the much needed supply

content and build an apparatus for handling the interconnections among the various sectors of the economy at a much greater detail. We call this the Keynes-Leontief-Klein Model. The history of Inter-industry-Macroeconometric Models is almost as old as the macro models. The empirical implementation of these models has generally evolved along with the available computing resources. Klein's (1986) example of the model he calls a 'Keynes-Leontief' model is a Macro-IO model with details that cause it to be close to an IM model. The general idea of an IM model is to use econometric equations to predict the behavior of each sector of each real final demand category at a detailed level.

Going by the objectives of our study, we have chosen the Keynes-Leontief-Klein methodology that integrates both the macroeconomic and sector-level behavior of the economy. The Keynesian Macro-Model has four main blocks – the Expenditure Block, the Monetary Block, and the Fiscal Block. Production in this sub-model is demand determined. The Leontief System on the other hand serves the purpose of a detailed production function. In itself, it contains the apparatus for connecting Production apparatus of the economy with the Final Demand on one side and the value addition in the economy on the other side. Therefore, the integrated model translates the total Final Demand of the economy into the Total Value Added, which is equal to it.

3.1.1 **The Macroeconometric Sub-Model**

Let us outline the components of the macro-model. Our model has three blocks, namely the Expenditure Block, the Monetary Block and the Fiscal Block. In the Expenditure Block, the elements of final demand are:

1. Private Consumption Demand
2. Investment Demand
3. Government Purchases and
4. Net Exports

The Monetary Block consists of

1. Money Demand
2. Money Supply

Components of the Fiscal Block are

1. Government Revenues
2. Government Expenditures

Together, these form the Macro-econometric Model, which is presented in Table 1 in the Appendix.

The macro-model consists of nine equations and six identities. At the outset it is important to recognize the fact that structural Macroeconometric Model ing has developed very rapidly in the last twenty years, incorporating new methodologies such as co - integration analysis to analyze behavioral relationships. Our study focuses on the time - period 1975 to 2000. As such, the data size is not adequately large to allow free interplay of modern time-series techniques. Hence, we have considered a structural macro -model of a more traditional version.

3.1.2 **Sector-level Details within the Econometric Model**

This model allows for detailed sector-level estimation of the behavioral relationships in order to supplement the Macro econometric estimates. For example, in the area of private

consumption expenditure, we can estimate individual functional forms for as many different sectors as permissible, given the data avail ability and compatibility constraints. These individual estimates add up to the aggregate consumption function. Similarly, the total investment expenditure can also be divided into major categories like Construction and Transport & Machinery and a similar detailed estimation procedure may be repeated. In the area of Foreign Trade, commodity-level export-import data can be used to develop the detailed sector-level estimates. We elaborate upon this point in the next sub-section.

3.2 **The Input-Output Sub-Model**

The Input-Output Sub-Model has a dual purpose. We use it to develop measures of interconnectedness in the economy and to supplement the Macroeconometric Model through the fundamental equality between Final Demand and Value Added in the economy. To this end, we have modeled the Final Demand components at the sector-levels and the corresponding Value Additions in each sector of the economy. The Leontief Solution is given by

$$\mathbf{x} = (\mathbf{I}-\mathbf{A})^{-1}\mathbf{f}$$

$$\Rightarrow \quad \mathbf{x} = \mathbf{L}\,\mathbf{f} \qquad \text{…….. (i)}$$

where **x** represents the vector of gross outputs, **L** is the familiar Leontief Inverse and **f** is the vector of final demands. In a similar way, from the Ghosh framework, we have

$$\mathbf{x}' = \mathbf{e}'\mathbf{X} + \mathbf{v}'$$

$$= \mathbf{x}'\langle\mathbf{x}\rangle^{-1}\mathbf{X} + \mathbf{v}'$$

$$= \mathbf{x}'\mathbf{B} + \mathbf{v}'$$

$$\Rightarrow \quad \mathbf{x' = v' (I-B)^{-1}}$$

$$\Rightarrow \quad \mathbf{x' = v'G}$$

$$\Rightarrow \quad \mathbf{\Delta x' = \Delta v' G}$$

where $\mathbf{<x>}$ is the diagonal matrix of gross outputs. The matrix $\mathbf{(I-B)^{-1} = G = [G_{ij}]}$ is called the Ghosh Inverse**.** It too forms the basis for some important measures of inter-relatedness among the different sectors of an economy. The element $\mathbf{G_{ij}}$ {(i,j)= 1,2,….,n}shows the change in the gross output of the i^{th} sector due to a unit change in the value added for the output of the j^{th} sector. The Leontief and Ghosh solutions derived above form the basis for the inter-temporal structural analysis of Sri Lanka. Coming back to the vector of final demands **f** in equation 3.2.1, we note that it is the sum of final consumption demand vector $\mathbf{f_C}$, final investment demand vector $\mathbf{f_I}$, final government purchases vector $\mathbf{f_G}$ and the net exports vector $\mathbf{f_E - f_{IM}}$**.** Hence, it is defined as $\mathbf{f' = [\ f_C + f_I + f_G + f_E - f_{IM}\ ]}$.

Each of the final demand component-vectors contains as many elements as the number of sectors in the economy. The purpose of the Input-Output Model is to accommodate these sector-level final demand estimates for each different component of final demand. This provides us with a method of detailing the entire model at each sector-level. The gross output of each sector is made up of intermediate inputs and value added in that sector. The fixed co-efficient Leontief Production Function is described by the Technology Matrix $\mathbf{A = [a_{ij}]}$ in equation (3.2.1) above. The $(ij)^{th}$ element of the Matrix $\mathbf{[a_{ij}]}$ denotes the i^{th} input per unit of the j^{th} output. Therefore, the gross output in each sector given by

$\mathbf{x_j} = {}^{n}\sum_{i=1} \mathbf{a_{ij}.x_j} + \mathbf{V_j}$, j = 1,2,….,n; where ${}^{n}\sum_{i=1} \mathbf{a_{ij}.x_j}$ stands for the total intermediate inputs used for producing the j^{th} output and $\mathbf{V_j}$ represents the value added in the j^{th} sector. This implies that the value added in each sector is the gross output $\mathbf{x_j}$ less the total intermediate inputs ${}^{n}\sum_{i=1} \mathbf{a_{ij}.x_j}$. Hence, we obtain

$$\mathbf{V_j} = \mathbf{x_j} - {}^{n}\sum_{i=1} \mathbf{a_{ij}.x_j} \quad , \; j = 1,2,\ldots,n$$

$$= \mathbf{(1 - {}^{n}\sum_{i=1} a_{ij}) x_j} \quad , \; j = 1,2,\ldots,n$$

In matrix notation, we have:

$$\mathbf{V} = \boldsymbol{\beta}\, \mathbf{x}$$

$$= \boldsymbol{\beta}\, \mathbf{L}\, \mathbf{f} \text{ (using the Leontief Solution) } \textbf{……..(ii)}$$

The Input-Output system acts as a bridge between the final demand and the value added in the economy. This is likely to be important for the development of more specific policy decisions requiring the use of microeconomic details. Both Macroeconometric Modeling and Input-Output Methods can play a major role in the integrated model. The total model is rounded up by the sector-level relationships that constitute the Input-Output System.

3.2.1 **Integration of the two models**

Since the basis for the integration is the equivalence between the final demand and the value addition in the economy, we begin by recalling that the final demand vector **f** can be expressed as [$\mathbf{f_c + f_I + f_g + f_E - f_m}$]. If we denote each row of the final demand vector **f** as $f_i = f_{ic} + f_{iI} + f_{ig} + f_{iE} - f_{im}$, we have, in an n-sector economy,

We can model each sector-level final demand component separately, by disaggregating that component of final demand into private consumption, investment, government purchases and net exports. However, at the practical level, data constraints may not allow the researcher to develop each of these individual relationships. For example, in case of private consumption, we might find only two sector-level regressions $\mathbf{f_{C1}}$ and $\mathbf{f_{C2}}$. In such cases we define the residual sector-level final consumption demand as

$\mathbf{f_{C,\,res} = (f_{C1} + f_{C2} + f_{C3} + \ldots + f_{Cn}) - (f_{C1} + f_{C2}),}$

where $\mathbf{(f_{C1} + f_{C2} + f_{C3} + \ldots + f_{Cn}) =}$ Macro-estimate of Total Consumption.

Then, for each of the residual sectors, final consumption demand is estimated by the method of pro-rata distribution based on the relevant Input-Output Table. The same method applies for each of the other final demand components at the sector-levels. In this way, the Macroeconometric estimates are tied up with the sector-level estimates of each component of final demand in the economy. We are now in a position to obtain the sector-level value additions from the Integrated Keynes Leontief Klein Model for the Sri Lankan Economy. Thus, we have a complete circuit from GDP to Final Demands, Sector-level production, Value Addition and back to GDP.

This approach provides a substantial and detailed production-and-supply-side content to conventional Macro-Econometric Models and remedies the short-circuit problem of conventional open static I/O models, where initial exogenous increases in final demand do not create subsequent rounds of income-induced multiplier-led expansions of consumption and investment expenditures. That brings us to the completion of the description of our

Integrated Macroeconometric and Input-Output Model. We now take up the discussion on the estimated results obtained from the model in the next chapter.

4. DATA BASE

We have used Sri Lanka's Input-Output Tables of 1986, 1994 and 2000 for the empirical analysis. The Input Output Tables of 1986 and 2000 have been sourced from The Ministry of Planning, Colombo, Sri Lanka while the Institute for Policy Studies has published the Input-Output Table of 2000, Colombo, Sri Lanka in 2004. In order to make inter -temporal comparisons meaningful, we converted each table into a nineteen-sector structure at the common base-year price of year 2000. The aggregation scheme is presented in Table 2 in the Appendix

Our model integrates the Keynesian Macroeconometric framework with Leontief's Input-output system. Estimation of this model required data at the Economy-wide or macro level as also at the sector levels. We also had to keep in mind the changing Input-Output relations in the economy. The period considered for estimating the model was from the year 1975 to 2000. Macroeconomic data was collected from various sources. The Main Aggregates and Detailed Tables, Parts I & II, of the National Income Accounts Statistics for the years 1975-2000 published by The United Nations are the basic source of data for the macro-model. In estimating the Fiscal Block additional data for the same period has been sourced from the corresponding Government Finance Statistics Yearbooks, Published by the IMF as also the Annual Reports of the Central Bank of Sri Lanka. The Monetary Block estimates have also used the Annual Reports of the Central Bank of Sri

Lanka in addition to the basic data. Supplementary data for the above parts of the model were also sourced from the Statistical Yearbooks for Asia and the Pacific (1975-2000), published by The United Nations. Data on International Trade and Balance of Payments for these years has been sourced from the International Financial Statistics (1995 & 2000), IMF Publications.

At the sector level, we have once again used the National Income Accounts Statistics published by the United Nations as the major data-source. Together with it, data for the period of study i.e.1975-2000 published by the United Nations has been obtained from four sources, namely the International Trade Statistics Yearbooks, the Foreign Trade Statistics Yearbooks for Asia and the Pacific, the Handbook of International Trade Statistics, and the Commodity Trade Statistics. In addition, the Direction of International Trade Statistics Yearbooks (1995-2000) as also the report on Trade Policy Review, Sri Lanka (1995) both IMF publications, have been extensively used.

5. SOME RESULTS OF STRUCTURAL ANALYSIS

An extended Input-output framework including both the Leontief and Ghosh systems was used for the structural analysis. Some of the main measures of interconnectedness that were used in the structural analysis were Backward Linkages, Output Multipliers, Forward Linkages, Income Multipliers, and Index of Dependence on Final Demand. Each measure was further classified into three categories – 'Strong', 'Medium' and 'Weak'. Key sectors of the economy were identified on the basis of Backward Linkages and Output Multipliers one the one hand and one the basis of Backward and Forward

Linkages on the other. The Backward Linkage of a sector is a measure of the extent to which it draws inputs from the other sectors of the economy. It is given by the column sums of the Leontief Inverse. In this paper, the Output Multiplier of a sector is defined as the change in the output of that sector due to a simultaneous unit-level change in the final demand of each sector in the economy. It is measured by the row-sum the Leontief Inverse. The Ghosh-Forward-Linkage of a sector measures the effect of a simultaneous unit-level change in the value addition of the sector on the outputs of all the sectors of the economy. We measure it by the row-sum of the Ghosh Inverse Matrix. Based on these results, we identified two sets of 'Key Sectors' of the economy. The First set was obtained from Backward Linkages and Output Multipliers while the second set was derived from Backward and Forward Linkages. Let us consider the Key Sectors Based on Backward Linkages and Output Multipliers. A notable feature is that the Garment sector (9), which has been instrumental in the economy's industrial expansion and export-diversification in recent years, does not feature as a Key sector in ay of the three years 1986, 1994 or 2000. Similarly, Tea (1) or Rubber (2), the main agricultural exports, or the Petroleum Products sector (17) which was the major contributor to Sri Lanka's industrial exports in the 1980-s, are conspicuously absent from the list of Key Sectors in 1986. In 1994 the Rubber sector (2), Chemicals & Chemical products (11) and other Manufactured Products (13) were the Key Sectors of the economy. The picture in the year 2000 is interesting. Key sectors now consist of agriculture-based sectors like Tea (1) and Rubber (2) on the one hand along with the Construction sector (16) and service based sectors like Trade Transport & Other Services (19). The two sets of 'Key Sectors' of the economy are summarized in Table 3 in the Appendix.

6. ECONOMETRIC ESTIMATES

We have considered a structural macro-model of a traditional version. Our macro-model, then, is of a traditional structural simultaneous-equations type. The equations in our model are either exactly identified or over-identified. In case of exactly identified equations, an often-used method of single-equation estimation is the method of Indirect Least Squares (ILS). For an over-identified equation, the Two-stage Least Squares (2SLS) method is appropriate. As such, even in case of an exactly identified equation, the ILS estimates converge with the 2SLS results. In this study, we have chosen the 2SLS method of single-equation estimation for the Macro-Econometric Sub-Model. The equations are linear in the parameters. This in no way compromises the goodness of fit and other standard statistical criteria, as is borne out by the 't' statistics associated with the estimated results. We have considered a maximum of 10% level of significance in assessing the estimated coefficients. While obtaining the first stage results of the 2SLS estimation process, the DW statistics of the equations were found to be statistica lly insignificant, implying the absence of First-Order Autoregressive pattern in the disturbance terms of the individual equations.

In a simultaneous equation system, the set of regressors is partly endogenous. Therefore, the conventional measures of R^2 may be misleading. Maddala (2000) has suggested two measures of the Goodness of Fit. The first one is the squared correlation between actual and estimated values of the explained variable. The second measure is based on the residual sum of squares form the second stage of the 2SLS method. It is given by [1 -

(Residual sum of squares/Total sum of squares)]. Following Maddala, we have reported the second measure in the discussions of the estimated model. Sector-level estimates of the various types of final expenditures were obtained by using the method of Ordinary Least Squares. Various experiments were made in the estimation process. The main results are shown in Table 4 in the Appendix.

In the Expenditure Block, Private Consumption Expenditure is a function of its own one-period lagged value as also disposable gross domestic product. Both the coefficients were statistically significant at the 5% level. Government consumption Expenditure is a function of its own one-period lagged value as also Government Revenue, both coefficients being statistically significant at the 1% level. Investment Expenditure as found to depend on three main factors – Bank Credit to the Private Sector, Bank Credit to the Government, and Foreign Direct Investment. The respective coefficients were each significant at 1% level. The real rate of Interest did not bear any significant relationship with Investment at the 10% level. Exports are a function of the Foreign Exchange Rate of the Sri Lankan Rupee since world income did not show a statistically significant coefficient at the 5% level. Imports on the other hand show a significant relationship with the economy's gross domestic product at the 1% level.

The estimation of the Monetary Block showed that the Price Level and Money Supply to be closely related in the Sri Lankan Economy. The natural logarithm of the Consumer Price Index was regressed on the natural log of the Money Supply to arrive at a statistically significant relationship at the 1% level.

The Government Tax Revenue in the Fiscal Block is a function of the gross domestic product with a coefficient significant at the 1% level. Government Non-Tax Revenue as a function of own one-period lagged and gross domestic product showed coefficients significant at the 1% and 10% levels respectively. In the estimated Macro-model, we have four main parameters, namely Bank Credit to the Private Sector, Bank Credit to the Government, Exchange Rate and Foreign Direct Investment. The link between the real and monetary sectors operates through the credit channel. We now present the results of sector-level estimates of Consumption, Investment, Exports and Imports.

At the sector-level, four main types of private consumption expenditures were identified. These were Food Beverages and Tobacco (10), Textiles Footwear & Leather Products (8), Electricity Water & Gas (18) and Other Manufactured Products (13). For each of these categories we found the gross domestic product to be a significant explanatory variable at the 1% 0r 5% levels of significance. The results are shown in Table 5 in the Appendix

In the case of Investment Expenditure at the sector-levels, we identified two main categories namely the Construction sector (16) and Machinery & Equipment Manufacturing sector (14). These are shown in Table 6 in the Appendix. Investment in the Construction sector is a function of Bank Credit to the Private Sector while investment in the Machinery & Equipment Manufacturing sector was estimated as a function of Bank Credit to the Government as also Foreign Financial Assets. The

coefficients of both these explanatory variables were statistically significant at the 1% level.

The next component of final expenditure in our model is Government Consumption. No sector-level details were identifiable for this category of final expenditure. In our integrated model, the government consumption expenditure for any year was therefore allocated to the nineteen sectors on a pro-rata basis depending upon the pattern revealed by the corresponding Input-Output Table.

Seven sector-level export categories that were identified are shown in Table 7 in the Appendix. These were Tea (1), Rubber (2), Other Agricultural Products (5), Garments (9), Non-Metallic Products (12), Other Manufactured products (13) and Machinery & Equipment Manufacturing (14). Among these, the first five sector-level exports are functions of the Exchange Rate of the Sri Lankan Rupee with statistically significant coefficients at the 1 % or 5% levels. The exports of other Manufactured Products showed a significant relationship with World Income at the 1% level in a double-log relationship while the exports of Machinery & Equipment Manufacturing was estimated as a function of the Logarithm of Exchange Rates at the 1% level.

Table 8 in the Appendix shows the nine sector-level imports that were identified. Imports of Rubber (2), Other Agricultural Products (5), Textiles Footwear & Leather Products, Food Beverages & Tobacco (10), Chemicals and Chemical Products (11), Non-Metallic Products (12), Other Manufactured Products (13) as also Basic Metals (15) are functions

of Sri Lanka's gross domestic product with all the coefficients significant at the 1% level. Import of Machinery & Equipment Manufacturing Sector (14) is a function of Total Investment in the economy and its coefficient statistically significant at the 1% level. The estimate of sector-level as also aggregate level exports and imports indicate that while Sri Lanka's exports are mainly governed by their relative prices via the Exchange rate of the Sri Lankan Rupee, the country's imports depend significantly on its gross domestic product.

Testing The Integrated Model

In order to test the overall validity of our model for the entire time period of study, we computed the Root Mean Square Percentage Errors (RMSPE) for the sector-level estimates. National Income Statistics Data at the sector levels was available at a six-sector aggregated form. The Root Mean Square Percentage Errors for the six broad sectors of the economy were computed by comparing the aggre gate and detailed sector-level GDP Estimates obtained from our model with the corresponding figures in the National Income Accounts of Sri Lanka. Table 9 in the Appendix shows the results.

In the next step of our empirical investigations, some simulation exercises were carried out in historical time in order to find out how the economic performance of Sri Lanka would have been affected under alternative policy regimes.

7. SIMULATION IN HISTORICAL TIME

We want to investigate whether the performance of the Sri Lankan economy could have been better during the period 1975-2000. For analytical purpose we have divided the period 1975-2000 into three phases – 1976-1983, 1984-1990 and 1990-2000. Our Macro-Model identifies four major exogenous variables that could possibly affect the growth performance of the economy. These are BCP (Bank Credit to the Private Sector), BCG (Bank Credit to the Government), FDI (Foreign Direct Investment) and EXCH (Exchange Rate between Sri Lankan Rupees and USD). In simulating the performance of the economy, we have altered the values of these variables at selected points of time as far as permissible within the broad limits of historical data and checked on the sensitivity of GDP to such changes. An iterative convergence-based estimation procedure was used for simulating the GDP of the economy during the period 1975-2000. Table 10 in the Appendix summarizes the simulation results. This table has three parts, namely BCG-Led Policy, BCP-Led Policy and BCP-FDI Policy. We begin with the BCG-Led Policy. The estimated model shows that BCG can stimulate growth in the Sri Lankan Economy through its impact on Total Investment TI. We may explain this as the positive impact of government investment in the economy. Therefore, it may seem that BCG will in fact stimulate growth.

However, a word of caution is necessary at this stage. The developing economy of Sri Lanka is also experiencing the problem of inflation. As our Macroeconometric Model shows, inflation in Sri Lanka is very closely linked with the growth rate of money supply in the economy. Our estimates show through Equation 7 that the rate of inflation in Sri

Lanka is very closely related to the rate of growth of money supply. The supply of money in turn can be explained in terms of monetization of the government budget deficit via BCG, as shown in Appendix II(A). In other words, a high rate of growth of bank credit consequent upon widening government budget deficits has been a major source of increase in money supply, creating inflation. On the other hand, bank credit to the government explains only a part of total investment in the economy because historically, BCG has been used mainly to finance the current account deficits of the government. Therefore, the costs and benefits of BCG need to be weighed against each other.

Data from the Central Bank of Sri Lanka for the period 1975 to 2000 shows that the government's investment (IG) accounts for a small percentage of BCG. This implies that the bulk of the BCG funds sourced by the government go towards meeting the Current expenses of the government. Again, current expenses of the government (CEG) are partly due to the government's current purchase of goods and services (CG) and partly due to the other current expenses in the form of interest payments and transfers to the private sector. It has been shown in this paper that the government's revenues (GR) adequately finance the government's current purchase of goods and services (CG). In addition, the ratio of government investment to government budget deficit is also small. Therefore, the government's interest payments and transfers to the private sector can be singled out as the main reason for the growing budget deficit, leading to monetization through BCG and inflation in the economy. Since BCG as a policy variable favors investment in the country, the implication is that public investment should be stepped up and not that BCG should be indiscriminately increased to finance additional other current expenses of the

government creating additional current account deficits in the government budget and inflation. Another result is worth noting in Table 10. Among the three factors explaining investment in Sri Lanka, the coefficients of BCP as also FDI show a much larger impact on total investment compared to BCG. In Table 10, for each of the three sub-periods, the rate of growth of GDP is highest under the BCP & FDI Policy, followed by BCP -Led Policy and least under the BCG-Led Policy.

This study has quantified the extent to which it would be possible for the government to augment resources by curtailing government expenditures such as transfers to the private sector. Table 11 in the Appendix shows that if it were possible to reduce the growth rate of the CEG-CG series to 2.5 per cent per annum (half the actual rate), then real resource augmentation would have been possible after the year 1988. These additional real resources would therefore find their way through increased flows to augment government investment in areas where private investment is slow to venture. In this way, we can reduce the government's current deficit on the one hand and stimulate growth through an increase in government investment on the other. The proposal for resource augmentation in no way requires additional funds in the form of BCG. Rather, the resource augmentation proposal focuses on curbing the other current expenses of the government to accommodate government investment. In this way, the public sector investment programs could be financed in a non-inflationary manner. The major conclusion that we reach is that both private sector investments through BCP and FDI as also government investment through BCG are complementary.

While the role of Government Investment in the economy is very crucial, it is equally important to understand that Bank Credit to the Government may not be the best way to increase Government Investment. Hence, the authors conclude that the growth rate of Sri Lanka's GDP can be substantially increased by encouraging market -based private-sector participation together with a systematic reduction in the current deficits in the government budget to release resources for investment by the government. In following this policy, the government has to provide a strong positive and credible signal to the private sector by reducing its current primary deficits, curbing current account expenditures and focusing on investment. This paper therefore emphasizes on a policy of augmenting growth by promoting the complementary roles of the government investment and private investment, both domestic and FDI.

8. THE SRI LANKAN ECONOMY IN THE NEW MILLENNIUM

The Millennium Development Goals developed by the United Nations (UN) in September 2000 and adopted recently by the 189 UN Member States including Sri Lanka contain high growth as one of the main targets. The target growth rate of GDP in the government's policy document '*Regaining Sri Lanka, 2002'* (RSL) was around 10% per annum in the new millennium. In 2006, the government brought out another policy document titled '*Mahinda Chintana'*, which laid down its vision of developing a new Sri Lanka through the Mahinda Chintana Goals (MCG). In fact, these goals are very similar to the Millennium Development Goals. The '*Mahinda Chintana'* document aims at raising the GDP growth rate in excess of 8% per annum between 2006 and 2012 and has set a target of 10% GDP growth-rate from the year 2016 onwards. In this context, the

natural question that arises is - how will the economy perform in the future? In this section, we investigate into the future course of the economy under alternative growth scenarios. We have used the Integrated Keynes-Leontief-Klein Model estimated for Sri Lanka and developed three scenarios for the years 2000 to 2015 – 'Business As Usual', 'Government's Policy' and 'Proposed Modifications'. We now discuss the process of developing these three scenarios.

Scenario 1: Business as Usual

This base-line scenario is simply an extension of the past trends that have emerged since the nineteen-nineties. It tells us how the economy is likely to evolve by the year 2015, if the economy performs as it has been doing in the past. The model contains four policy-parameters, namely Bank Credit to the Private Sector (BCP), Bank Credit to the Government (BCG), Foreign Direct Investment (FDI) and the exchange rate of the Sri Lankan Rupee (EXCH). The past growth rates of these parameters were 6.60%, 1.78%, 4.82%, and 8.08% respectively. Future projections of GDP for the period 2000-2015 were worked out using these growth rates of the policy parameters in the macro-econometric sub-model. The annual growth rates growth rates of GDP for the projection period 2000-2015 were computed from these estimates of GDP.

After this, nineteen sector-level projections for each of the four categories of Final Demand i.e. Private Consumption, Government Consumption, Total Investment and Net Exports were developed, based on the aggregation scheme (Table 2 in the Appendix) used in the Input-Output tables. A vector of Final Demand was formed by summing up

the sector-level projections of the different components of Final Demand. Outputs of the nineteen sectors were obtained from the Input-Output table of the year 2000, using the Final Demand vector and equation 3.2.1 of the Input-Output model given in Section 3.2 above. These sector-level outputs were used to compute the annual growth rates of the outputs of the nineteen sectors of the Sri Lankan economy for the period 2000 to 2015.

We also considered the important issue of Public Debt in our study with the rest of the future projections, using supplementary data from the Central Bank of Sri Lanka. Public Debt in Sri Lanka has been due to recurrent and excessive deficits in the government's budget. We related Public or National Debt (ND) and the government's Bud get Deficit (BD) by the defining $ND = ND_{-1} + BD$. In other words, the level of ND in any year is the sum of the previous year's ND (i.e. ND_{-1}) and the present year's BD. These variables were linked to the model in two steps. In the first step, the proxy ser ies $ND_{-1} + BD$ was used to obtain estimates of the ND series. The second step estimated the BD series from the BCG data used in our macro-model because the government's loans from the banking sector or the parameter BCG in the model forms the major source of financing the Budget Deficit BD. The level of the BD variable could be tracked very closely with the estimates obtained from the BCG series. Therefore, by using the parameter BCG, estimates were generated for BD and used in turn to estimate ND. The study assumes zero public debt in the year 2000 and proceeds to make projections up to the year 2015. Hence, the Cumulative BCG (CUMBCG) figures were used as a proxy for Public or National Debt in the estimation of the Debt-GDP Ratio.

In the context of National Debt, the question arises whether the estimated level of National Debt is feasible – i.e., will the economy be able to repay it? The answer would depend on how the Debt-GDP ratio behaves over time. If for any scenario, the ratio declines over time under, then it is worth attempting. An attempt was made to assess how long it would take before the economy began to repay its National Debt. From the past growth rates of the parameters of our model, Government Total Revenues (GR) and Government Consumption (CG) were estimated and the excess of government total revenues over government consumption expenditure (GR -CG) was calculated. Once this projected surplus exceeds the projected BCG figure, it was considered as payback time for the economy.

Table 12 in the Appendix shows the forecasts of GDP under Scenario 1. During the period 2000 to 2015, GDP grows at an average annual compounded growth rate of 6.71% per annum. In the year 2000, Sri Lanka's Gross Domestic Product in millions of Sri Lankan Rupees at constant prices of the year 2000 was Rs.1253624 Million. Between 2000 and 2005, the average annual growth rate of GDP comes out to be 6.68%. From 2005 to 2010, it decreases slightly to 6.55% per annum. Then for the period 2010 -2015, the growth rate of GDP improves to 6.92% per annum. On the average, the "Business As Usual' scenario secures an average GDP growth rate of 6.71%. We observe that the GDP growth rate achieved in this scenario is less than the target of 10% GDP growth set by the government in its policy document.

Scenario 2: 'Government's Policy'

At the outset it must be mentioned that the second scenario titled 'Government's Policy' developed through the integrated research-model may differ from the projections made by the '*Mahinda Chintana'* document, because the results derive from the application of economic data to the model whereas the government's official projections are derived independently. Not all the assumptions underlying the official projections are amenable to incorporation in our model. Nevertheless, the second scenario 'Government's Policy' was developed by incorporating the main strategy of private-enterprise-led growth adopted by the policy makers in Sri Lanka. The government's policy document '*Regaining Sri Lanka'* (RSL, 2002) fixed a target of 10% annual growth rate of real GDP for attaining the MDG-s. The RSL document observes that South-East Asian countries have achieved high GDP levels through their export orientation and by relying more and more on Foreign Direct Investment (FDI). Empirical investigations revealed that the share of FDI in TI in Sri Lanka has been low, and fluctuating over time. FDI as a percentage of TI has ranged from less than 1% to more than 12% but for most of the years it has hovered from 1% to 5% (UN and ESCAP data, 1975 - 2000). Another important feature of the government's policy initiative is to call for 'accelerated privatization' (RSL, 2000) so that 'the major share of responsibility of growth lies on the private sector' (RSL, 2000). The RSL document has mentioned a specific policy in this regard. It is to raise the annual growth rate of bank credit to the private sector to 14%. In our model with the policy parameters Bank Credit to the Government Sector BCG, Bank Credit to the Private Sector BCP, Foreign Direct Investment FDI and Exchange Rate EXCH, we have therefore relied on the BCP parameter to assess the impact of the

government's proposed policy of private-sector led growth. This second scenario 'Government's Policy' shows the results of the government's policy initiatives outlined in its policy document '*Regaining Sri Lanka, 2002'*. The analytical mechanism involved is the same as under the 'Business as usual' scenario worked out under the past trend, with the changed value of the BCP parameter. The average annual growth rate of GDP increases from 6.71% to 8.06% p.a. during the time-span 2000 to 2015. We present the GDP growth rates of Scenario 2 in Table 13 of the Appendix.

Starting from the year 2000 when Sri Lanka's Gross Domestic Product in millions of Sri Lankan Rupees at constant prices of the year 2000 was Rs.1253624 Million, the average annual growth rate of GDP under Scenario 2 during 2000-2005 turns out to be 7.6%. For the years 2005 to 2010, the annual growth rate of GDP works out at 7.9%. Between the years 2010 and 2015 too, the growth rate of GDP continues to improve, moving up to 8.67%. On the average, Scenario 2 secures an average GDP growth rate of 8.06%, closer to but lower than the target of 10% per annum. In the next section, we consider the results of the proposed modifications within the broad guidelines set by the government's stance, under the third scenario.

Scenario 3: 'Proposed Modifications'

Finally, the third alternative 'Proposed Modifications' develops a scenario in which this research proposal attempts to improve upon the outcome of Scenario 2. The growth rates of the parameters of the model are the same in Scenario2 and Scenario3. This third

alternative investigates the effects of increasing government investment in the economy, within the overall guidelines set the government's policy document, in order to find out whether further growth is possible. Government investment does not feature explicitly as a variable in the model. It is contained in the Total Investment (TI) variable. If resources are made available for additional government investment, then it would show as an increase in autonomous investment expenditure in the model.

To build this scenario, the first task is to identify the sources, if any, that cou ld augment resources for increased government investment in the Sri Lankan economy, without worsening the public debt profile in the process. While assessing the possibility of resource augmentation, certain fiscal characteristics of the economy were obser ved. Government Budget deficits have occurred because of excessive Current Expenditures of the government. Government Current Expenditures (CEG) consist of Government Consumption (CG) and Other Current Expenditures (OCEG). This last component OCEG consists of government transfers and interest payments on past debt, which creates Budget Deficits. Therefore, the basic idea behind resource augmentation for investment purposes is to is to reduce OCEG and to translate it into additional investment expenditure, say through government's investment spending IG on infrastructure development. This addition to total investment TI will be in the nature of autonomous investment, increasing the real GDP of the economy.

The methodology for Resource Augmentation consiste d of the following steps:

a) From the Annual Reports of the Central Bank of Sri Lanka and United Nations National Income Accounts data, the series (OCEG = CEG -CG) was constructed for the time period 1975 to 2000, in current prices. Using the implicit GDP Deflators, the series was converted into data at constant prices of 2000.

b) The historical growth rate of the series OCEG (i.e. the difference CEG - CG) has been 5.07% per annum. For the future period 2000 to 2015, the series OCEG was considered to be growing at half of the earlier pace, releasing real resources to augment TI. The differential impact on GDP, although positive, is not of a high order.

Table 14 in the Appendix shows the forecasts of GDP and the annual growth rates of GDP under the third scenario 'Proposed Modifications'. Starting from the level of Rs. 1253624 million in the year 2000, the GDP of Sri Lanka is forecasted to reach Rs. 4089119 million in the year 2015 at an average annual growth rate of 8.20%. During the years 2000-2005, it is projected to grow at 8.21% per annum. Later on, for the years 2005-2010 the annual growth rate of GDP comes out to be 7.82% while for the years 2010-2015 the rate of GDP growth achieved is 8.58% per annum. We find that the average growth rate of GDP at 8.20% is 1.8 percentage points below the official target of 10% even after the suggested modifications to the government's policy are incorporated in the model.

Comparison of GDP growth rates under the three scenarios

We now turn to a comparison of the three scenarios. All three scenarios start from a common GDP figure of Sri Lankan Rs. 1253624 million at constant prices of 2000. Under the government's policy, there is an improvement in GDP growth rates. The proposed modification with resource augmentation shows a further step-up in the growth rates of GDP. However, incremental growth rates of real GDP due to the proposed modifications show a diminishing trend. Hence, the overall impact of the proposed modification on the average annual growth rate is only 0.14%. There is an improvement in the annual growth rate of real GDP in Scenario-2 over Scenario-1. Scenario-3 improves only marginally over Scenario-2. Under none of the three scenarios does our model show real GDP-growth rates of 10% or more. The economy is expected to grow at around 8% to 8.2% per annum on the average, during the first fifteen years of the new millennium.

Sector-level performance under the three scenarios

Table 15 in the Appendix makes a comparison of the sector-level growth performance under the three scenarios. While the 'Government's Policy' scenario improves the growth performance of each sector over the 'Business As Usual Scenario', the third alternative scenario 'Proposed Modifications' shows marginal improvements for some sectors and marginal reductions in growth rates for the rest of the sectors over the forecasts of the 'Government's Policy' scenario. Those sectors that show improvements in the growth rates of output in Scenario 3 over Scenario 2 are Tea, Rubber, Coconut Paddy, Other Agriculture, Mining & Quarrying, Milling, Textiles Clothing & Footwear, Garments,

Food Beverages & Tobacco, and Non-Metallic products. On the other hand, the sectors that show marginal reductions in the growth rates are Chemicals and Chemical Products, Other Manufactured Products, Machinery & Equipment Manufacturing, Basic Metals, Construction, Petroleum, Electricity and Other Services. Since the overall growth rate of GDP in the economy improves marginally, we have reasons to believe that the sectors showing marginal improvement in output growth rates contribute relatively more to GDP than those that show marginal reductions in the growth rates of output.

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rates contribute relatively more to GDP than those that show marginal reductions i n the growth rates of output.

Another important question that arises in this context is how the relative positions of the sectors change in the three scenarios. For a ready reference, the sectors with high, medium and low growth rates under the three sce narios are shown in Table 16 in the Appendix. From this table, we observe that the number of high-growth and medium-growth sectors increases as we move from Scenario 1 to Scenario 2. Therefore, we find that the group of low-growth sectors becomes gradually smaller as we move from Scenario 1 to Scenario 2 and on to Scenario 3. Under Scenario 1, there are six sectors with low-growth potential in the economy. These are Food Beverages & Tobacco (10), Non-Metallic Products (12), Coconut (3), Mining & Quarrying (6), Textiles Footwear & Leather Products (8) and Basic Metals. Except for the Textiles Footwear & Leather Products (8) sector which also records low growth under Scenario 2 and Scenario 2, all the others sectors climb up into the group of High -Growth or Medium-growth sectors as we move fro Scenario 1 to Scenario 2 and finally Scenario 3. For example, the sectors Food Beverages & Tobacco (10) and Coconut (3) get absorbed in the medium -growth group of sectors, the Basic Metals sector (15) and the Mining & Qua rrying Sector (8) climb up to the high-growth group, while the Non-Metallic Products Sector (12) moves into the medium-growth group under Scenario 2 and the high-growth group under Scenario 1.

Debt-GDP ratios under the three scenarios

In the future projections, the impact on the Debt-GDP ratio was also determined under the three scenarios. The government is aware of the mounting pressure on its finances. It has been taking measures to keep public debt under control as far as possible, given the compulsions faced by its ethnic strife as also its fundamental nature of a developing economy. In our simulations, we have started from a level of zero public debt in 2000, to assess the incremental impact of the three alternative scenarios on the Debt -to-/GDP ratio. The exact mechanism of this analytical apparatus has already been discussed in the detailed analysis of Scenario1. The results shown in Table 17 of the Appendix reveal that the proposed government policy will be able to reduce the Debt/GDP ratio and the proposed modifications to the government policy will bring it down further.

Today, the majority of economists argue that government debt is detrimental to the economy, chiefly because it erodes the future growth potential of the economy. Analysis of Sri Lanka's Fiscal Scenario reveals that the economy has been consistently enjoying current primary surplus in its government budgets. The proportion of investment expenditure in the government budgets is also on the decline. The deficits and increasing public debt are a consequence of mounting interest obligations of the past and transfers by the government. According to the quantitative results obtained from the model, the government's proposals for augmenting revenues are likely to produce results no bet ter than the past trend. Therefore, given the past obligations, it is likely that the burden of

fiscal reforms would be borne by pruning government investment and/or social sector transfers.

Investment-GDP ratios under the three scenarios

Investment is the mainspring of economic growth. The government of Sri Lanka, in its policy document Regaining Sri Lanka has targeted a Total Investment/GDP ratio of 25% or more in order to arrive at a GDP growth rate of 10% p.a. In Table 17 of the Appendix, we show that if the past trend of the economy continues then under Scenario -1, the ratio of Total Investment to GDP (TI/GDP) gradually declines. This ratio picks up and stays above the benchmark of 25% under the government's policy scenario and even more under the proposal for modification to augment resources.

Government Policy In The Model And Official Projections

Up until now, three scenarios based on the integrated Keynes -Leontief-Klein Model for the Sri Lankan Economy have been developed and discussed to show th e alternative possibilities for the economy in the new millennium. Among these, Scenario 2 shows the results of obtained when the integrated model adopts the government's policies. The official projections contained in the government's ' *Mahinda Chintana'* (MC) and '*Regaining Sri Lanka'* (RSL 2002) are not exactly the same as the ones that we have developed in Scenario 2 (i.e. the 'Government's Policy' scenario from our model). Table 18 of the Appendix compares the forecasts of GDP growth rate obtained under S cenario 2 with the official projections of the ' *Mahinda Chintana'* (MC) document and shows that the difference in growth rates is quite small.

The government's Official Projections mentioned in the policy document ' *Mahinda Chintana'* (MC) state that during the period 2006-2016, Agriculture, Forestry & Fishing activities will grow at 4% to 5% per annum on the average. Industry, including Mining, Quarrying, Manufacturing, Construction and Electricity Gas & Water will grow at 8% to 9%. Finally, the Services sector is slated to grow at 9% to 10% per annum. The results obtained from our model under Scenario-2 reflect the forecasts under government's policies. Under this scenario, the Agriculture and allied sector is expected to grow at around 6%, the Industrial sector at 10% while the services sector is expected to grow at about 7.5%.

9. SUMMARY AND CONCLUSIONS

In this paper, we have developed and estimated a Keynes-Leontief-Klein type of integrated Macroeconometric and Input-output Model and studied the structural changes in respect of the Key Sectors of the Sri Lankan economy for the period 1975-2000. The results of the Structural Analysis show that notwithstanding the structural changes that have occurred in the country, the economy still needs to diversify more. Essentially, the Key Sectors comprise Plantation and Service Oriented economy even in the year 2000.

We developed and estimated the Keynes-Leontief-Klein Model for Sri Lanka to carry out some simulation exercises in historical time. The results of simulation clearly show the complementary roles of private investment, government investment and foreign direct investment in accelerating growth and reducing inflationary pressures in the economy .

With regard to the future prospects, we developed three scenarios for the Sri Lankan economy for the years 2001 to 2015, namely – Business as Usual or Scenario 1, the Government's policy or Scenario 2 and proposed Modifications to the Government's policies i.e. Scenario 3.

In Scenario 1, the GDP of the economy is expected to grow at an average annual rate of 6.71%. The leading sectors of the economy that would experience high growth rates of output in excess of 8% per annum are Other Manufactured Products (13), Garments (9), Rubber (2) ad Tea (1).

Scenario 2 assumes that the economy will experience private enterprise led growth. According to the government's policy document *Regaining Sri Lanka 2000* (RSL), credit to the private sector is expected to grow at 12% to 14% per annum under the government's policy. Incorporating this parametric change in our model, we find that the economy would grow at 8.06% per annum during the period 2000 – 2015. In fact, while the RSL document targeted a 10% growth of GDP in the new millennium, the *Ten Year Horizon Development Framework or Mahinda Chintana 2006-2016* (THDF) of the government of Sri Lanka has projected that the economy would grow at around 8% from 2006 to 2010 and at 10% or more thereafter. Moreover, a comparison of GDP growth rates projected in the THDF document and those obtained in Scenario 2 of our model shows that for each of the years during the period 2006 – 2015, the two sets of GDP growth rates are very close till the year 2010. At the sector level, Scenario 2 shows that eight sectors would be experiencing growth rates of output in excess of 8% per annum.

These leading sectors would be other Manufactured Products (13), Construction (16, Basic Metals (15), Rubber (2), Garments (9), Tea (1), Machinery & Equipment Manufacturing (14) and Mining & Quarrying (6) i n descending order of projected growth rates.

In Scenario 3 we have proposed some modifications to the government's policy to test whether higher growth rates are feasible. The proposed modifications consist of a Resource Augmentation program. It emerges that the Resource Augmentation proposal would increase the Growth rate of GDP marginally from 8.06% to 8.20% in Scenario 3. The growth profile of sector of the sector-level outputs in Scenario 3 is very similar to the one obtained in Scenario 2, except fo r the fact that the growth rate of each sector improves, although by a small magnitude. In the process, the Non-Metallic Products sector(13) now joins the league of leading Sectors. Finally, the Debt-GDP ratio is least under Scenario 3 and highest under Sc enario 1. However, under all the three scenarios, the Debt-GDP ratio diminishes over time during the years 2000 -2015, because GDP grows much faster than BCG.

APPENDIX

Table1 The Macroeconometric Sub-Model

EXPENDITURE BLOCK
CP = f (GDPD,CP_{-1},RR) ; Equation 1
CG = f(CG_{-1},GR, BCG,FL); Equation 2
ID = f (BCP, BCG,FDI,RR, GDP_{-1},); Equation 3
EX = f(EXCH, EXPW); Equation 4
IM = f(EXCH, GDP); Equation 5
MONETARY BLOCK
R = f(GDP, MS); Equation 6
CPI = f(CPI_{-1} ,MS,GDP); Equation 7
FISCAL BLOCK
GTR = f(GDP,IM); Equation 8
GNTR = f(GDP,$GNTR_{-1}$); Equation 9
IDENTITIES
TI = ID + FDI; Identity 1
GDPAD = (CP+CG)+ TI +(EX-IM); Identity 2
RR = R-INFL; Identity 3
INFL = (CPI-CPI_{-1})/CPI_{-1}; Identity 4
GDPD = GDP – GTR; Identity 5
GR = GTR+GNTR; Identity 6

Exogenous & Predetermined Variables: CP_{-1}, CG_{-1}, BCG, $GNTR_{-1}$, GDP_{-1}, FDI, FL, EXPW, BCP, EXCH, MS, CPI_{-1}.

Endogenous Variables: CP, GDPD, CG, GR, GTR, GNTR, ID, TI, GDP, EX, IM, CPI, R, RR, INFL.

List of Abbreviations:

The variables, parameters and their respective notations are defined below.

CP = Private Consumption Expenditure

CP_{-1} = Lagged Private Consumption Expenditure

GDPD = Disposable GDP

GDPAD = Aggregate Demand

GDP = Gross Domestic Product

GDP_{-1} = Lagged Gross Domestic Product

CG = Government Consumption Expenditure

CG_{-1} = Lagged Government Expenditure

GR = Government Revenue

GTR = Government Tax Revenue

GNTR = Government Non-Tax Revenue

$GNTR_{-1}$ = Lagged Government Non-Tax Revenue

TI = Total Investment

ID = Domestic Investment

EX = Exports

IM = Imports

BCG = Bank Credit to the Gov ernment Sector

BCP = Bank Credit to the Private Sector

FDI = Foreign Direct Investment

FL = Foreign Loans

EXCH = Exchange Rate (S ri Lankan Rupees/US Dollar)

MS = Money Supply

CPI = Consumer Price Index

CPI_{-1} = Lagged Consumer Price Index

R = Nominal Rate Of Interest

RR = Real Rate of Interest

INFL = Inflation

EXPW = World Demand

Table 2 Aggregation Scheme

	1986	1994	2000
1.	Tea	• Tea Growing • Tea Processing	• Tea Growing • Tea Processing
2.	Rubber	• Rubber Growing • Rubber Processing	• Rubber Growing • Rubber Processing
3.	Coconut	• Coconut Growing • Coconut Fiber & Yarn	• Coconut & Toddy • Coconut Processing
4.	Paddy	• Paddy Growing	• Paddy
5.	Other Agriculture	• Livestock • Fishing • Logging & Firewood • Forestry • Other Agriculture	• Vegetables • Fruits • Highland Crops • Potatoes • Minor Export Crops • Betel & Areca nut • Miscellaneous Agricultural Products • Livestock • Plantation Development • Firewood • Forestry • Fisheries
6.	Mining & Quarrying	Mining & Quarrying	Mining & Quarrying
7.	Milling (Rice & Flour)	Milling (Rice & Flour)	Milling (Rice & Flour)
8.	Textiles	• Textiles • Leather & Leather Products	Textiles Footwear & Leather Products
9.	Garments	Garments	Garments

	1986	1994	2000
10.	Food, Beverages & Tobacco	• Dairy Products • Bread • Other Bakery Products • Confectionery • Beverages • Bottled Fruit • Alcoholic Beverages • Desiccated Coconut • Other Processed Food • Tobacco Manufacturing	• Food Beverages & Other • Tobacco
11.	• Chemicals & Chemical Products • Agrochemicals & Fertilizers	• Fertilizers & Agrochemicals • Chemicals & Chemical Products • Toilet Preparation • Pharmaceuticals • Oils & Fats	Chemicals & Fertilizers
12.	• Non-Metallic Products • Structural Clay	• Structural & Clay Products • Ceramic & Glass Products • Ceramic & Cement Products	Non-Metallic & Other Mineral Products
13.	• Other Manufactured Products • Other Manufactures	• Wood Products • Paper & Paper Products • Printing & Publishing • Rubber Prods • Other Manufactured Products	• Wood & Wood Prods • Paper & Paper Prods • Plastic & Rubber Prods

	1986	1994	2000
14.	• Machinery & Equipment Manufacturing • Light Engineering • Electrical Appliances • Transport Equipment • Other Machinery	• Light Engineering • Electrical Appliances • Transport Equipment • Machinery & Equipment	• Other Manufacturing (Machinery & Equipment)
15.	Basic Metals	Basic Metals & Rolling	• Basic Metal Prods • Fabricated Metal Prods
16.	Construction	Construction	Construction
17.	Petroleum	Petroleum & Coal Prods	Petroleum Industry
18.	Electricity	Electricity & Water	Electricity Gas Water
19.	Services	• Road Passenger Transport • Railway Transport • Trade & Other Transport • Banking • Insurance • Ownership & Dwellings • Communication • Hotels & Restaurants • Tourism • Other Services • Health Services • Education Services • Govt. Admin & Defense • NGO • Non Profit Government Institutions	• Wholesale & Retail Trade • Transport • Hotels & Restaurants • Tourist Ships Travel Agents • Post & Communications • Banking Insurance Real Estate • Ownership Of Dwellings • Pub Admin & Defense • Other Personal Services.

Table 3 Key Sectors of the economy

Year	Key Sectors Based on Backward Linkages and Output Multipliers	Key Sectors Based on Backward and Ghosh Forward Linkages
1986	N.A.	Petroleum Industry(17) Electricity, Water & Gas(18)
1994	Rubber (2), Chemicals & Chemical Products (11), Other Manufactured Products (13)	Rubber (2), Chemical & Chemical products (11), Other Manufactured products (13), Non-Metallic products (12), Electricity Water & Gas (18)
2000	Rubber (2), Tea (1), Construction (16), Trade Transport & Other Services(19)	Rubber (2), Tea (1), Construction (16), Non-Metallic products (12)

Table 4 Estimated Equations of the Macro Model

	1.CP	2.CG	3.ID	4.EX	5.IM	7.LNCPI	8.GTR	9.GNTR
Const	12500.62 (1.21)	-2702.07 (-0.53)	76067.91 (6.05)	-3766.09 (-0.36)	-47362.9 (-2.58)	-4.68 (-29.92)	12395.32 (2.05)	1431.31 (0.58)
CP_{-1}	0.51 (2.38) [b]	-	-	-	-	-	-	-
GDPD	0.42 (2.43) [b]	-	-	-	-	-	-	-
CG_{-1}	-	0.71 (5.52) [a]	-	-	-	-	-	-
GR	-	0.25 (2.58) [a]	-	-	-	-	-	-
BCP	-	-	0.44 (10.98) [a]	-	-	-	-	-
BCG	-	-	0.35 (2.97) [a]	-	-	-	-	-
FDI	-	-	0.54 (5.05) [a]	-	-	-	-	-
EXCH	-	-	-	62.05 (24.41) [a]	-	-	-	-
$GNTR_{-1}$	-	-	-	-	-	-	-	0.69 (4.67) [b]
GDP	-	-	-	-	0.50 (21.36) [a]	-	0.15 (19.77) [a]	0.01 (1.54) [c]
LNMS	-	-	-	-	-	0.78 (51.96) [a]	-	-
R-Squared	0.99	0.96	0.94	0.96	0.95	0.99	0.94	0.77

Source: Results from the Study

Note: Figures in the parentheses are the t-values, significant at: (a) 1 per cent, (b) 5 per cent, (c) 10 per cent

Equation	Significant Explanatory Variables
1.Private Consumption Expenditure	Lagged Private Consumption Expenditure CP_{-1} , Disposable Gross Domestic Product GDPD,
2.Government Consumption Expenditure	Lagged Government Consumption Expenditure CG_{-1}, Government Total Revenue(Tax and Non-Tax) GTR
3.Investment	Bank Credit to the Private Sector BCP, Bank Credit to the Public Sector BCG, Foreign Direct Investment FDI
4.Exports	Exchange Rate of Sri Lanka Rupees/ US Dollar EXCH
5.Imports	Gross Domestic Product GDP
6. Nominal rate of Interest	--
7. Inflation	Rate of Growth of Money Supply LNMS
8.Government Tax Revenue	GDP
9.Government Non-Tax Revenue	Lagged Government Non-Tax Revenue $GNTR_{-1}$, Gross Domestic Product GDP

Table 5 Estimates of Private Consumption Expenditure At Sector Levels

	Sector Name an Number			
	Food Beverages & Tobacco (Sector 10)	Textiles, Clothing & Footwear (Sector 8)	Electricity, Water & Gas (Sector 18)	Other Manufactured Products (Sector 13)
Constant	38021.77 (7.33)	-4896.16 (-2.97)	16740.10 (6.69)	-3493.78 (-4.48)
GDPD	0.28 (34.43) [a]	0.05 (19.30) [a]	0.03 (7.5) [b]	0.03 (25.24) [a]
R- Squared	0.98	0.94	0.71	0.97

Source: Results from the Study

Note: Figures in the parentheses are the t -values, significant at: (a) 1 per cent and (b) 5 per cent

Table 6 Estimates of Domestic Investment at Sector Levels

	Sector Name an Number	
	Construction & Land Development (Sector 16)	Machinery & Equipment Manufacturing (Sector 14)
Constant	16467.01 (0.22)	35631.07 (1.43)
BCP	0.22 (13.12) [a]	-
BCG	-	0.75 (3.26) [a]
FDI	-	1.06 (4.99) [a]
R- Squared	0.89	0.56

Source: Results from the study

Note: Figures in the parentheses are the t-values, significant at: (a) 1 per cent

Table 7 Estimates of Sector Level Exports

	Sector Name and Numbers						
	Tea (Sector1)	Rubber (Sector 2)	Other Agriculture (Sector 5)	Garments (Sector 9)	Non-Metallic Products (Sector12)	Other Manufactured Products (Sector13)	Machinery & Equipment Manufacturing (Sector14)
Constant	25593.5 (10.43)	1331.551 (8.67)	3451.31 (4.33)	-48307.2 (-8.70)	-341.478 (-0.91)	-15.98 (-10.77)	-0.63 (-1.63)
EXCH	260.10 (4.33) [a]	5.48 (1.46)	168.27 (8.61) [a]	3277.22 (24.08) [a]	70.13 (7.63) [a]	-	-
LN(EXCH)	-	-	-	-	-	-	2.48 (14.19) [a]
LN(GDPW)	-	-	-	-	-	5.53 (15.63) [a]	-
R- Squared	0.45	0.08	0.76	0.96	0.72	0.91	0.90

Source: Results from the Study

Figures in the parentheses are the t-values, significant at: (a) 1 per cent

Table 8 Summary Estimates of Sector Level Imports

	Sector Numbers								
	(2)	(5)	(8)	(10)	(11)	(12)	(13)	(14)	(15)
Constant	-58.50 (-4.26)	18193.77 (4.73)	-63532.6 (-12.87)	-10298 (-5.51)	2628.99 (0.86)	-1833.7 (-9.49)	-185.14 (-7.36)	-860.10 (-6.59)	25946.24 (2.89)
GDP	0.00013 (4.73) [a]	0.020 (4.43) [a]	0.15 (23.75) [a]	0.03 (13.76) [a]	0.04 (11.20) [a]	0.04 (19.52) [a]	0.04 (23.79) [a]	-	0.10 (8.96) [a]
TI	0.00040 (2.94) [b]	-	-	-	-	-	-	0.01 (16.4) [a]	-
R- Square	0.94	0.47	0.96	0.90	0.85	0.95	0.96	0.92	0.78

Source: Results from the Study

Figures in the parentheses are the t-values, significant at: (a) 1 per cent (b) 5 per cent

Table 9 Root Mean Squared Percentage Errors

1	Agriculture, Hunting, Forestry & Fishing	0.25
2	Mining & Quarrying	1.44
3	Manufacturing	0.25
4	Electricity, Gas & Water	3.05
5	Construction	0.33
6	Trade Transport & Other Services	0.11

Table 10. Summary Of Growth Rates (Figures In Percentages) During 1975 -2000

Part 1: BCG-Led Policy				
	1976-1983	1984-1990	1991-2000	1976-2000
BCP: Actual	13.74	0.40	9.24	8.58
Simulated	13.74	3.35	8.14	8.58
BCG: Actual	13.11	9.32	2.61	5.02
Simulated	14.80	15.00	15.00	14.94
FDI : Actual	19.65	-14.95	25.82	4.82
Simulated	24.51	0.25	1.41	7.25
EXCH: Actual	15.83	7.86	6.96	9.59
Simulated	15.83	7.86	6.87	9.59
GDP: Actual	5.49	3.64	5.30	4.91
Simulated	7.81	5.09	6.55	6.03

Part 2: BCP-led policy				
BCP: Actual	13.74	0.40	9.24	8.58
Simulated	16.19	15.00	15.00	15.35
BCG: Actual	13.11	9.32	2.61	5.02
Simulated	13.11	9.32	2.61	5.02
FDI : Actual	19.65	-14.95	25.82	4.82
Simulated	24.51	0.25	1.41	7.25
EXCH: Actual	15.83	7.86	6.96	9.59
Simulated	15.83	7.86	6.87	9.59
GDP: Actual	5.49	3.64	5.30	4.91
Simulated	7.95	6.07	7.39	6.96

Part 3: BCP and FDI led policy				
	1976-1983	1984-1990	1991-2000	1976-2000
BCP: Actual	13.74	0.40	9.24	8.58
Simulated	16.19	15.00	15.00	15.35
BCG: Actual	13.11	9.32	2.61	5.02
Simulated	13.11	9.32	2.61	5.02
FDI : Actual	19.65	-14.95	25.82	4.82
Simulated	27.85	5.00	5.00	11.21
EXCH: Actual	15.83	7.86	6.96	9.59
Simulated	15.83	7.86	6.87	9.59
GDP: Actual	5.49	3.64	5.30	4.91
Simulated	8.16	6.31	7.43	7.12

Source: Results from the Study

Table 11 Possibility Of Resource Augmentation

(Million Sri Lankan Rupees at constant prices of year 2000)

Year	CEG-CG (New)	CEG-CG (Old)	Additional Resources (Old – New)
1988	73 687	74 626	939
1989	75 577	78 504	2 927
1990	77 516	82 584	5 068
1991	79 505	86 875	7 370
1992	81 544	91 390	9 845
1993	83 636	96 139	12 503
1994	85 782	101 135	15 353
1995	87 982	106 390	18 408
1996	90 240	111 919	21 679
1997	92 555	117 735	25 180
1998	94 929	123 853	28 924
1999	97 364	130 289	32 925
2000	99 862	137 060	37 198

Source: Compiled and estimated from Annual Reports of the Central Bank of Sri Lanka .

Table 12 GDP Forecasts under Scenario 1

Years	GDP (million Sri Lankan Rupees, at constant prices of the year 2000)	Average annual GDP Growth Rate
2000	1253624	-
2005	1732119	-
2000-05	-	6.68%
2010	2378284	-
2005-10	-	6.55%
2015	3322610	-
2010-15	-	6.92%
2000-15	-	6.71%

Table 13 GDP Forecasts under Scenario 2

Years	GDP (million Sri Lankan Rupees, at constant prices of the year 2000)	Average Annual Growth Rate of GDP
2000	1253624	-
2005	1807995	-
2000-05	-	7.60%
2010	2646070	-
2005-10	-	7.91%
2015	4009307	-
2010-15	-	8.67%
2000-15	-	8.06%

Table 14 GDP Forecasts under 'Scenario 3'

Years	GDP(million Sri Lankan Rupees, at constant prices of the year 2000)	Growth Rate of GDP
2000	1253624	-
2005	1859582	-
2000-05	-	8.21%
2010	2709865	-
2005-10	-	7.82%
2015	4089119	-
2010-15	-	8.58%
2000-15	-	8.20%

Table 15 Average Annual Growth Rates of Sector-level Output, 2000-15

SECTORS		Scenario 1:	Scenario 2:	Scenario 3:
1	Tea	8.75%	8.90%	8.92%
2	Rubber	8.80%	9.43%	9.41%
3	Coconut	4.69%	6.15%	6.23%
4	Paddy	5.87%	7.08%	7.22%
5	Other Agriculture	6.18%	7.45%	7.60%
6	Mining & Quarrying	4.54%	8.28%	8.21%
7	Milling	5.86%	7.06%	7.20%
8	Textiles Clothing & Footwear	3.34%	3.72%	3.80%
9	Garments	8.95%	9.07%	9.08%
10	Food Beverages & Tobacco	4.90%	6.02%	6.22%
11	Chemicals & Chemical Products	5.85%	7.43%	7.06%
12	Non-Metallic Products	4.70%	7.93%	8.13%
13	Other Manufactured Products	12.44%	13.36%	13.21%
14	Machinery & Equipment Manufacturing	7.99%	8.86%	8.81%
15	Basic Metals	1.89%	10.02%	9.33%
16	Construction	6.18%	11.67%	11.57%
17	Petroleum	5.71%	6.33%	6.16%
18	Electricity Water & Gas	6.36%	7.68%	7.60%
19	Trade Transport & Other Services	6.31%	7.54%	7.12%

Table 16 Sectors with high, medium and low growth rates

Scenario 1	Scenario 2	Scenario 3
High Growth Sectors under the three scenarios		
Other Manufactured Products (13)	Other Manufactured Products (13)	Other Manufactured Products (13)
Garments (9)	Construction (16)	Construction (16)
Rubber (2)	Basic Metals (15)	Rubber (2)
Tea (1)	Rubber (2)	Basic Metals (15)
	Garments (9)	Garments (9)
	Tea (1)	Tea (1)
	Machinery & Equipment Manufacturing (14)	Machinery & Equipment Manufacturing (14)
	Mining & Quarrying (6)	Mining & Quarrying (6)
		Non-Metallic Products (12)
Medium Growth Sectors under the three scenarios		
Machinery & Equipment Manufacturing (14)	Non-Metallic Products (12)	Electricity Water & Gas (18)
Electricity Water & Gas (18)	Electricity Water & Gas (18)	Other Agriculture (5)
Trade Transport & Other Services (19)	Trade Transport & Other Services (19)	Paddy (4)
Construction (16)	Other Agriculture (5)	Milling (7)
Other Agriculture (5)	Chemicals & Chemical Products (11)	Trade Transport & Other Services (19)
Paddy (4)	Paddy (4)	Chemicals & Chemical Products (11)
Milling (7)	Milling (7)	Coconut (3)
Chemicals & Chemical Products (11)	Petroleum Products (17)	Food Beverages & Tobacco (10)
Petroleum Products (17)	Coconut (3)	Petroleum Products (17)
	Food Beverages & Tobacco (10)	
Low Growth Sectors under the three scenarios		
Food Beverages & Tobacco (10)	Textiles Footwear & Leather Products (8)	Textiles Footwear & Leather Products (8)
Non-Metallic Products (12)		
Coconut (3)		
Mining & Quarrying (6)		
Textiles Footwear & Leather Products (8)		
Basic Metals (15)		

Table 17 Comparison of Debt-to-GDP and Investment-to-GDP Ratios under the Three Scenarios

	Debt-to-GDP ratio			Investment-to-GDP ratio		
Year	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
2005	19.27%	18.46%	15.31%	24.01%	28.00%	29.87%
2010	15.33%	13.78%	11.12%	21.95%	30.99%	32.60%
2015	11.98%	9.93%	7.79%	20.01%	35.17%	36.43%

Table 18 Comparison of GDP Growth between Scenario2 and MC Projections

Year	Sceanrio-2	MC projections
2005	7.35%	6.2%
2006	7.56%	7.4%
2007	7.75%	7.5%
2008	7.93%	7.8%
2009	8.09%	8.0%
2010	8.24%	8.3%
2015	8.93%	8.5%
2016	-	10.6%

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