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Macro economic effects of public investment in infrastructure in India[1]

K. N. Murty and A. Soumya [2]

Abstract

This paper attempts to build an aggregative, structural, macro-econometric model for India. Investment and output in the model are disaggregated into four sectors, viz., (a) agriculture including forestry & fishing, (b) manufacturing including mining, (c) infrastructure, which includes power, transport, communication and construction and (d) services sector, covering all other activities in the economy. Annual time series data for the period 1978-79 to 2005-06 are used for this purpose. A preliminary trend analysis has shown slowing down of the economy during '90s and thereafter. There are also significant structural shifts in production from agriculture to infrastructure and services in the Indian economy.

The proposed model has 75 endogenous variables of which 36 are equations and 39 identities. It also has 39 exogenous variables including 10 dummy variables. The model emphasizes the inter-relationships between internal and external balances and also the relation between money, output, prices and balance of payments. The model also tries to link economic growth with poverty reduction in a very simplistic way. Three-stage least squares method is used to estimate the model for the period 1980-81 to 2002-03. The model is validated for its in-sample and out-of-sample (2003-06) forecasting ability. Though the model did fairly well for in-sample forecasting for many variables, the good performance is limited to fewer variables in the case of out-of-sample forecasting. A few counter factual policy simulations relating to public investment in infrastructure are undertaken to illustrate the usefulness of the model for analyzing the policy options in a simultaneous equations framework.

The estimated model indicated significant crowding-in effect between private and public sector investment in agriculture, manufacturing and services sectors. Importantly, the infrastructure sector shows crowding-out between public and private sector investments. Also, there are significant complementarities between public sector investments in infrastructure and all other sectors. The 11th Plan document advocated 30% increase in total public investment or equivalently 70% increase in infrastructure investment to achieve a GDP growth of 8%. However, in view of the global economic crisis and the recent slowing down of the Indian economy, counter factual simulation with sustained 10% increase in public sector investment in infrastructure (and 4.3% increase in aggregate public sector investment in the long-run) is only attempted here, under different financing options. The scenario impacts are as under. For example, a sustained 10% increase in public sector investment in infrastructure financed through commercial bank credit to govt. shows an almost equal decline (9.8%) i.e. crowding-out of private investment in infrastructure sector. But, there are complementary effects in private investments in all the other three sectors, leading to an increase of 2.8% aggregate private investment. Further, due to increase in absorption, real output in the agriculture, manufacturing, infrastructure and services sectors seem to increase by 1.7%, 2.4%, 3.0% and 2.7% respectively, which sets-in motion all other macro economic changes. The aggregate real output increases by 2.4% in the long-run compared to base

[1] We are very grateful to Dr. K. Krishnamurty for his immense help in improving the model specification and detailed discussions on appropriate data used here. We also received extensive help and support from Professor R. Radhakrishna, Former Director, IGIDR and presently Honorary Professor, CESS. However, we only are responsible for any errors and omissions that still remain.

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simulation. Due to increase in public investment, the resource gap of the public sector, gross fiscal deficit and hence the reserve bank credit to the govt., after deducting the govt. borrowing from commercial banks, will increase. This increases reserve money, money supply (3.3%) and wholesale price level (0.4%). The prime lending rate will rise by 0.2% over the long-run. The external sector will also be benefited with rise in exports (2.3%), imports (4.6%) and significant improvement in trade balance. The poverty ratios will decline by 0.6% and 0.7% in rural and urban areas. Alternative scenarios using financing of public investment through net capital inflows and reduction in govt. current expenditure show similar but much smaller benefits to the economy. Finally, a 2% decline in world income due to global economic crisis will reduce the real GDP by 0.6% and increase poverty level by 0.1% in India.

Introduction

There has been a lot of public debate in recent months about (a) the global economic crisis, its recessionary effects on the Indian economy, (b) measures to overcome further sliding down of the economy, (c) the role and potential of infrastructure sector in accelerating the GDP growth and (d) the ways and means of raising resources for public investment in infrastructure sector and particularly the use of accumulated foreign capital inflows for this purpose. This paper attempts to address these issues and seek quantitative answers in a macro economic theoretical framework. The tool of counter factual policy simulation is used for this purpose. The answers to the above questions seem affirmative as detailed below[3].

A macro econometric model is as a system of simultaneous equations, seeking to explain the behavior of key economic variables at the aggregate level, based on the received theories of macroeconomics. Macro econometric modeling, in general, pursues two objectives: forecasting and policy analysis. The latter objective is the focus of this study. Fiscal and monetary policies are the foremost policies that are virtually analyzed in macro econometric models from their inception. Economy-wide macro econometric models can help in understanding the main macro economic problems of a country and attempt to obtain quantitative answers for fiscal, monetary and other policy initiatives. The imperative role of public investment in achieving economic growth (and thereby employment generation) seems to be in sharp focus in India. In light of this, it would be worthwhile to analyze the impact of

[3] While browsing through the literature on infrastructure sector in India, we came across the most comprehensive study by the 'Expert Group on the Commercialization of Infrastructure Projects' with Dr. Rakesh Mohan as Chairman. Their report, submitted in 1996, has examined in detail all aspects of this most crucial sector and made policy recommendations relating to its commercialization, role of capital markets, the necessary regulatory framework, fiscal reform, and sub-sector specific issues for the post-reform period. We are thankful to Dr. Dinesh Singh for bringing this reference to our notice.

increase in public investment in infrastructure sector on growth and poverty by using a macro econometric model for India.

This paper attempts to utilize the tool of an aggregative, structural, macro econometric model to analyze the macroeconomic effects of changes in selected exogenous variables for India. Before we give the details of the proposed model, its estimation etc., it would be useful to briefly look at the literature on this topic pertaining to India. A detailed review of macro econometric models built for Indian economy is beyond the scope of this paper[4]. Since this study proposes to analyze the economy from a monetary framework, and also analyse the impacts of public investment in infrastructure, it would be worthwhile to look into how the monetary and fiscal sectors were modeled in the Indian context[5]. This will be useful for identifying the research issues pertinent to this study.

The classical theory postulates that public investment may displace private investment or more generally expenditure. The impact works through the rate of interest. It may also work through movements in the price level depending on how such investment is financed and the extent of capacity utilization in the economy. According to Keynesians, the public investment gives adequate push to private investment through multiplier if the economy is operating under below capacity (Krishnamurty, 2000). However, the investment in infrastructure activities like irrigation, power, transport etc. should help in stimulating and facilitating private investment by creating new capacities.

Following Wagner (1890), the public finance studies generally postulate that growth in public expenditure over time is caused by growth in national income. Here, public expenditure works as a behavioral variable similar to private consumption expenditure. Most macro econometric models have tended to take the opposite view. The divergent views following Keynes (1936) treats public expenditure as an exogenous policy instrument designed to correct short-term cyclical fluctuations in aggregate expenditures**.** Causal relation between the these two variables, in turn, rests on more basic differences in assumptions. **(**Balvir Singh and B.S. Sahani, 1984).

[4] A comprehensive review of macro econometric models and policy modeling for India can be found in Krishnamurty (2001), Pandit and Krishnamurty (2004) and Bhattacharya and Kar (2005).

[5] A good review of monetary sector models was provided by Jadhav (1990)

Recent studies show that there has been a crowding-in effect between public and private investments in manufacturing, infrastructure and services sectors (Krishnamurty and Pandit, 1985; Murty and Soumya, 2006), which in turn will have an impact on the economic growth of a country. Public investment adds to real capital stock, which in turn increases the real output. This phenomenon has attracted attention also in understanding the tradeoff between growth and inflation. A contrary view is that public investment can exert a negative influence on private investment as both the sectors compete for scarce physical and financial resources by the very nature of its role in developing countries. It can drain-off resources to itself by a non-price rationing mechanism such as licensing and other controls. Some empirical studies have concluded that the crowding-out effect dominates in India (e.g. Sundararajan and Thakur 1980).

However, public investment not only provides supply of crucial inputs such as irrigation, power and transport, but also augments aggregate demand. It may encourage private investment from the supply as well as demand side. Some studies ascribe the deceleration in industrial growth in India since the mid-sixties to slowing down of public investment (e.g. Srinivasan and Narayana, 1977 and Ahulwalia 1982). This view projects the complementarity between public and private investments.

Modeling monetary sector and its links with fiscal and external sectors became a challenging task in India after 1970s. Modeling money and monetary policy for the determination of real output and price level has increased considerably in India (e.g. Rangarajan and Mohanty, 1997 and Rangarajan, 2000). In these models, stock of money varies endogenously through feedback from reserve money, which changes to accommodate fiscal deficit and changes in foreign exchange reserves. The output supply is determined by net capital stock, and output in infrastructure both with lags; while the price level depends on the money supply and production. Some models attempt to link the real, monetary and fiscal sectors [e.g. Krishnamurty and Pandit (1985) and Murty and Soumya (2006a)].

Modeling the external sector was not a major concern in the earlier models, because of restrictions on trade. But, in the recent years, several models emerged with detailed emphasis on the external sector and it's interlinks with the monetary and fiscal sectors. Krishnamurty and Pandit (1996) modeled the merchandise trade flows in supply-demand framework and included disaggregated output, prices and investment behavior.

Macroeconomic impact of fiscal deficit on balance of payments in India is an emerging issue in recent years since the inception of stabilization program. Rangarajan and Mohanty (1997) postulated that fiscal deficit increases the absorption in the economy relative to output and the output effect of deficit follows with a lag.

In a recent paper, Sastry et. al. (2003), have analyzed the sectoral linkages between agriculture, industry and services in the Indian economy. This study emphasized the role of agriculture through its demand linkages with other sectors in determining the over-all growth of the economy. The next section outlines the methodology and the proposed model of this study.

Methodology and Proposed Model

This paper tries to extend the work by the authors (Murty and Soumya, 2006a), wherein they attempted to build a small macro econometric model for India using the absorption approach of Pollak. The model emphasizes the inter-relationships between internal and external balances and also the relation between money, output, prices and balance of payments.

The model strives for a balance between the two polarized approaches of the classicals and the Keynesians. While classicals contend that changes in money supply, ultimately results in changes in the price level, the Keynesians on the other hand postulate that the changes in money supply eventually leads to changes in output, under conditions of less than full employment. Viewing reality lying somewhere in between these two extremes, one can postulate that changes in money supply affect both the output and the price level. Thus, the model tries to capture the effects of changes in money supply on both output and price level.

The model mainly focuses on the level of economic activity measured by production and also determination of money supply and its links with fiscal operations. Capital formation, price behavior are also modeled in detail. The economy is divided into four sectors namely (i) Agriculture including allied activities (ii) Manufacturing including mining and quarrying (iii) Infrastructure including electricity, gas, water supply; construction; transport, storage & communication and (iv) Services including trade, financing, insurance and public administration. Besides modeling output, capital formation and price behavior, the model also includes separate sub models on fiscal and monetary sectors and external sector. The level of economic activity is supply driven in agriculture, infrastructure and services sectors. In the manufacturing sector, it is a mixture of both supply and demand factors. Besides net

capital stock, infrastructure output, rainfall and gross cropped area affects output in agriculture sector. In the case of manufacturing sector, besides net capital stock, aggregate demand for domestically produced goods or in other words, real private absorption, and imports have a significant impact on total output. In the proposed model, private investment is assumed to be explained by (a) public investment in that specific sector, (b) real interest rate, (c) public sector resource gap and (d) relative price or sectoral terms of trade. The variable public sector resource-gap, defined as the difference between gross public sector savings and investment, is common to all the four sub-sectors and expected to have a negative correlation with private investment. Based on the net effect of the above four explanatory variables of private investment, we classify whether there exists 'crowding-in' or 'crowding-out' between public and private investments. If the net effect is positive (negative), we say that there exists crowding-in (crowding-out) respectively.

It also has an interest rate equation, which is an inverse demand function for money. The interest rate determinants are real output, money supply, and rate of inflation. Price behavior is explained through sectoral wholesale price indexes. Money supply per unit of GDP intended to measure overall liquidity in the economy, is a common determinant of price level in all sectors. Wholesale prices in manufacturing sector are also influenced by unit value index of imports and wholesale price index of minerals, fuel and power, light and lubricants.

The sub-model on fiscal and monetary sectors includes the set of govt. activities and its links with monetary operations. External sector is modeled through supply of exports, demand for imports and unit value (price) of exports obtained as a reduced form equation assuming equilibrium between export demand and supply. The export supply depends on relative export price adjusted for India-US bilateral exchange rate and real domestic income. The import demand function depends on the domestic absorption and the relative import price also adjusted for India-US bilateral exchange rate. The endogenous bilateral India-US nominal exchange rate is a function of domestic rate of inflation, current account balance and the change in foreign assets of RBI.

In order to link the poverty reduction with economic growth, the model postulates a simple relationship between head count ratio and the per capita real income, separately for rural and urban areas in India.

Based on the methodology outlined above, we propose the following model[6], which consists of 4 blocks- real, fiscal, monetary and external sectors. These 4 blocks are regrouped into 3 separate modules for econometric estimation. Module-I consists of all macro economic equations covering fiscal, monetary and external sectors. Module-II covers all real sector equations, which include production, investment, and prices. Module-III has only two equations representing rural and urban poverty ratios[7].

Trends and patterns in Indian macro economy

It is important to understand the trends and patterns in the observed data, before estimating the proposed model and using it for counter factual simulations. This provides a backdrop for interpreting the empirical results to be obtained. The data were taken from the National Accounts Statistics (NAS), published by CSO, and the Handbook of Statistics on Indian Economy, published by the RBI. The poverty estimates are based on the National Sample Survey (NSS) data.

The study period is 1978-79 to 2002-03. Although data are now available for two more recent years for GDP and few other variables, there are gaps for many other variables and therefore we confined our analysis to the above period. For any macro econometric model, the choice of sectoral break-up is very important and it determines the over-all size of the model. Here, we chose a 4 sector disaggregation for the investment and outputs of the real sector from the NAS. These four sub-sectors are (a) agriculture including forestry & fishing (Industry group 1), (b) manufacturing including mining (Industry groups 2 and 3), (c) infrastructure, which includes electricity, gas, water supply; construction; and transport, storage & communication (Industry groups 4, 5 and 7) and (d) services sector, covering all other activities (Industry groups 6, 8 and 9). For simplicity of reference these four sub-sectors are called (i) agriculture, (ii) manufacturing, (iii) infrastructure and (iv) services respectively, in the rest of the document.

Most of the variables for the real and external sectors used in the econometric analysis are in real form (1993-94 prices) to avoid inflationary effects. The monetary and fiscal variables are in current prices. All price variables are indices with 1993-94 as unity. To study the macro economic trends, decade-wise annual average compound growth rates for all the variables are

[6] The explanatory variables given in each equation are those actually found to be empirically suitable after careful search process during estimation. It is therefore more appropriate to call the given model as 'selected model' instead of 'proposed model'.

[7] Due to space constraint, the detailed model specification is omitted from here. However, the estimated model along with description of all variables used in the model is given in Appendix-II.

computed using semi-logarithmic regressions[8] and are given in Appendix-I, Table-1. To analyze the structural changes/patterns, average percentage shares of important variables are also given in the same table. A few variables are also plotted to understand visually the trends and fluctuations in them (Chart-I).

Output and Prices:

Real gross domestic product at factor cost, an indicator of total economic activity or proxy for real income, grew by a moderate 5.7% p.a. during the entire study period 1980-81 to 2002-03. The relatively good performance of the Indian economy during post-'80s, compared to earlier period, is attributable to the better utilization of industrial capacity and favorable demand conditions. The real output growth has accelerated from 5.4% during '80s to 6.2% during '90s. Between 1993-03, the post-liberalization decade, which is also our data period for policy simulation analysis, the real output has grown at 6% p.a., which implies a significant slowing down in the economy during 2000-03. Real per capita output (income) also shows similar trends.

The above aggregate growth was made possible through differential sectoral growth: Agricultural output grew by 3%, manufacturing by 6.6%, infrastructure by 6.5% and services sector by 7.2% during 1980-03. From the decade-wise trends, it is clear that the manufacturing sector has slowed-down secularly, while infrastructure and services have accelerated. Agriculture has shown acceleration during '90s, but decelerated later. Some analysts attribute this slowing down of the Indian economy during 2000-03 period, to supply related 'infrastructural bottlenecks', which perhaps is due to deceleration of investment in this crucial sector (See also Shetty, 2001 for similar findings)[9].

The growth rate in the wholesale price index fluctuated between 6.6-7.8%, which declined to 5.5% during 1993-03. The rate of inflation declined at differential rates, the most rapid decline (12.7%) being during '90s. The decline became slower during 1993-03. The national

[8] Due to volatility in the data for certain variables, the compound growth rates for the sub periods do not match well with that of the entire period. To avoid this, some analysts recommend smoothing of the series using moving average method before computing growth rates. This has not been done here.

[9] Perhaps anticipating this, the 'expert group' has made projections of yearly investment requirements during 1996-2006 in order to achieve the desired 8.5% GDP growth in India by 2005-06. The required total investment in infrastructure over the 10 year period 1996-2006 is estimated at Rs. 750,000 crores, with a break-up of 85% from domestic and 15% external sources. The share of infrastructure investment in GDP is projected to increase from 5.5% in 1994-95 to 7% in 2000-01 and 8% in 2005-06. However, in retrospect, we notice that the share of infrastructure investment (out of GDP) declined to merely 3.5% in 2002-03. The desired GDP growth seems to have been achieved despite this decline.

income deflator, shows similar trends but at 0.5-1% higher level. Sector specific GDP deflators (proxies for sectoral output prices) also show varying rates of changes, the slowest growth (7.2%) being for manufacturing output price and the most rapid (9.4%) for infrastructure output price. The agricultural output price grew at 9.0% p.a. during the entire study period, 1980-2003. The recent decade shows deceleration in these prices as well.

The real GDP share in agriculture fell from 36.4% in '80s to 29.1% in '90s and it stood at 26.5% during the recent decade (1993-03), a sizable decline of 10 percentage points. The non-agriculture exhibits the opposite pattern. Within the non-agriculture, share of the services sector is the largest, accounting for more than one-third of the GDP. The share has gone-up from 32.3% in '80s to 37% in '90s and more recently to 38.8% of the GDP. The GDP share of infrastructure remained stagnant around 14-15%, although the GDP level has roughly little over doubled. The GDP share of manufacturing sector improved marginally from 17.6% in '80s to 19.4% in '90s and even subsequently. Thus, there is a structural shift in production from agriculture to infrastructure and services in the Indian economy.

Investment and savings:

During 1980-03, real public investment in agriculture and manufacturing sectors has declined by 2.1% and 0.1% respectively, whereas real public investment in infrastructure and services sectors grew by 3.9% and 3.7% respectively. These investment trends are consistent with the production trends discussed above. The public investment in all sectors put together grew by 2.5% in the study period. In fact, the public investment growth has decelerated from 4.5% during '80s to 2.2% during '90s. In the post-liberalization period, the growth is only 1.1%. This is the result of massive disinvestment of public sector units in the country during post-90s.

To a certain extent, private investment has substituted for public investment. Private investment in agriculture, manufacturing, infrastructure and services sectors grew by 4.2%, 6.9%, 5.9% and 6.3% respectively in the entire study period. Private total investment in all sectors grew by 6.3% in the study period. Between '80s and '90s, private investment accelerated in agriculture and manufacturing (substantially), but nearly stagnant or decelerated in the other two sectors. In the post-'93 period, except in agriculture, private investment slowed down in all the three other sectors. The graphs depicting investment shares also confirm this.

Nominal gross domestic savings in the economy has been growing at an average rate of 16.2% during 1980-'03, which is 0.6% faster than the growth in nominal gross investment (15.6%). However, both gross domestic savings and investment seem to have decelerated by about 4% p.a. during the recent decade[10]. These trends indicate that there has been some disillusionment in the investment climate during post-'93 period in India. The reasons could be fall in demand and recessionary conditions in the Indian economy.

Fiscal and monetary variables:

In developing countries, the finances of the government play an important role in the growth of the economy. Govt. total expenditure consists of current and capital expenditures. The nominal total govt. expenditure has decelerated from 16.2% in '80s to 14.1% in '90s. The govt. consumption expenditure, however, accelerated from 15.4% to 16.3%. Therefore, the deceleration in govt. expenditure can solely be attributed to the deceleration in investment. These trends continued into 1993-03 period as well. Although the nominal govt. direct tax collection has accelerated, the total revenue seems to have decelerated. Some fiscal prudence has led to deceleration in the fiscal deficit over the years. In fact, fiscal deficit decelerated from 18.7% in '80s to 15.8% in '90s. However, the govt. seems to have lost control over fiscal deficit again during 1993-03. Money supply grew more or less steadily at about 17% during the study period. Nominal interest rate grew marginally during '80s by 0.8% p.a., but dropped significantly since then and the trend continued.

External sector:

Real export growth from the country has accelerated rapidly from 5.1% in '80s to 10.8% in '90s, with an overall growth of 9.5% p.a. Exports seems to have picked-up again (10.6%) during 1993-03. The unit value of exports, proxy for export price, has increased slower than export quantity during most of the period except during '80s and much slower in the recent decade. The export competitiveness was facilitated by significant depreciation of Indian rupee (9.4%) against the US$, in addition to rise in unit value of exports. Despite rupee depreciation, growth in real imports has accelerated very rapidly from 7.3% in '80s to 14.7% in '90s, mainly due to higher demand. A substantial part of these imports could be POL imports, which have become essential both as inputs and final consumption goods. The

[10] Not with standing this deceleration in domestic savings (and investment), there are serious criticisms about the over estimation of the rate of domestic savings during recent years by the CSO (e.g. Shetty, 2005, 2006). Dr. Shetty puts the extent of over estimation in the savings rate around 3-4% during 2000-03.

import growth however seems to have slowed down to 7.8% during 1993-03. The nominal trade balance, as expected, has been negative and highly volatile, particularly during the '90s and thereafter. The opening-up of the economy must have been largely responsible for this.

Poverty ratios:

The data on the head count (poverty) ratios, separately for rural and urban India, are taken from Radhakrishna et. al. (2004) and Panda (2006). The poverty estimates in these studies are obtained using data from the NSS, which are on calendar-year basis for some years and crop-year (July-June) for others. There are also gaps in the data for some years due to non-existence of NSS rounds. In order to match NSS rounds with NAS time series, simple average of two adjacent years is used wherever necessary. For the purpose of estimating regressions, the data are interpolated for missing years. We know that this is not a very satisfactory way, but there is no other alternative. The poverty ratios shows declining trend, though with some fluctuations, in both rural and urban areas. The rate of decline also seems to have been slowed down in recent years. The fluctuations are more in the rural poverty estimates. The head count ratio declined by about 3-5% during the study period.

In summary, the above trend analysis shows that the macro economy has been under severe stress with high volatility and slowing down of investment and economic growth during the mid '90s and thereafter. However, the infrastructure and services sectors seem to hold some hope. This paper therefore tries to look at the potential of increasing public investment in the infrastructure sector as a vehicle for accelerating economic growth and reaching the much debated 10% GDP growth in India.

Estimated Model:

The proposed macro econometric model consists of 4 blocks- real, fiscal, monetary and external sectors. It has 74 endogenous variables (36 equations and 38 identities) and 39 exogenous variables. For convenience of estimation and future improvements, the model is estimated in three separate modules (I, II and III) using 3SLS method for each module. The module-I contains all the macro economic relationships except the real sector equations, which are put into module-II. Module-III has only 2 equations representing rural and urban head count (poverty) ratios. Due to lags and use of rate of change in some variables, the actual estimation uses data for 1981-82 to 2002-03.

While estimating the model, a TREND variable is included in some equations to capture the autonomous time related changes in the endogenous variables. Dummy variables are included in the model to separate the pre- and post-liberalization (1991-92 onwards) effects and also to capture the abnormal fluctuations in the data for certain variables. The choice of the equations was guided by expected sign as well as statistical significance for the coefficients and high goodness-of-fit, including absence of serial correlation for residuals. It may be mentioned that the choice of lag length for various determinants was also guided by expected sign and near significance. It involved careful search process. The finally selected model is given in Appendix-II

A perusal at the estimated model indicates that the model is estimated quite well. Almost all the regression coefficients are significant at 5% or less. The signs of the coefficients also look appropriate, a priori. However, despite our best efforts, some of the equations still seem to suffer from the problem of serial correlation. In order to understand the direction and relative magnitude of response of each determinant on the dependent variable, the estimated mean partial elasticities are also given in each equation. It is important to note however that the direction and size of response implied by these mean partial elasticities is only indicative and the net impacts measured through policy simulations are likely to be different from these mean partial elasticities. For this reason, the interpretation of the individual coefficients may be of less importance except making few observations on the implied incremental capital-output ratios (ICOR) for different sectors and the direction of association between some important variables in the model.

From the coefficient of the net capital stock variable in the agricultural production function, the implied ICOR in agriculture is low at 1.4. Thus, there exists significant (nearly unitary) output response in Indian agriculture with respect to capital stock. It is interesting to note that there is a significant complementarity between outputs of agriculture and infrastructure, the latter acting as an essential input to the former. The same is also true for manufacturing and services. In the manufacturing sector, which includes mining and quarrying, the implied ICOR is very high at 27.0, indicative of low productivity of capital or high capital intensity. For the infrastructure sector, the implied ICOR seems to decline from 23.2 to 10.5 during pre- and post-reform periods. It reflects the relatively high capital intensity of this sector, but it is encouraging that the capital intensity has declined significantly (more than halved) during post-reform period. The implied ICOR of the services sector is low at 2.5. In three of the

sectors, public investment variable has a positive coefficient in the respective private investment equations and sets the stage for crowding-in effect between public and private investments in them. However, the infrastructure sector seems to exhibit significant crowding-out phenomenon. The resource-gap variable also seems to contribute to this phenomenon in sectors other than agriculture. The real interest rate (current or lagged) seems to be significant despite it being regulated by the central bank until recently. It is interesting to notice significant cross complementarity between private investments in infrastructure and all the other three sectors as well.

From the estimated money supply equation, with the increase in reserve money, the money supply will go up by 1.3%, more than proportionately (money multiplier). As expected, CRR has an inverse relationship with money supply, the partial elasticity being 0.4. Government nominal revenue from direct taxes and indirect taxes as well as non-tax revenue seem to increase with income. Government consumption expenditure also increases with income. The export supply (demand), import demand functions and nominal bilateral exchange rate equations all have expected signs for their determinants.

As expected, the head count (poverty) ratio is inversely related to per capita real income in both rural and urban areas. The partial elasticity is 0.6 in rural and 0.8 in urban areas of India. This seems to be the broad linkage between economic growth and poverty reduction. It underlies the familiar 'trickle down' hypothesis, with all its limitations. In reality, the nature and extent of (absolute) poverty depends on several socio-economic factors, real income being only one of them.

Simulation methodology:

To assess the empirical adequacy of the full model in describing the historical data, EViews package was used to solve the 74 relations together iteratively for each year with deterministic simulation and dynamic solving options for the entire sample period, 1981-82 to 2002-03. The simulated values for the above period are also called the 'base simulation' values. Assessment of the full model was done by (a) comparing the time series plots of actual and base simulation values and (b) computing the summary measures, mean absolute percentage error (MAPE) and root mean square percentage error (RMPE). Based on all these three criteria, the base simulation was found to trace the historical data quite well. Due to limitation of space, these details are omitted here.

The allocative and dynamic effects due to the above exogenous/policy change are quantified as percentage changes, also known as multipliers, with reference to base simulation values. They are reported only at four points of time, namely response in the same year of exogenous change (immediate or instantaneous or impact), response after one year (short-term), response between 1-5 years (medium term) and response between 1-20 years (long-term). Since the responses change each year rather slowly, the short-term, medium-term and long-term responses are simple (cumulative) averages of the respective time periods. In the case of head count ratio, rate of inflation, rate of interest and trade balance, the impacts are changes in level, not rates of change. It may be mentioned that these percentage responses are contemporaneous in nature (policy simulation vs. base simulation) and should not be treated as usual percentage rate of change over time. These responses therefore are likely to be different from the direct responses (both partial and net) implied by the estimated equations. The results of counterfactual simulations are discussed below.

Counterfactual Policy Simulations:

Thus, from the signs, magnitudes, t-ratios of the coefficients and goodness of fit measures of all the equations in the model, we infer that there is considerable simultaneity in the macro economic relationships and the model is indeed a simultaneous system. Further, due to several endogenous lags, the model is truly dynamic in nature and impacts of any exogenous change will be spread over time. There will be both short- and long-run responses, which will enable us to analyze counter factual policy simulations.

The estimated model thus indicated significant crowding-in effect between private and public sector investment in agriculture, manufacturing and services sectors. Importantly, the infrastructure sector shows crowding-out between public and private sector investments. Also, there are significant complementarities between public sector investments in infrastructure and all other sectors. The main purpose of this paper is to analyze the impacts of hypothetical sustained[11] change(s) in public sector real investment in the infrastructure sector financed through different sources like (a) borrowing from commercial banks, (b) net capital inflows, and (c) reducing govt. current expenditure. The macro economic effects of few other policy scenarios relating to (i) shifting public investment from

[11] Some analysts prefer to hypothesize one-period or shock-type exogenous change. If the underlying estimated model is dynamically stable, the impacts of any one-period exogenous change should decay over time and all the endogenous variables return to base simulation levels. In other words, shock-type simulations are inappropriate for studying long-term policy effects. The present model confirmed this property.

manufacturing/service sectors to agriculture, (ii) reducing CRR and (iii) decline in world income due to global economic crisis are also attempted[12]. The policy simulation can be done for any sample period or even post-sample period. Here, the period 1981-'82 to 2005-'06 is chosen to have long enough time for the stabilization of impacts.

The 11th Plan document advocated 30% increase in total public investment or equivalently 70% increase in infrastructure investment to achieve a GDP growth of 8%. However, in view of the global economic crisis and the recent slowing down of the Indian economy, counter factual simulation with sustained 10% increase in public sector investment in infrastructure is only attempted here, under different financing options.

Sustained 10% increase in public sector real investment in infrastructure sector financed through borrowing from commercial banks:

It is hypothesized that the govt. will raise the necessary investment resources through borrowing from commercial banks. In this simulation, therefore, both the exogenous variables, real public investment in infrastructure (PCFINF) and commercial bank credit to govt. (BCG) are increased by the same amount after price adjustment. Since BCG is in nominal terms, the amount of bank credit to govt. is expressed in current prices using public sector infrastructure investment deflator (PGKINF). Assuming competing needs for money, in other words 'liquidity crunch', the bank credit that was available to commercial sector earlier (in base simulation) will be lesser in the policy simulation by the amount borrowed by the govt. for investment in the infrastructure sector. Such a policy will reduce the reserve bank credit to the govt. and thereby reserve money and money supply. Changes in money supply will trigger several other changes in the economy. A sustained 10% increase in real public investment in infrastructure[13], envisaged as above, has both short- and long-run effects on all the sectors of the Indian economy. The impacts and the dynamic multipliers are given in Table-1.

[12] In order to ensure the symmetry of impacts for each exogenous variable, both an increase and a decrease in that variable have been attempted separately. We found that the impacts are numerically identical except for the sign change. Further, the simulation impacts due to different exogenous variables are also fully additive.

[13] This constitutes Rs. 1794 crores in 1981-82 and Rs. 3747 crores in 2002-03 at 1993-94 prices. These expenditures, in nominal terms, are 2.4% and 1.6% of govt. total revenue; 0.4% and 0.3% of GDP in respective years. From the past experience, during 1993-03, both public and private investments in infrastructure have grown at 2% p.a. The average investment growth was higher at 3.9% and 5.9% during 1980-03 in the public and private sectors. The investment projections in infrastructure made by the 'Expert Group' for public and private sectors are much higher than what we are postulating. However, some analysts (e.g. Sastry et. al., 2003) believe that sustained public investment may not be possible under the present circumstances of resource crunch in the economy.

Impacts:

From the estimated model, it can be seen that public investment in infrastructure will affect private investment in that sector only with a one-year lag. This probably is due to gestation lags and delays. However, there is another important channel namely the monetary (or interest rate) channel, which can bring about crowding-in or crowding-out depending on the sign and magnitude of the coefficient. Yet another channel is the output price channel, which is highly significant here.

The immediate impact of the 10% increase in real public investment in infrastructure in 1981-82 financed by commercial bank credit will be on private investment. Higher credit flows to government seem to crowd-out (reduce) real private investment in infrastructure, manufacturing and services by 5.8%, 7.7% and 4.6% respectively compared to base simulation. The private disinvestment in infrastructure has increased from Rs. -66,723 crores to Rs. -70,622 crores in 1981-82. Likewise, the disinvestment in manufacturing has increased from Rs. -48,856 crores to Rs. -52,622 crores. The service sector seems to absorb the maximum crowding-out effect namely from Rs -84,122 crores to Rs. -87,952 crores. of additional real public investment. However, there is a sizable increase in real private investment in agriculture from Rs. 13,051 crores to Rs. 13,657 crores, i.e. by 4.6%, leading to a net decrease in the total private investment of Rs. 10,889 crores, i.e. by 5.8% in the first year. Thus, there is a reallocation of private investment from infrastructure, manufacturing and services to agriculture. Due to this policy change, public sector resource gap will increase by 4.6% and fiscal deficit by 1.9%.

Due to one-period lag for the net capital stock variable in the production function for the infrastructure sector, the output will increase only with a lag. Due to decrease in investment, aggregate demand in the economy will decrease by 0.4%, which in turn decreases manufacturing output (0.5%) and thereby total real output will decrease marginally (0.1%). Real private consumption seems to be declining negligibly.

Increase in commercial bank credit to government will have an adverse effect on net RBI credit to government there by reducing reserve money and money supply (2.4%). Wholesale prices in all sectors seem to fall as the money supply as a ratio to real output has decreased. The price deflators in all sectors which are positively linked to respective sectoral wholesale prices will fall, causing a small decline in wholesale price index for all commodities (0.6%).

The GDP deflator also declines (1.0%), resulting in a nearly equal decrease in nominal output (1.1%). Interest rate (PLR), computed using inverse demand function for money, is nearly unaffected despite changes in its determinants. Government total expenditure increases marginally by 0.7% due to increase in public investment but decrease in government consumption (1.1%) and current expenditure (0.6%). Government revenues seems to decrease by 1.2% due to fall in all its components - direct (8.4%) and indirect (0.8%) tax and non-tax revenue (4.5%) in view of decline in nominal income (1.1%).

The unit value of exports (exports price) seems to increase negligibly (0.1%) as the domestic price decreases in the first year. Hence, real exports are nearly unaffected, but real imports fell significantly (2.3%) due to rise in relative import price and fall in domestic absorption. The trade balance improves by Rs. 190 crores as a consequence. Due to fall in real income, rural/urban poverty ratios have increased negligibly. Thus, overall, the immediate effects of 10% increase in public investment in infrastructure financed through commercial bank credit are not very encouraging except for rise in private investment in agriculture and decline in all prices.

In the short-term (1981-83), the trends seem to continue in most of the variables, but the negative effects get dampened. Sustained increase in real public investment in infrastructure continues to crowd-out private investment in infrastructure more strongly (22.3%) in the short-term. However, the level of crowding-out has reduced from first year to short-term. Nevertheless, private investment (disinvestment) in all other sectors has increased (decreased) due to complementarity causing total private disinvestment to decrease by 3.2%. Real output in agriculture alone has increased negligibly (1%), but it has decreased in all other three sectors- manufacturing (0.2%), infrastructure (0.1%) and services (0.7%). Aggregate real output therefore decreased by 0.2% in the short-term. Public sector resource gap (5.3%) and fiscal deficit (2.8%) seem to continue their rising trend in the short-term also. Average money supply has decreased from Rs. 50,979 crores to Rs. 50,706 crores i.e. by 0.5%. Interest rate seems to decline by 0.1% due to decline in real output and lagged inflation. The external sector and poverty ratios are nearly unaffected and remain as those in base simulation.

The medium-term effects look much better- moving towards positive benefits to the Indian economy. The aggregate real income goes-up by 0.3% compared to decline both in immediate and after one-year (short-term). There has been improvement in private

investment/disinvestment in all the four sectors, both in absolute magnitude and rate of change compared to the short-term. This naturally has led to increase in real output aswell. The real aggregate GDP has increased by 0.3% over the base simulation. The GDP deflator and the nominal output also have recorded an increase. Due to the 10% sustained increase in real public investment in infrastructure, fiscal deficit and money supply will increase, which will trigger some mild price rise (0.5%) and inflation (0.3%). Unlike in the previous time period, the poverty ratios have declined marginally (0.1%).

In the long run (1981-2002), due to a 10% sustained increase in public investment in infrastructure crowds-out private investment in infrastructure by 9.8%. However, there will be crowding-in in all the three other sectors- agriculture (6.8%), manufacturing (4.2%) and services (4.3%). Aggregate real output has increased by 2.4% with highest increase in infrastructure (3.0%) compared to other sectors. Aggregate demand seems to increase at a faster rate with increased aggregate investment (4.0%). Both public sector resource gap (1.8%) and fiscal deficit (2.2%) slow down than in both short and medium-terms. However, both government consumption (2.8%) and revenues (3.1%) seem to increase faster in the long-term. Money supply increases faster by 3.3% over base simulation, which leads to a marginal increase in wholesale prices (0.4%) through its components- wholesale prices of agriculture (0.1%), manufacturing (0.4%) and fuel, power, and lubricants (0.4%). In the external sector, both real exports (2.3%) and real imports (4.6%) have increased. Head count ratios in both rural and urban areas have declined by 0.6%.

Few other alternative simulations are also attempted aimed at raising the necessary resources for public investment through utilizing (i) net capital inflows (capital account balance of BOP), (ii) reducing govt. current expenditure, (iii) shifting public investment from manufacturing/service sectors to agriculture, (iv) reducing CRR and (v) decline in world income due to global economic crisis are also attempted. Among these, financing of public investment through net capital inflows and reduction in govt. current expenditure shows similar but much smaller benefits to the economy. Finally, a 2% decline in world income due to global economic crisis will reduce the real GDP by 0.6% and increase poverty level by 0.4% in India[14].

[14] Some recent studies (e.g. Himanshu 2006) aimed at decomposing the rate of decline in poverty into growth, inequality and population components indicate that the economic growth is the largest contributor to decline in poverty in urban India. However, some other analysts (e.g. Panda 2006) argue that growth may only be a necessary but not sufficient condition for poverty reduction.

Summary and Conclusions:

This study has analyzed the likely macro economic effects of changes in public investment in infrastructure in India. The quantified effects include the allocative and dynamic responses of the chosen policy change on important macro economic variables relating to four broad sectors- real, fiscal, monetary and external sectors of the Indian economy. The real sector further decomposed into four sub-sectors, agriculture, manufacturing, infrastructure and services. The sign and magnitude of the effects vary over time- immediate to long- run.

Briefly, the estimated model indicated significant crowding-in effect between private and public sector investment in agriculture, manufacturing, and services sectors. However there is a significant crowding-out in infrastucture sector. This has important consequences for investment/disinvestment policies of the govt. in each of these sectors. Sustained increase in public investment in infrastructure was found to stimulate sizable increase in private investment in all other sectors. Such a policy is expected to result in wide spread changes in the fiscal and monetary sectors of the economy. Thus, public sector investment in infrastructure has the potential to provide the much-needed push and accelerate the growth process of the Indian economy.

A 10% sustained increase in public sector investment in infrastructure (about Rs. 3747 crores in 2002-03 at 1993-94 prices), financed through borrowing from commercial banks, will enable the Indian economy to grow at an additional 2.4% in the long run (above the baseline). As seen in Table-5, in terms of compound growth rate, this increase is only 0.2% in aggregate real GDP growth per annum over the 20 year period[15]. Therefore, in order to achieve an additional 1% real GDP growth, a sustained 50% increase in public sector investment in infrastructure may be needed. This increase is less than the 70% growth in public investment in infrastructure suggested in the 11th Five-year plan document. Further, such growth is non-inflationary and welfare improving through higher govt. revenue and 0.6% reduction in poverty in rural and urban areas. There will be a little additional expenditure on the govt. side, but we believe that such investment is quite feasible and cost effective. An alternative

[15] Shetty, 2001 suggests that the banking system can provide additional resources to the extent of Rs. 15,000-16,000 crores p.a. for infrastructure development in specific projects without causing inflation.

simulation wherein the govt. utilizes accumulated capital inflows instead of borrowing from commercial banks, gave similar results, with few changes in external and monetary sectors.

Table-1: Impacts of 10% sustained increase in public investment in infrastructure from 1981-82 onwards financed through bank credit to govt. (BCG)

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Nominal Income	Y	118.7	117.3	-1.1	145.5	145.3	-0.2	191.1	193.1	1.0	906.8	934.4	3.0
GDP Deflator	PGDP	0.3	0.3	-1.0	0.4	0.4	0.1	0.4	0.4	0.6	1.0	1.0	0.4
Real Income	YR	418.4	418.1	-0.1	406.2	405.4	-0.2	444.3	445.8	0.3	796.9	816.0	2.4
Agriculture	YAR	165.3	165.3	0.0	167.6	167.8	0.1	181.3	181.8	0.3	233.0	236.9	1.7
Manufacturing	YMNR	64.9	64.6	-0.5	69.8	69.7	-0.2	80.3	80.8	0.6	152.9	156.5	2.4
Infrastructure	YINFR	58.2	58.2	0.0	57.8	57.8	-0.1	61.2	61.3	0.2	116.8	120.3	3.0
Services	YSRR	130.1	130.1	0.0	110.9	110.1	-0.7	121.5	121.9	0.3	294.2	302.2	2.7
Real Private Investment	PITOTR	-186.6	-197.5	-5.8	22.7	21.9	-3.2	52.0	53.5	2.8	126.7	130.3	2.8
Agriculture	PIAGR	13.1	13.7	4.6	9.2	9.7	4.5	9.8	10.1	3.8	10.8	11.6	6.8
Manufacturing	PIMNR	-48.9	-52.6	-7.7	11.4	10.8	-5.7	27.3	27.9	2.1	65.1	67.9	4.2
Infrastructure	PIINFR	-66.7	-70.6	-5.8	3.2	2.5	-22.3	8.2	7.7	-6.4	15.0	13.5	-9.8
Services	PISRR	-84.1	-88.0	-4.6	-1.2	-1.0	18.3	6.8	7.8	15.0	35.8	37.3	4.3
Real Public Investment	PCFTOTR	50.5	52.3	3.6	52.2	54.1	3.5	55.5	57.4	3.5	68.9	71.9	4.3
Public Sector Saving (N)	GDSPUB	3.5	3.4	-3.1	5.8	5.8	-0.4	6.8	7.0	2.3	3.8	6.0	59.3
Public resource Gap	RGPUB	11.1	11.6	4.6	11.8	12.4	5.3	15.8	16.6	5.0	68.5	69.8	1.8
Gross Domestic Saving (N)	GDS	7.8	7.3	-7.0	20.8	20.8	0.2	31.8	32.9	3.3	247.2	256.4	3.7
Gross Capital Formation (N)	GCFADJ	5.2	4.5	-14.2	20.3	20.3	0.1	33.8	35.2	4.1	253.4	263.5	4.0
Real Private Consumption	PCR	388.8	388.6	0.0	383.8	383.6	0.0	404.8	405.9	0.3	587.5	598.1	1.8
Govt. Consumption (N)	GFCE	12.3	12.2	-1.1	15.7	15.7	-0.2	21.2	21.4	0.9	100.2	103.0	2.8
Govt. Current Expenditure(N)	GCE	21.2	21.0	-0.6	25.7	25.6	-0.1	36.2	36.4	0.5	196.9	199.7	1.4
Govt. Revenue (N)	TR	20.9	20.7	-1.2	27.0	26.9	-0.2	36.9	37.2	0.9	163.8	168.8	3.1

Table-1 (contd..): Impacts of 10% sustained increase in public investment in infrastructure from 1981-82 onwards financed through bank credit to govt. (BCG)

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Direct Taxes (N)	DT	0.7	0.7	-8.4	1.7	1.7	-1.0	3.2	3.3	2.4	32.0	33.2	3.6
Indirect Taxes (N)	IDT	19.6	19.4	-0.8	24.1	24.1	-0.1	31.6	31.8	0.7	117.8	121.2	2.8
Non-tax Revenue (N)	NTX	0.6	0.6	-4.5	1.1	1.1	-0.5	2.1	2.1	1.9	14.0	14.5	4.0
Fiscal Deficit (N)	GFD	12.6	12.8	1.9	13.5	13.9	2.8	17.6	18.3	4.0	80.3	82.1	2.2
Money Supply	M3	37.3	36.4	-2.4	51.0	50.7	-0.5	79.7	81.1	1.8	552.0	570.1	3.3
Interest rate (N)	PLR	16.3	16.3	0.0	12.5	12.4	-0.1	13.7	13.8	0.1	14.2	14.3	0.2
Wholesale price index	P	0.3	0.3	-0.6	0.4	0.4	-0.1	0.4	0.4	0.5	1.0	1.0	0.4
Inflation rate	INFL	-8.4	-9.0	-0.6	8.2	8.5	0.3	8.4	8.6	0.3	7.1	7.1	0.0
Real Exports	EXPTR	27.5	27.5	0.0	27.5	27.5	0.0	28.3	28.4	0.1	79.2	81.1	2.3
Real Imports	IMPTR	19.7	19.2	-2.3	24.5	24.5	-0.3	29.8	30.4	2.3	87.1	91.1	4.6
Unit Value of Exports	UVEXP	0.3	0.3	0.1	0.3	0.3	0.0	0.3	0.3	0.0	0.8	0.8	2.1
Trade Balance	TB	-0.9	-0.7	0.2	-2.8	-2.8	0.0	-5.0	-5.3	-0.3	-15.7	-16.0	-0.4
Head Count Ratio-Rural (%)	HCRRUR	47.2	47.2	0.0	47.2	47.3	0.0	45.4	45.4	-0.1	37.4	36.8	-0.6
Head Count Ratio-Urban (%)	HCRURB	42.1	42.1	0.0	42.9	42.9	0.0	42.0	41.9	-0.1	34.1	33.4	-0.6

*: Rs. '000 crores, except for GDP deflators, price level, rate of inflation, rate of interest, unit value of exports and exchange rate. N: Nominal, i.e. current prices. #: Changes in level.
BS: Base simulation; PS: Policy simulation.

Table-2: Impacts of 10% sustained increase in public investment in infrastructure from 1981-82 onwards financed through net capital inflows (NCIF)

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Nominal Income	Y	118.7	117.3	-1.1	145.5	144.3	-0.8	191.1	190.4	-0.4	906.8	920.6	1.5
GDP Deflator	PGDP	0.3	0.3	-1.0	0.4	0.4	-0.5	0.4	0.4	-0.1	1.0	1.0	0.0
Real Income	YR	418.4	418.1	-0.1	406.2	405.1	-0.3	444.3	443.3	-0.2	796.9	806.5	1.2
Agriculture	YAR	165.3	165.3	0.0	167.6	167.8	0.1	181.3	181.9	0.3	233.0	237.2	1.8
Manufacturing	YMNR	64.9	64.6	-0.5	69.8	69.4	-0.6	80.3	79.9	-0.5	152.9	153.6	0.4
Infrastructure	YINFR	58.2	58.2	0.0	57.8	57.8	-0.1	61.2	61.2	-0.1	116.8	119.3	2.1
Services	YSRR	130.1	130.1	0.0	110.9	110.1	-0.7	121.5	120.3	-1.0	294.2	296.4	0.7
Real Private Investment	PITOTR	-186.6	-197.5	-5.8	22.7	16.6	-26.8	52.0	49.2	-5.4	126.7	125.6	-0.9
Agriculture	PIAGR	13.1	13.7	4.6	9.2	9.7	5.3	9.8	10.2	4.9	10.8	11.7	7.6
Manufacturing	PIMNR	-48.9	-52.6	-7.7	11.4	9.0	-21.5	27.3	26.1	-4.6	65.1	64.9	-0.3
Infrastructure	PIINFR	-66.7	-70.6	-5.8	3.2	1.1	-67.3	8.2	6.8	-16.3	15.0	13.2	-12.0
Services	PISRR	-84.1	-88.0	-4.6	-1.2	-3.2	-154.8	6.8	6.1	-10.3	35.8	35.8	0.2
Real Public Investment	PCFTOTR	50.5	52.3	3.6	52.2	54.1	3.5	55.5	57.4	3.5	68.9	71.9	4.3
Public Sector Saving (N)	GDSPUB	3.5	3.4	-3.1	5.8	5.7	-1.8	6.8	6.8	-0.9	3.8	4.8	27.8
Public resource Gap	RGPUB	11.1	11.6	4.6	11.8	12.4	5.2	15.8	16.6	5.1	68.5	70.7	3.2
Gross Domestic Saving (N)	GDS	7.8	7.3	-7.0	20.8	20.1	-3.1	31.8	31.2	-1.9	247.2	247.8	0.3
Gross Capital Formation (N)	GCFADJ	5.2	4.5	-14.2	20.3	19.4	-4.2	33.8	33.1	-2.2	253.4	253.5	0.0
Real Private Consumption	PCR	388.8	388.6	0.0	383.8	383.5	-0.1	404.8	404.6	0.0	587.5	593.2	1.0
Govt. Consumption (N)	GFCE	12.3	12.2	-1.1	15.7	15.6	-0.8	21.2	21.1	-0.4	100.2	101.5	1.3
Govt. Current Expenditure(N)	GCE	21.2	21.0	-0.6	25.7	25.5	-0.5	36.2	36.1	-0.2	196.9	198.2	0.7
Govt. Revenue (N)	TR	20.9	20.7	-1.2	27.0	26.7	-0.9	36.9	36.7	-0.4	163.8	166.2	1.4

Table-2 (contd..): Impacts of 10% sustained increase in public investment in infrastructure from 1981-82 onwards financed

through net capital inflows (NCIF).

		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Direct Taxes (N)	DT	0.7	0.7	-8.4	1.7	1.7	-3.5	3.2	3.2	-1.5	32.0	32.4	1.4
Indirect Taxes (N)	IDT	19.6	19.4	-0.8	24.1	24.0	-0.6	31.6	31.5	-0.3	117.8	119.5	1.4
Non-tax Revenue (N)	NTX	0.6	0.6	-4.5	1.1	1.1	-2.2	2.1	2.1	-0.7	14.0	14.2	2.0
Fiscal Deficit (N)	GFD	12.6	12.8	1.9	13.5	13.9	2.7	17.6	18.3	4.0	80.3	83.2	3.6
Money Supply	M3	37.3	36.4	-2.4	51.0	50.1	-1.8	79.7	79.2	-0.6	552.0	560.4	1.5
Interest rate (N)	PLR	16.3	16.3	0.0	12.5	12.4	-0.1	13.7	13.7	0.0	14.2	14.3	0.1
Wholesale price index	P	0.3	0.3	-0.6	0.4	0.4	-0.5	0.4	0.4	-0.2	1.0	1.0	0.1
Inflation rate	INFL	-8.4	-9.0	-0.6	8.2	8.0	-0.2	8.4	8.4	0.1	7.1	7.1	0.0
Real Exports	EXPTR	27.5	27.5	0.0	27.5	27.5	0.0	28.3	28.3	-0.2	79.2	80.2	1.2
Real Imports	IMPTR	19.7	19.2	-2.3	24.5	24.1	-1.9	29.8	29.4	-1.2	87.1	88.3	1.4
Unit Value of Exports	UVEXP	0.3	0.3	0.1	0.3	0.3	0.1	0.3	0.3	-0.2	0.8	0.8	1.0
Trade Balance	TB	-0.9	-0.7	0.2	-2.8	-2.6	0.2	-5.0	-4.9	0.1	-15.7	-15.0	0.7
Head Count Ratio-Rural (%)	HCRRUR	47.2	47.2	0.0	47.2	47.3	0.0	45.4	45.5	0.0	37.4	37.1	-0.3
Head Count Ratio-Urban (%)	HCRURB	42.1	42.1	0.0	42.9	42.9	0.0	42.0	42.0	0.0	34.1	33.8	-0.3

*: Rs. '000 crores, except for GDP deflators, price level, rate of inflation, rate of interest, unit value of exports and exchange rate. N: Nominal, i.e. current prices. #: Changes in level.
BS: Base simulation; PS: Policy simulation.

Table-3: Impacts of 10% sustained increase in public investment in agriculture from 1981-82 onwards financed through equivalent govt. disinvestment in manufacturing.

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Nominal Income	Y	118.7	118.7	0.1	145.5	145.7	0.1	191.1	191.6	0.3	906.8	913.3	0.7
GDP Deflator	PGDP	0.3	0.3	0.1	0.4	0.4	0.0	0.4	0.4	-0.1	1.0	1.0	-0.2
Real Income	YR	418.4	418.4	0.0	406.2	406.4	0.1	444.3	445.8	0.3	796.9	803.2	0.8
Agriculture	YAR	165.3	165.3	0.0	167.6	167.9	0.1	181.3	182.9	0.9	233.0	240.9	3.4
Manufacturing	YMNR	64.9	64.9	0.0	69.8	69.8	-0.1	80.3	80.1	-0.2	152.9	152.8	-0.1
Infrastructure	YINFR	58.2	58.2	0.0	57.8	57.8	0.0	61.2	61.2	0.0	116.8	116.6	-0.2
Services	YSRR	130.1	130.1	0.0	110.9	110.9	0.1	121.5	121.5	0.0	294.2	293.0	-0.4
Real Private Investment	PITOTR	-186.6	-187.1	-0.3	22.7	22.0	-3.1	52.0	50.9	-2.2	126.7	126.4	-0.2
Agriculture	PIAGR	13.1	13.0	-0.1	9.2	9.7	4.8	9.8	10.5	8.0	10.8	11.9	10.0
Manufacturing	PIMNR	-48.9	-49.9	-2.2	11.4	10.1	-11.2	27.3	25.8	-5.6	65.1	64.1	-1.7
Infrastructure	PIINFR	-66.7	-66.5	0.4	3.2	3.3	1.7	8.2	8.0	-1.9	15.0	14.9	-0.7
Services	PISRR	-84.1	-83.8	0.4	-1.2	-1.2	6.6	6.8	6.5	-3.5	35.8	35.6	-0.6
Real Public Investment	PCFTOTR	50.5	50.5	0.0	52.2	52.2	0.0	55.5	55.5	0.0	68.9	68.9	0.0
Public Sector Saving (N)	GDSPUB	3.5	3.5	0.2	5.8	5.8	0.2	6.8	6.9	0.3	3.8	4.1	9.1
Public resource Gap	RGPUB	11.1	11.1	0.0	11.8	11.8	0.0	15.8	15.7	-0.3	68.5	68.1	-0.6
Gross Domestic Saving (N)	GDS	7.8	7.8	-0.5	20.8	20.7	-0.5	31.8	31.4	-1.3	247.2	246.7	-0.2
Gross Capital Formation (N)	GCFADJ	5.2	5.2	-1.0	20.3	20.2	-0.6	33.8	33.4	-1.4	253.4	252.3	-0.4
Real Private Consumption	PCR	388.8	388.8	0.0	383.8	383.9	0.0	404.8	405.5	0.2	587.5	590.9	0.6
Govt. Consumption (N)	GFCE	12.3	12.3	0.1	15.7	15.7	0.1	21.2	21.2	0.1	100.2	100.6	0.4
Govt. Current Expenditure(N)	GCE	21.2	21.2	0.0	25.7	25.7	0.0	36.2	36.2	0.1	196.9	197.3	0.2
Govt. Revenue (N)	TR	20.9	20.9	0.1	27.0	27.0	0.1	36.9	36.9	0.1	163.8	164.6	0.5

Table-3 (contd..): Impacts of 10% sustained increase in public investment in agriculture from 1981-82 onwards financed through equivalent govt . disinvestment in manufacturing.

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Direct Taxes (N)	DT	0.7	0.7	0.5	1.7	1.7	0.1	3.2	3.2	-0.4	32.0	31.9	-0.5
Indirect Taxes (N)	IDT	19.6	19.6	0.0	24.1	24.1	0.1	31.6	31.6	0.2	117.8	118.6	0.7
Non-tax Revenue (N)	NTX	0.6	0.6	0.3	1.1	1.1	0.2	2.1	2.1	0.5	14.0	14.1	1.0
Fiscal Deficit (N)	GFD	12.6	12.6	0.0	13.5	13.5	0.0	17.6	17.5	-0.2	80.3	79.8	-0.6
Money Supply	M3	37.3	37.4	0.2	51.0	51.1	0.1	79.7	79.8	0.2	552.0	555.9	0.7
Interest rate (N)	PLR	16.3	16.3	0.0	12.5	12.5	0.0	13.7	13.7	0.0	14.2	14.2	0.1
Wholesale price index	P	0.3	0.3	0.0	0.4	0.4	0.0	0.4	0.4	-0.1	1.0	1.0	-0.1
Inflation rate	INFL	-8.4	-8.4	0.0	8.2	8.2	0.0	8.4	8.3	-0.1	7.1	7.1	0.0
Real Exports	EXPTR	27.5	27.5	0.0	27.5	27.5	0.0	28.3	28.4	0.2	79.2	79.9	0.8
Real Imports	IMPTR	19.7	19.6	-0.1	24.5	24.5	-0.1	29.8	29.8	0.0	87.1	87.7	0.6
Unit Value of Exports	UVEXP	0.3	0.3	0.0	0.3	0.3	0.0	0.3	0.3	0.3	0.8	0.8	0.8
Trade Balance	TB	-0.9	-0.9	0.0	-2.8	-2.8	0.0	-5.0	-5.0	0.0	-15.7	-15.0	0.7
Head Count Ratio-Rural (%)	HCRRUR	47.2	47.2	0.0	47.2	47.2	0.0	45.4	45.4	-0.1	37.4	37.2	-0.2
Head Count Ratio-Urban (%)	HCRURB	42.1	42.1	0.0	42.9	42.9	0.0	42.0	41.9	-0.1	34.1	33.8	-0.2

*: Rs. '000 crores, except for GDP deflators, price level, rate of inflation, rate of interest, unit value of exports and exchange rate. N: Nominal, i.e. current prices. #: Changes in level.
BS: Base simulation; PS: Policy simulation.

Table-4: Impacts of 10% sustained increase in public investment in agriculture from 1981-82 onwards financed through decrease in govt. current expenditure (CGE).

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Nominal Income	Y	118.7	118.0	-0.6	145.5	144.7	-0.6	191.1	189.9	-0.6	906.8	908.9	0.2
GDP Deflator	PGDP	0.3	0.3	-0.6	0.4	0.4	-0.6	0.4	0.4	-0.6	1.0	1.0	-0.9
Real Income	YR	418.4	418.6	0.0	406.2	406.2	0.0	444.3	444.3	0.0	796.9	803.9	0.9
Agriculture	YAR	165.3	165.3	0.0	167.6	167.8	0.1	181.3	181.9	0.4	233.0	237.5	1.9
Manufacturing	YMNR	64.9	65.0	0.2	69.8	69.9	0.1	80.3	80.3	0.0	152.9	154.0	0.7
Infrastructure	YINFR	58.2	58.2	0.0	57.8	57.8	0.0	61.2	61.2	-0.1	116.8	118.1	1.1
Services	YSRR	130.1	130.1	0.0	110.9	110.7	-0.2	121.5	120.9	-0.5	294.2	294.2	0.0
Real Private Investment	PITOTR	-186.6	-189.2	-1.4	22.7	20.0	-11.9	52.0	50.0	-3.8	126.7	126.5	-0.2
Agriculture	PIAGR	13.1	13.6	3.9	9.2	9.7	5.3	9.8	10.3	5.4	10.8	11.8	8.9
Manufacturing	PIMNR	-48.9	-48.7	0.3	11.4	11.3	-1.0	27.3	27.4	0.3	65.1	66.5	2.0
Infrastructure	PIINFR	-66.7	-69.0	-3.5	3.2	1.1	-66.2	8.2	6.3	-23.0	15.0	12.6	-15.8
Services	PISRR	-84.1	-85.0	-1.1	-1.2	-2.2	-73.4	6.8	6.1	-10.3	35.8	35.6	-0.5
Real Public Investment	PCFTOTR	50.5	52.3	3.6	52.2	54.1	3.5	55.5	57.4	3.5	68.9	71.9	4.3
Public Sector Saving (N)	GDSPUB	3.5	4.1	16.0	5.8	6.4	10.4	6.8	7.5	10.2	3.8	7.0	84.4
Public resource Gap	RGPUB	11.1	11.0	-1.1	11.8	11.7	-0.8	15.8	15.7	-0.6	68.5	68.0	-0.8
Gross Domestic Saving (N)	GDS	7.8	7.9	1.9	20.8	20.7	-0.2	31.8	31.5	-1.1	247.2	248.3	0.4
Gross Capital Formation (N)	GCFADJ	5.2	5.4	3.7	20.3	20.3	-0.1	33.8	33.5	-1.0	253.4	253.9	0.2
Real Private Consumption	PCR	388.8	388.8	0.0	383.8	384.0	0.1	404.8	405.1	0.1	587.5	591.8	0.7
Govt. Consumption (N)	GFCE	12.3	12.3	-0.6	15.7	15.6	-0.6	21.2	21.1	-0.6	100.2	100.2	0.1
Govt. Current Expenditure(N)	GCE	21.2	20.5	-3.3	25.7	24.9	-3.0	36.2	35.3	-2.6	196.9	193.8	-1.5
Govt. Revenue (N)	TR	20.9	20.8	-0.6	27.0	26.8	-0.6	36.9	36.6	-0.7	163.8	163.9	0.1

Table-4 (contd..): Impacts of 10% sustained increase in public investment in agriculture from 1981-82 onwards financed through decrease in govt. current expenditure (CGE).

Variable/Year		1981-82			1981-83			1981-85			1981-2002		
		BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev	BS	PS	% Dev
Direct Taxes (N)	DT	0.7	0.7	-4.3	1.7	1.7	-2.3	3.2	3.2	-2.1	32.0	31.9	-0.4
Indirect Taxes (N)	IDT	19.6	19.5	-0.4	24.1	24.0	-0.4	31.6	31.4	-0.5	117.8	118.1	0.2
Non-tax Revenue (N)	NTX	0.6	0.6	-2.3	1.1	1.1	-1.5	2.1	2.1	-1.2	14.0	14.0	0.3
Fiscal Deficit (N)	GFD	12.6	12.5	-0.4	13.5	13.5	-0.5	17.6	17.5	-0.5	80.3	79.8	-0.7
Money Supply	M3	37.3	36.8	-1.4	51.0	50.3	-1.4	79.7	78.5	-1.5	552.0	549.3	-0.5
Interest rate (N)	PLR	16.3	16.3	0.0	12.5	12.4	0.0	13.7	13.7	-0.1	14.2	14.3	0.2
Wholesale price index	P	0.3	0.3	-0.4	0.4	0.4	-0.5	0.4	0.4	-0.6	1.0	1.0	-0.7
Inflation rate	INFL	-8.4	-8.7	-0.3	8.2	7.9	-0.3	8.4	8.2	-0.2	7.1	7.1	0.0
Real Exports	EXPTR	27.5	27.5	0.0	27.5	27.5	0.0	28.3	28.3	0.0	79.2	80.1	1.0
Real Imports	IMPTR	19.7	19.8	0.6	24.5	24.6	0.4	29.8	29.8	0.0	87.1	88.2	1.2
Unit Value of Exports	UVEXP	0.3	0.3	0.0	0.3	0.3	0.1	0.3	0.3	0.2	0.8	0.8	1.1
Trade Balance	TB	-0.9	-0.9	0.0	-2.8	-2.8	0.0	-5.0	-5.0	0.0	-15.7	-15.0	0.7
Head Count Ratio-Rural (%)	HCRRUR	47.2	47.2	0.0	47.2	47.2	0.0	45.4	45.4	0.0	37.4	37.2	-0.2
Head Count Ratio-Urban (%)	HCRURB	42.1	42.1	0.0	42.9	42.9	0.0	42.0	42.0	0.0	34.1	33.8	-0.2

*: Rs. '000 crores, except for GDP deflators, price level, rate of inflation, rate of interest, unit value of exports and exchange rate. N: Nominal, i.e. current prices. #: Changes in level.
BS: Base simulation; PS: Policy simulation.

Table-6: Long-run compound growth rates of endogenous variables (%) in base and different policy simulations over 1981-2002

Variable	Base simulation	PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7
Aggregate Demand	**5.8**	**5.9**	**5.9**	**5.9**	**5.9**	**5.8**	**5.6**	**5.7**
Nominal Output (Y)	**15.0**	**15.2**	**15.2**	**15.2**	**15.1**	**15.1**	**14.9**	**15.0**
Real Output (YR)	**6.3**	**6.5**	**6.5**	**6.5**	**6.4**	**6.4**	**6.2**	**6.3**
Agriculture (YAR)	**2.7**	**2.9**	**2.9**	**2.9**	**2.9**	**2.9**	**2.7**	**2.7**
Manufacturing (YMNR)	**6.9**	**7.0**	**7.1**	**7.0**	**7.0**	**6.9**	**6.7**	**6.8**
Infrastructure (YINFR)	**7.1**	**7.4**	**7.4**	**7.3**	**7.2**	**7.1**	**7.0**	**7.1**
Services (YSRR)	**9.1**	**9.2**	**9.2**	**9.2**	**9.1**	**9.0**	**8.7**	**9.0**
Private Investment (PITOTR)	**5.1**	**5.2**	**5.2**	**5.3**	**5.4**	**5.3**	**6.3**	**4.9**
Agriculture (PIAGR)	**2.7**	**3.0**	**2.9**	**2.9**	**2.9**	**2.7**	**2.6**	**2.7**
Manufacturing (PIMNR)	**5.9**	**6.1**	**6.0**	**6.1**	**6.1**	**6.1**	**6.7**	**5.6**
Infrastructure (PIINFR)	**1.4**	**3.7**	**4.3**	**2.7**	**-0.5**	**1.6**	**8.3**	**1.1**
Services (PISRR)	**4.9**	**4.6**	**4.6**	**5.0**	**5.4**	**5.1**	**3.2**	**4.7**
Real Private Consumption (PCR)	**4.4**	**4.5**	**4.5**	**4.5**	**4.4**	**4.4**	**4.3**	**4.3**
Public Investment (PCFTOTR)	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**	**2.2**
Government Consumption (GFCE)(N)	**15.3**	**15.4**	**15.4**	**15.4**	**15.3**	**15.3**	**15.1**	**15.2**
Government Revenues (TR) (N)	**14.5**	**14.6**	**14.7**	**14.7**	**14.6**	**14.5**	**14.4**	**14.4**
Wholesale Price Index (P)	**7.7**	**7.6**	**7.6**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**
Money Supply (M3)	**18.1**	**18.2**	**18.2**	**18.3**	**18.2**	**18.1**	**17.9**	**17.9**
Real Exports (EXPTR)	**11.0**	**11.1**	**11.1**	**11.1**	**11.1**	**11.0**	**10.8**	**10.9**
Real Imports (IMPTR)	**11.0**	**11.0**	**11.1**	**11.2**	**11.1**	**11.0**	**10.2**	**10.9**

PS-1: Without any financing source; PS-2: Financed through commercial bank credit; PS-3: Financed through net capital inflows; PS-4: Financed through govt. current expenditure; PS-5: 10% Sustained increase in public investment in agriculture financed through disinvestment in manufacturing; PS-6: 2% Sustained decrease in CRR; PS-7: 2% Sustained decrease in world real income.

Table-5: Long-run impacts of 10% sustained increase in public investment in infrastructure financed through alternative sources

Variable		BS (Mean value)	% Dev. of Policy Sim. from Base Sim.						
			PS-1	PS-2	PS-3	PS-4	PS-5	PS-6	PS-7
Nominal Income	Y	906.8	3.2	3.0	1.5	0.2	0.7	0.0	-1.2
GDP Deflator	PGDP	1.0	0.4	0.4	0.0	-0.9	-0.2	-0.4	-0.5
Real Income	YR	796.9	2.6	2.4	1.2	0.9	0.8	0.5	-0.6
Agriculture	YAR	233.0	1.7	1.7	1.8	1.9	3.4	0.2	0.0
Manufacturing	YMNR	152.9	2.7	2.4	0.4	0.7	-0.1	0.7	-1.0
Infrastructure	YINFR	116.8	3.2	3.0	2.1	1.1	-0.2	0.8	-0.4
Services	YSRR	294.2	3.0	2.7	0.7	0.0	-0.4	0.4	-0.9
Real Private Investment	PITOTR	126.7	3.3	2.8	-0.9	-0.2	-0.2	0.6	-2.6
Agriculture	PIAGR	10.8	6.8	6.8	7.6	8.9	10.0	0.6	0.5
Manufacturing	PIMNR	65.1	4.9	4.2	-0.3	2.0	-1.7	1.0	-2.9
Infrastructure	PIINFR	15.0	-9.5	-9.8	-12.0	-15.8	-0.7	1.2	-2.4
Services	PISRR	35.8	4.6	4.3	0.2	-0.5	-0.6	-0.3	-3.2
Real Public Investment	PCFTOTR	68.9	4.3	4.3	4.3	4.3	0.0	0.0	0.0
Public Sector Saving (N)	GDSPUB	3.8	62.2	59.3	27.8	84.4	9.1	-0.3	-24.9
Public resource Gap	RGPUB	68.5	1.6	1.8	3.2	-0.8	-0.6	-0.4	1.0
Gross Domestic Saving (N)	GDS	247.2	4.1	3.7	0.3	0.4	-0.2	0.1	-3.1
Gross Capital Formation (N)	GCFADJ	253.4	4.4	4.0	0.0	0.2	-0.4	0.1	-2.6
Real Private Consumption	PCR	587.5	1.9	1.8	1.0	0.7	0.6	0.3	-0.4
Govt. Consumption (N)	GFCE	100.2	2.9	2.8	1.3	0.1	0.4	0.0	-1.2
Govt. Current Expenditure(N)	GCE	196.9	1.5	1.4	0.7	-1.5	0.2	0.0	-0.6
Govt. Revenue (N)	TR	163.8	3.2	3.1	1.4	0.1	0.5	0.0	-1.3
Direct Taxes (N)	DT	32.0	3.8	3.6	1.4	-0.4	-0.5	-0.1	-1.7
Indirect Taxes (N)	IDT	117.8	3.0	2.8	1.4	0.2	0.7	0.0	-1.1
Non-tax Revenue (N)	NTX	14.0	4.2	4.0	2.0	0.3	1.0	0.0	-1.6
Fiscal Deficit (N)	GFD	80.3	2.0	2.2	3.6	-0.7	-0.6	-0.5	0.8
Money Supply	M3	552.0	3.4	3.3	1.5	-0.5	0.7	-0.2	-1.9
Interest rate (N)	PLR	14.2	0.2	0.2	0.1	0.2	0.1	0.0	0.0
Wholesale price index	P	1.0	0.3	0.4	0.1	-0.7	-0.1	-0.4	-0.3
Inflation rate	INFL	7.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
Real Exports	EXPTR	79.2	2.5	2.3	1.2	1.0	0.8	0.4	-1.4
Real Imports	IMPTR	87.1	5.1	4.6	1.4	1.2	0.6	0.9	-1.8
Unit Value of Exports	UVEXP	0.8	2.3	2.1	1.0	1.1	0.8	0.6	-2.1
Trade Balance	TB	-15.7	-0.4	-0.4	0.7	0.7	0.7	0.1	-1.2
Head Count Ratio-Rural (%)	HCRRUR	37.4	-0.6	-0.6	-0.3	-0.2	-0.2	-0.1	0.1
Head Count Ratio-Urban (%)	HCRURB	34.1	-0.7	-0.6	-0.3	-0.2	-0.2	-0.1	0.1

PS-1: Without any financing source; PS-2: Financed through commercial bank credit;
PS-3: Financed through net capital inflows; PS-4: Financed through govt. current expenditure;
PS-5: 10% Sustained increase in public investment in agriculture financed through disinvestment in manufacturing; PS-6: 2% Sustained decrease in CRR; PS-7: 2% Sustained decrease in world real income.

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Appendix-I

Table-1: Annual Average Compound Growth Rates (%) of important variables used in the model.

Variable	Annual Compound Growth Rate (%) during			
	(1980-89)	(1990-99)	(1980-03)	(1993-03)
Real Sector				
Nominal Income	13.9	15.2	14.5	12.4
GDP Deflator	8.1	8.5	8.4	6.1
Agriculture	8.1	9.4	9.0	6.5
Manufacturing	6.8	7.1	7.2	5.0
Infrastructure	10.9	9.3	9.4	5.7
Services	7.7	8.1	8.0	6.4
Real Income	5.4	6.2	5.7	6.0
Agriculture	3.0	3.2	3.0	2.2
Manufacturing	7.3	6.9	6.6	5.9
Infrastructure	5.4	6.8	6.5	8.0
Services	7.1	7.9	7.2	7.9
Real Income Per Capita	3.1	4.1	3.6	4.0
Real Private Consumption	4.1	5.0	4.5	5.2
Real Personal Disposable Income	6.6	7.0	6.5	7.1
Head count ratio- rural (%)	-4.3	-2.7	-2.7	-5.1
Head count ratio- urban (%)	-3.1	-4.3	-3.2	-4.7
Gross Domestic Savings (N)	16.2	15.4	16.2	12.7
Gross Investment (N)	16.8	16.1	15.6	11.7
Fiscal Sector				
Govt. Consumption (N)	7.7	6.4	5.9	7.0
Govt. Total Expenditure(N)	16.2	14.1	14.3	13.8
Govt. Revenue (N)	15.9	13.6	14.1	12.1
Direct Taxes (N)	14.5	18.9	17.2	15.2
Indirect Taxes (N)	16.5	12.1	13.4	11.1
Non-tax Revenue (N)	14.7	14.2	13.8	12.2
Fiscal Deficit (N)	18.7	15.8	15.4	17.2
Govt. Non-market Borrowings (N)	19.1	15.0	14.9	19.3
Monetary Sector				
Money Supply	17.3	17.4	17.2	16.6
Price Level	6.6	7.8	7.7	5.5
Rate of Inflation (%)	-4.9	-12.7	-3.0	-10.3
Rate of Interest (%)	0.8	-1.7	-0.8	-7.5

Appendix-I, Table-1 contd..

Table-1 (contd.): Annual Average Compound Growth Rates (%) of important variables used in the model.

Variable	Annual Compound Growth Rate (%) during			
	(1980-89)	(1990-99)	(1980-03)	(1993-03)
External Sector				
Real Exports Demand	5.1	10.8	9.5	10.6
Real Imports Demand	7.3	14.7	9.3	7.8
Unit Value of Exports	9.7	7.5	9.2	3.6
Exchange Rate (N, Rs./$)	7.6	9.1	9.4	5.7
Trade Balance (N) #	9.0	26.9	13.2	13.1
Real Total Investment	4.9	6.0	4.8	1.8
Public Investment	4.5	2.2	2.5	1.1
Agriculture	-3.9	-0.1	-2.1	-0.8
Manufacturing	7.3	0.1	-0.1	-4.7
Infrastructure	6.4	1.8	3.9	1.9
Services	3.3	5.1	3.7	3.6
Private Investment	5.3	8.2	6.3	2.3
Agriculture	2.6	3.5	4.2	4.8
Manufacturing	6.0	11.7	7.0	0.8
Infrastructure	5.3	5.2	5.9	2.0
Services	5.6	4.8	6.2	4.0
Real GDP Share (%)				
Agriculture	36.4	29.1	31.5	26.5
Manufacturing	17.6	19.4	18.6	19.6
Infrastructure	13.7	14.5	14.4	15.1
Services	32.3	37.0	35.5	38.8

Note: The annual average compound growth rate is computed using semi-logarithmic regression over time for each variable.
N: Nominal, i.e. current prices.
#: In absolute value.

Appendix-II

Description of variables:

Endogenous variables (Rs. '000 Crores):

1. ABSP: Real Private Absorption (NAS)
2. AD: Real Aggregate Absorption (NAS & RBI)
3. ADD: Real Aggregate Demand for domestically produced goods (NAS & RBI)
4. BCP: Bank Credit to Commercial Sector (Nominal) (RBI)
5. CAB: Current account balance (Nominal) (RBI)
6. DEPAG: Real Depreciation in Agriculture (NAS)
7. DEPINF: Real Depreciation in Infrastructure (NAS)
8. DEPMN: Real Depreciation in Manufacturing (NAS)
9. DEPSR: Real Depreciation in Services (NAS)
10. DT: Direct tax revenues (Nominal) (NAS)
11. EXPT: Exports (DGCI&S) (Nominal) (RBI)
12. EXPTBOP: Exports (Merchandise) (Nominal) (RBI)
13. EXPTR: Real Exports (DGCI&S) (RBI)
14. EXR: Exchange Rate against US $ (Nominal, Rs. /$) (RBI)
15. EXRIDX: Index of exchange rate –Rs./$ (Base: 1993-94=1.000)(Nominal)(RBI)
16. GCE: Govt. current expenditure (ADORC) (Nominal) (NAS)
17. GCFADJ: Gross domestic capital formation by type of assets(adj) (Nominal NAS)
18. GCFTOT: Gross domestic capital formation by using sectors(Nominal) (NAS)
19. GDS: Gross domestic savings (Nominal) (NAS)
20. GDSADORC: Gross domestic savings of ADORC (Nominal) (NAS)
21. GDSPUB: Gross domestic savings of public sector (Nominal) (NAS)
22. GFCE: Govt. Final consumption expenditure (doesn't include consumption of fixed capital) (ADORC) (Nominal) (NAS)
23. GFD: Gross Fiscal Deficit of both central and state govt. (Nominal) (RBI)
24. GXP: Govt. Total Expenditure (including current and capital) (ADORC) (Nominal) (NAS)
25. HCRRUR: Head count ratio in rural areas (%)
26. HCRURB: Head count ratio in urban areas (%)
27. IDT: Indirect tax revenues (Nominal) (NAS)
28. IMPT: Imports (DGCI&S) (Nominal) (RBI)
29. IMPTBOP: Imports (Merchandise) (Nominal) (RBI)
30. IMPTR: Real Imports(DGCI&S) (RBI)
31. KAGR: Real Net Capital Stock in Agriculture (NAS)
32. KINFR: Real Net Capital Stock in Infrastructure (NAS)
33. KMNR: Real Net Capital Stock in Manufacturing (NAS)
34. KSRR: Real Net Capital Stock in Services (NAS)
35. M3: Money Supply (Nominal) (RBI)
36. NTX: Non-tax revenues (including income from entrepreneurship and property and miscellaneous current receipts (Nominal) (NAS)
37. P: Wholesale Price Index (1993-94=1.0) (RBI)
38. PCFTOTR: Real aggregate public investment (NAS)
39. PCR: Real Private Consumption (NAS)
40. PGDP: GDP deflator (1993-94=1.0) (NAS)
41. PGKE: Implicit price deflator for public sector investment (1993-94=1.0) (NAS)
42. PIADJR: Real Aggregate private investment adjusted to errors & omissions (NAS)
43. PIAGR: Real gross private investment in agriculture (NAS)
44. PIINFR: Real gross private investment in infrastructure (NAS)
45. PIMNR: Real gross private investment in manufacturing (NAS)
46. PISRR: Real gross private investment in services (NAS)
47. PITOTR: Real aggregate private investment (NAS)

48. PLR: Prime lending ratio (RBI)
49. PNA: Price of non-agriculture sector (NAS)
50. PPIE: Implicit price deflator for public sector investment (1993-94=1.0) (NAS)
51. PRAG: Price deflator for Agriculture, forestry & fishing (Industry group 1 of NAS) (NAS)
52. PRINF: Price deflator for Infrastructure incl. electricity, gas, water supply; construction; transport, storage & communication (Industry groups 4, 5 and 7 of NAS) (NAS)
53. PRMN: Price Deflator for Manufacturing incl. mining & quarrying (Industry groups 2 and 3 of NAS) (NAS)
54. PRSR: Price Deflator for Services incl. all others (Industry groups 6, 8 and 9 of NAS) (NAS)
55. PYD: Personal disposable income (Nominal) (NAS)
56. PYDR: Real personal disposable income (NAS)
57. RBFA: Net Foreign Exchange Assets of RBI (Nominal) (RBI)
58. RCG: Reserve bank credit to the govt. (Nominal) (RBI)
59. RGPUB: Public sector resource gap (Nominal) (NAS)
60. RM: Reserve money (Nominal) (RBI)
61. TB: Trade balance (DGCI & S) (Nominal) (RBI)
62. TBBOP: Trade balance (Merchandise) (Nominal) (RBI)
63. TR: Govt. current revenues (ADORC) (Nominal) (NAS)
64. UVEXP: Unit Value of Exports (1993-94=1.0) (RBI)
65. WPAG: Wholesale Price Index for Agricultural Commodities(1993-94=1.0)(RBI)
66. WPFPLL: Wholesale Price Index for Minerals, Fuels Power, Light and Lubricants (1993-94=1.0) (RBI)
67. WPMN: Wholesale Price Index for Manufactured Products (1993-94=1.0) (RBI)
68. Y: Output at factor cost (Nominal) (NAS)
69. YAR: Real Output in Agriculture, forestry & fishing (Industry group 1 of NAS) (NAS)
70. YINFR: Real Output in Infrastructure incl. electricity, gas, water supply; construction; transport, storage & communication (Industry groups 4, 5 and 7 of NAS) (NAS)
71. YM: Gross Domestic Product at Market Prices (Nominal) (NAS)
72. YMNR: Real Output in Manufacturing incl. mining & quarrying (Industry groups 2 and 3 of NAS) (NAS)
73. YNAR: Real Output in Non-Agriculture Sector (=YMNR+YINFR+YSRR) (NAS)
74. YSRR: Real Output in Services incl. all others (Industry groups 6, 8 and 9 of NAS) (NAS)
75. YR: Real Output at factor cost (NAS)

Exogenous Variables (Rs. '000 Crores):

1. AREA: Index of Gross Cropped Area (1993-94=1.0) (RBI)
2. BCG: Commercial Bank Credit to Government (Nominal) (RBI)
3. CRR: Cash Reserve Ratio (RBI)
4. DNB: Non-Market Borrowings of both central and state govts. (Nominal) (RBI)
5. D81t91: Regime shift in exchange rate
6. D81t92: Dummy for pre reform period (1981-92)
7. D81t94 Unexpected fluctuations in WPMN, NTX
8. D81t96 Unexpected fluctuations in PRSR
9. D81t97 Unexpected fluctuations in GFCE
10. D81t99 Unexpected fluctuations in PRINF
11. D81, 95-6, 00-1: Unexpected fluctuations in PIINFR
12. D919496 PLR
13. D92t97: Regime shift in exchange rate

14. D96 Unexpected fall in WPFPLL
15. D01 Unexpected fall in WPFPLL
16. EB: External borrowings by the govt. (Nominal) (RBI)
17. EM2: Errors and omissions in gross capital formation by using sectors (NAS)
18. GCL: Government's currency liabilities to public (Nominal) (RBI)
19. GDSRCNDQG: Gross domestic savings of Railways, Communications, Non-Departmental Enterprises and quasi govt. bodies (Nominal) (NAS)
20. INVSB: Invisibles in Current Account Balance (Nominal) (RBI)
21. MISCR: Other capital receipts of the govt. (Nominal) (RBI)
22. MISCRD: Miscellaneous bank credit available to commercial sector
23. MISRM: Miscellaneous components of reserve money including RBI non-monetary liabilities (Nominal) (RBI)
24. NCIF: Net capital inflows including net capital account in the balance of payments and errors & omissions (Nominal) (RBI)
25. NTOT: Aggregate population (millions) (NAS)
26. OGCE: Other govt. current expenditures (including IPD,CTS,IGAA) (Nominal) (NAS)
27. OTP: Other transfer payments (including IPD, CTS etc.) (Nominal) (NAS)
28. PCFAGR: Real Gross Public Investment in Agriculture (NAS)
29. PCFINFR: Real Gross Public Investment in Infrastructure (NAS)
30. PCFMNR: Real Gross Public Investment in Manufacturing (NAS)
31. PCFSRR: Real Gross Public Investment in Services (NAS)
32. RAIN: Annual Rainfall (mm) (NAS)
33. RBCS: RBI credit to the commercial sector (Nominal) (RBI)
34. SUB: Subsidies (Nominal) (NAS)
35. UVIMP: Unit Value of Imports (1993-94=1.0) (RBI)
36. UVIMP4: Unit Value of Imports of Fuel (1993-94=1.0) (RBI)
37. WPEXP: World Price Index (1993-94=1.0) (IFS)
38. WPRW: Index of procurement prices of Rice and Wheat (1993-94=1.0) (RBI)
39. WYR: Real World Income (IFS)

Estimated Model: **Period: 1981-82 to 2002-03** **Method: 3SLS**

Module-I: Real Sector:

Production:

Real GDP in Agriculture:

1. YAR = -268.355 +30.184 RAIN +225.286 AREA + 0.696 $KAGR_{-1}$ + 0.302 YINFR
(-22.71) (8.15) (14.82) (22.92) (12.36)
EL: 0.12 0.96 0.93 0.15

- 0.428 AR (1)
(-5.30)

$\bar{R}^2$ = 0.99 DW = 2.28

Real GDP in Manufacturing:

2. YMNR = 0.131 ADD + 0.037 $KMNR_{-1}$ + 0.170 IMPTR + 0.706 AR (1)
(12.10) (2.78) (3.10) (9.91)
EL: 0.76 0.15 0.10

$\bar{R}^2$ = 0.99 DW = 1.36

Real GDP in Infrastructure:

3. YINFR = -24.286 + 0.095 $KINFR_{-1}$ – 0.052 ($KINFR_{-1}$*D81t92) + 22.233 D81t92
(-9.61) (7.55) (-8.54) (8.92)
SR EL: 0.31 -0.07
LR EL: 4.03 -0.95

+ 0.923 $YINFR_{-1}$
(33.96)

$\bar{R}^2$ = 0.99 DW = 2.46

Real GDP in Services:

4. YSRR = -157.677 + 0.393 $KSRR_{-1}$ + 1.164 YINFR + 0.464 AR (1)
(-7.14) (6.90) (5.59) (6.44)
EL: 1.07 0.46

$\bar{R}^2$ = 0.99 DW = 1.62

Capital Formation:

Real Gross Investment in Agriculture: Private

5. PIAGR = -41.290 + 0.054 YAR+ 1.204 $PCFAGR_{-1}$+ 0.205 PCFINFR
(-11.68) (12.42) (9.48) (8.18)
EL: 1.14 0.61 0.55

- 0.067 (PLR_{-1}- $INFL_{-1}$) + 26.769 (PRAG/PGDP)
(-2.89) (8.22)
-0.04 2.41

+ 1.822 D81t92 - 0.592 AR (1)
(9.61) (-5.26)

$\bar{R}^2$ = 0.94 DW = 1.96

Real Gross Investment in Manufacturing: Private

6. PIMNR = -130.864+0.608 YMNR + 1.898 PCFMNR + 1.215 (PIINFR+PCFINFR)
(-2.32) (6.62) (4.64) (4.68)

EL: 1.46 0.47 0.86

- 0.886 (RGPUB/PGKE) - 1.245 (PLR_{-1} - $INFL_{-1}$)
(-7.64) (-3.17)
-0.89 -0.13

+ 79.938 (PRMN/PGDP) + 0.584 AR (1)
(1.58) (4.93)
1.30

$\bar{R}^2$ = 0.82 DW = 2.17

Real Gross Investment in Infrastructure: Private

7. PIINFR = -72.550 + 0.105 YINFR - 0.679 $PCFINFR_{-1}$ - 0.047 (RGPUB/PGKE)
(-13.34) (7.81) (-7.17) (-3.18)
EL: 0.82 -1.32 -0.20

- 0.557 (PLR - INFL) + 104.048 (PRINF/PGDP)
(-7.99) (13.93)
-0.27 6.68

+ 9.147 D81, 95-6, 00-1
(21.95)

$\bar{R}^2$ = 0.87 DW = 2.22

Real Gross Investment in Services: Private

8. PISRR = -189.841 + 0.092 YSRR + 1.014 PCFSRR + 0.915 (PIINFR+PCFINFR)
(-14.58) (18.13) (10.51) (22.71)
EL: 0.81 0.57 1.23

- 0.508 (RGPUB/PGKE) – 1.334 (PLR - INFL) (-14.26) (-11.25)
-0.96 -0.29

+ 173.919 (PRSR/PGDP) - 0.594 AR (1)
(14.50) (-10.98)
5.40

$\bar{R}^2$ = 0.94 DW = 2.29

Adjusted Total Investment: Private

9. PIADJR = -16.961 + 0.346 PITOTR + 0.894 $PIADJR_{-1}$
(-2.29) (5.10) (16.16)
SR EL: 0.29
LR EL: 2.75

$\bar{R}^2$ = 0.94 DW = 2.17

Real Consumption: Private

10. PCR = 165.885 + 0.526 PYDR + 0.258 ($(GFCE/P)_{-1}$+$PCFTOTR_{-1}$) +0.699 AR (1)
(16.55) (48.98) (5.89) (8.27)
EL: 0.65 0.07

$\bar{R}^2$ = 0.99 DW = 1.51

Depreciation equations:

Real Depreciation in Agriculture:

11. $DEPAG = -8.263 + 0.061\ KAGR_{-1}$
(-3.07) (6.99)
EL: 1.81

$\bar{R}^2 = 0.61$ DW = 1.58

Real Depreciation in Manufacturing:

12. $DEPMN = 18.502 + 0.032\ KMNR_{-1} + 0.224\ AR(1)$
(5.10) (6.11) (8.06)
EL: 0.52

$\bar{R}^2 = 0.74$ DW = 2.24

Real Depreciation in Infrastructure:

13. $DEPINF = -3.850 + 0.078\ KINFR_{-1} - 0.130\ AR(1)$
(-3.40) (27.42) (-2.78)
EL: 1.15

$\bar{R}^2 = 0.95$ DW = 1.93

Real Depreciation in Services:

14. $DEPSR = -4.802 + 0.032\ KSRR_{-1}$
(-2.98) (16.44)
EL: 1.22

$\bar{R}^2 = 0.91$ DW = 1.24

Price Behavior:

Wholesale Prices: Agriculture

15. $WPAG = 0.139 + 0.405\ (M3/YR) + 0.653\ WPRW + 0.541\ AR(1)$
(3.25) (4.13) (8.36) (4.76)
EL: 0.23 0.63

$\bar{R}^2 = 0.99$ DW = 2.13

Wholesale Prices: Manufacturing

16. $WPMN = 0.900 + 0.195\ (M3/YR) + 1.056\ ((M3/YR)*D81t94)$
(43.30) (3.65) (32.31)
EL: 0.12 0.65
$+ 0.056\ WPFPLL + 0.128\ UVIMP - 0.771\ D81t94$
(2.46) (5.98) (-34.21)
0.06 0.15
$\bar{R}^2 = 0.99$ DW = 1.52

Wholesale Prices: (Minerals, Fuels Power, Light and Lubricants)

17. $WPFPLL = 0.044 + 0.606\ (M3/YR) + 0.145\ UVIMP4$
(4.54) (13.34) (14.11)
SR EL: 0.33 0.15
LR EL: 0.68 0.31

$+ 0.145\ D01 - 0.091\ D96 + 0.512\ WPFPLL_{-1}$
(17.34) (-12.44) (21.75)

$\bar{R}^2 = 0.99$ DW = 1.93

Implicit Price deflators:

Implicit Price Deflator for Gross Investment: Public

18. PGKE = -0.106 + 1.130 P + 0.743 AR (1)
(-3.46) (44.97) (20.26)
EL: 1.10

$\bar{R}^2 = 0.99$ DW = 1.58

Implicit Price Deflator for Gross Investment: Private

19. PPIE = 0.944 P - 0.210 AR (1)
(77.18) (3.11)
EL: 0.90

$\bar{R}^2 = 0.96$ DW = 1.93

Sectoral price deflators:

Implicit Price Deflator: Agriculture

20. PRAG = -0.054 + 1.037 WPAG - 0.232 AR (1)
(-5.93) (123.55) (-2.56)
EL: 1.06

$\bar{R}^2 = 0.99$ DW = 2.14

Implicit Price Deflator: Manufacturing

21. PRMN = 0.016 + 0.362 WPMN + 0.669 $PRMN_{-1}$
(2.36) (11.92) (21.99)
SR EL: 0.36
LR EL: 1.07

$\bar{R}^2 = 0.99$ DW = 1.64

Implicit Price Deflator: Infrastructure

22. PRINF = -1.038 + 1.170 WPFPLL + 0.015 INFL + 0.758 D81t99
(-14.08) (36.47) (4.99) (19.16)
EL: 1.30 0.12

$\bar{R}^2 = 0.98$ DW = 1.52

Implicit Price Deflator: Services

23. PRSR = 0.729 + 0.802 (M3/YR) + 0.740 (M3/YR)*D81t96) - 0.577 D81t96
(49.65) (54.28) (38.09) (-36.43)
EL: 0.47 0.21

$\bar{R}^2 = 0.99$ DW = 2.08

Module-II: Fiscal Sector:

Revenues from Total Direct Taxes of (ADORC) (Nominal)

24. DT = -2.645 + 0.052 (YNAR* PNA)
(-3.32) (52.92)
EL: 1.09

$\bar{R}^2 = 0.99$ DW = 2.33

Revenues from Total Indirect Taxes (ADORC) (Nominal)

25. IDT = 10.901 + 0.108 YM + 0.603 AR (1)
(3.11) (41.85) (4.91)
EL: 0.91

$\bar{R}^2 = 0.99$ DW = 2.02

Total Non-Tax revenues (ADORC) (Nominal)

26. NTX = -9.352 + 0.020 Y + 7.524 D81t94
(-7.07) (24.68) (7.73)
EL: 1.32

$\bar{R}^2 = 0.97$ DW = 1.34

Govt. Final Consumption Expenditure (ADORC) (Nominal)

27. GFCE = 37.712 + 0.556 TR – 37.012 D81t97
(11.63) (53.95) (-15.83)
EL: 0.90

$\bar{R}^2 = 0.99$ DW = 1.69

Gross Fiscal Deficit (Nominal)

28. GFD = 0.471 RGPUB + 0.684 GFD_{-1} + 0.406 AR (1)
(5.01) (7.86) (2.06)
SR EL: 0.41
LR EL: 1.28

$\bar{R}^2 = 0.99$ DW = 1.87

Monetary Sector:

Money Supply (Nominal)

29. M_3 = 4.826 RM – 18.606 CRR + 4.646 (CRR*D81t92) + 0.839 AR (1)
(33.80) (-5.98) (3.32) (7.56)
EL: 1.29 0.37 0.05

$\bar{R}^2 = 0.99$ DW = 1.80

Prime Lending Rate

30. PLR = 0.012 YR – 0.007 M3 + 0.321 $INFL_{-1}$ + 0.443 PLR_{-1}
(2.22) (-2.47) (1.82) (1.81)
SR EL: 0.66 -0.26 0.18
LR EL: 1.19 -0.47 0.32

$\bar{R}^2 = 0.47$ DW = 1.81

External Sector:

Real Exports

31. EXPTR = 1.535 ((UVEXP*EXR) / WPEXP) + 0.050 YR_{-1}
(6.44) (4.73)
EL: 0.53 0.48
+ 0.378 AR (1)
(2.66)

$\bar{R}^2 = 0.95$ DW = 1.32

Unit Value of Exports

32. $UVEXP = -0.169 + 0.001\ YR_{-1} - 0.008\ ((P*EXR) / WPEXP) + 0.00001\ WYR$

	(-4.16)	(5.82)	(-9.72)	(8.93)
SR EL:		0.93	-0.31	0.69
LR EL:		1.78	-0.59	1.33

$+ 0.476\ UVEXP_{-1}$
(7.21)

$\bar{R}^2 = 0.99$ DW = 2.41

Real Imports

33. $IMPTR = -69.627 + 0.174\ AD - 0.670\ ((UVIMP*EXR) / P) + 0.780\ AR(1)$

	(-5.17)	(10.85)	(-1.66)	(-6.85)
EL:		1.95	-0.01	

$\bar{R}^2 = 0.99$ DW = 1.79

Exchange Rate

34. $EXR = 36.457 - 0.635\ INFL - 6.569\ CAB/RBFA + 0.196\ \Delta RBFA$

	(11.54)	(-2.10)	(-2.44)	(4.29)
EL:		-0.18	-0.20	0.13

$- 8.203\ D\ 81t91$
(-2.50)

$\bar{R}^2 = 0.88$ DW = 0.95

Module-III:

Poverty ratios:

Head Count Ratio: Rural

35. $HCRRUR = 60.604 - 28.989\ (PYDR/NTOT) + 0.529\ AR(1)$

	(15.19)	(-6.32)	(3.13)
EL:		-0.61	

$\bar{R}^2 = 0.88$ DW = 2.06

Head Count Ratio: Urban

36. $HCRURB = 60.045 - 32.034\ (PYDR/NTOT)$

	(51.34)	(-22.71)
EL:		-0.75

$\bar{R}^2 = 0.96$ DW = 1.64

Identities:

37. $ABSP = PCR + PIADJR$

38. $ADD = ABSP + (GFCE / P) + PCFTOTR + EXPTR - IMPTR$

39. $AD = ADD + IMPTR$

40. $PYD = YM - TR + SUB + OTP$

41. $PYDR = PYD / PGDP$

42. $P = 0.215 * WPAG + 0.147 * WPFPLL + 0.637 * WPMN$

43. YR = YAR + YNAR

44. YNAR = YMNR + YINFR + YSRR

45. Y = PGDP * YR

46. YM = Y + IDT - SUB

47. PGDP = (PRAG * YAR + PRMN * YMNR + PRINF * YINFR + PRSR * YSRR) / YR

48. PNA = (PRMN * YMNR + PRINF * YINFR + PRSR * YSRR) / YNAR

49. KAGR = KAGR(-1) + PIAGR + PCFAGR - DEPAG

50. KMNR = KMNR(-1) + PIMNR + PCFMNR - DEPMN

51. KINFR = KINFR(-1) + PIINFR + PCFINFR - DEPINF

52. KSRR = KSRR(-1) + PISRR + PCFSRR - DEPSR

53. PITOTR = PIAGR + PIMNR + PIINFR + PISRR

54. PCFTOTR = PCFAGR + PCFMNR + PCFINFR + PCFSRR

55. GCFTOT = (PITOTR * PPIE) + (PCFTOTR * PGKE)

56. GCFADJ = (PIADJR * PPIE) + (PCFTOTR * PGKE)

57. GDS = GCFADJ + CAB + EM2

58. GCE = GFCE + SUB + OGCE

59. GXP = GCE + (PCFTOTR * PGKE)

60. TR = DT + IDT + NTX

61. GDSADORC = TR - GCE

62. GDSPUB = GDSADORC + GDSRCNDQG

63. RGPUB = (PCFTOTR * PGKE) - GDSPUB

64. RM = RCG + RBCS + RBFA + GCL + MISRM

65. D(RCG) = GFD - D(BCG) - DNB - EB - MISCR

66. BCP = M3 - RCG - BCG - RBFA - GCL + MISCRD

67. EXPT = EXPTR * UVEXP

68. IMPT = IMPTR * UVIMP

69. TB = EXPT - IMPT

70. EXPTBOP = K1T * EXPT

71. IMPTBOP = K2T * IMPT

72. TBBOP = EXPTBOP - IMPTBOP

73. CAB = TBBOP + INVSB

74. RBFA = RBFA(-1) + TBBOP + INVSB + NCIF

Note: The t-ratios are given in parenthesis. For important variables, the short-run mean partial elasticity is also given below the t-ratios.

Appendix-III

Estimated Partial Elasticities of the Dependent Variables w.r.t. Selected Independent Variables

Dependent variable	Independent variables					
YAR	RAIN **0.12**	AREA **0.96**	$KAGR_{-1}$ **0.93**	YINFR **0.15**		
YMNR	ADD **0.76**	$KMNR_{-1}$ **0.15**	IMPTR **0.1**			
YINFR	$KINFR_{-1}$ Pre-reform (1981-92) SR: **-0.07** LR: **-0.95** Reform (1993-2002) SR: **0.31** LR: **4.03**					
YSRR	$KSRR_{-1}$ **1.07**	YINFR **0.46**				
PIAGR	YAR **1.14**	$PCFAGR_{-1}$ **0.61**	PCFINFR **0.55**	Real PLR **-0.04**	(PRAG/PGDP) **2.41**	
PIMNR	YMNR **1.46**	PCFMNR **0.47**	(PCFINFR+ PIINFR) **0.86**	(RGPUB/ PGKE) **-0.89**	Real PLR **- 0.13**	(PRMN/ PGDP) **1.30**
PIINFR	YINFR **0.82**	PCFINFR **-1.32**	(RGPUB/ PGKE) **-0.20**	Real PLR **-0.27**		(PRINF/P GDP) **6.68**
PISRR	YSRR **0.81**	PCFSRR **0.57**	(PCFINFR+ PIINFR) **1.23**	(RGPUB/ PGKE) **-0.96**	Real PLR **-0.29**	(PRSR/ PGDP) **5.40**
PCR	PYDR **0.65**	$((GFCE/P)_{-1}+PCFTOTR_{-1})$ **0.07**				
WPAG	M3/YR **0.23**	WPRW **0.63**				
WPMN	M3/YR 1981-94 **0.65** 1995-02 **0.12**	WPFPLL **0.06**	UVIMP **0.15**			
WPFPLL	M3/YR SR: **0.33** LR: **0.68**	UVIMP4 SR: **0.15** LR: **0.31**				
DT	(YNAR*PNA) **1.09**					
IDT	YM **0.91**					
NTX	Y **1.32**					
GFCE	TR **0.9**					

Estimated Partial Elasticities of the Dependent Variables w.r.t. Selected Independent Variables - Continued…

Dependent variable	Independent variables			
GFD	RGPUB SR: **0.41** LR: **1.28**			
M3	RM **1.29**	CRR Pre-reform (1981-92) **0.05**	Reform (1993-2002) **-0.37**	
PLR	YR SR: **0.66** LR: **1.19**	M3 SR: **-0.26** LR: **-0.47**	$INFL_{-1}$ SR: **0.18** LR: **0.32**	
EXPTR	((UVEXP*EXR) / WPEXP) **0.53**		YR_{-1} **0.48**	
UVEXP	YR_{-1} SR: **0.93** LR: **1.78**	((P*EXR) / WPEXP) SR: **-0.31** LR: **-0.59**		WYR **0.69** **1.33**
IMPTR	AD **1.95**	((UVIMP*EXR)/P) **-0.01**		
EXR	INFL **-0.18**	CAB/RBFA **-0.20**		ΔRBFA **0.13**

SR: Short-run; LR: Long-run.