

Structural Transformation, Trade Policies and Income Distributional Impacts: A
CGE Model of India

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1. Introduction

India has registered an impressive 7 to 8% GDP growth after launching the liberalization in 1991. Reforms were initiated in the public sector, financial sector and investment and trade regimes and it helped better integration with the global economy. However its crucial sector, agriculture, which is the source of livelihood for nearly two- third of the population has lost its momentum and lagging behind at below 3% growth and its share in GDP falling very sharply over the years. Moreover the economy has witnessed a significant structural transformation in the composition of output. Agriculture share in total GDP has gone down from 42% in 1970 to 18 % in 2007 whereas service sector sector has gone up from about one-third to more than 50% in the same period. Within the agriculture sector, both production and consumption have seen significant structural transformation in the last 2 decades or so. Diversification has taken place from food to non food crops. But even though agriculture's share in value added has gone down, it still employs over 60 per cent of the population .

On the macroeconomic front, the growth performance over the period was marked by relatively higher rates of savings, investment and improvements in many other macroeconomic indicators. Investment ratio has gone up to 34 per cent in 2006 coupled with increases in domestic and national savings. Notable increases in the external sector were also witnessed. As regards exports of goods and services, its ratio over GDP increased from a mere 6% of GDP in early eighties to 23 per cent in 2006. While the share of imports of goods and services in GDP rose from 8.7 percent in 1981 to around 26 percent in 2006. It is also to be noted that due to trade reforms, tariffs on consumer goods were drastically reduced as compared to tariffs on intermediate and capital goods.

The trade composition, however, shows an increasing concentration of manufactured goods accounting for 70 per cent of total merchandise exports in 2005. The shares of food and agricultural raw materials in total exports was declining over time. In the case of imports, manufacturing accounts for slightly more than 50 percent of total imports and its share has increased over time. Fuels account for more than one third of the total imports. The shares of food and agricultural raw materials in total imports have been coming down over time. There has

generally been a reduction in poverty over the last three decades both in the rural and urban areas. However, the reduction was significant between 1993-94 and 1999-00 which could be attributed to an increase in GDP growth. However, there are empirical evidences that inequality based on Gini coefficients , in both rural and urban, has shown increasing trend over time.

In the recent years Indian government has been working out various policies to increase foreign capital investment but the increasing current account deficit is a cause for concern. Also the recent Euro crisis is expected to result in fall in export demand as EU is our largest trading partner in exports from India. India is also likely to continue with the trade reform and import liberalisation. Keeping these factors in view it is proposed to analyse the impact of various policy scenarios mainly to deal with the external sector and to see how it impacts the domestic economy and in particular income distribution between rural and urban across income groups.

The paper is organised as follows: The next section presents briefly the objectives of the study. The third section presents an overview of the economy and the trend in income distributional impacts of growth based on past studies. The fourth section discusses the methodology , data base and the detailed sectoral classification. The results of the scenario are presented and interpreted in Setion 5. This is followed by Summary and conclusion.

2. Aim of the Study

This paper attempts to analyse the policy scenario of changes in the external sector and its impact on income distribution using Computable general equilibrium model. Base year is taken as 2006-07 for which the latest SAM is available for India. Then the results were projected to 2019-20. This paper uses dynamic recursive model to project the results for future years.

The paper initially provides baseline scenario for the projected year 2019-20. There were 3 alternative scenario of GDP growth assumption, 6%, 8% and 10% that have been considered. Structural transformation within agriculture and across sectors for the future years are imposed based on the expected trend, through consumption parameters and total factor productivity which would drive the changes in production pattern. This is followed by policy scenarios.

3. An overview of the Economy Growth and the Income Distribution

3.1 Sectors driving economic growth:

In the world scene, the position of emerging economies like India and China have been rising steadily in the last 2 decades since reforms and the share of India GDP in the world which is at 6% in 2002 is expected to move to 11% in 2025 (Virmani, 2005) . The composition of the growth is subject to significant changes. Service sector has been steadily showing impressive growth due to increasing growth of communication, Hotels and banking. Industry sector growth is led by construction and capital intensive manufacturing. Agriculture is not only showing an average decline but also very volatile in the year to year growth.

The decadal growth rate for the period ending 2006-07 has been computed for the value added (at current prices) of the broad sectors and are reported in Table 1. The economy growth is mainly driven by 4 sectors: Construction, Capital intensive manufacturing, Transport and Other Services. Agriculture and allied growth is the lowest of all with food crops registering a meagre 5% annual growth at current prices.

Table 1 Annual Growth rate from 1997-98 to 2006-07-
Value added at factor cost – at current prices

Sectors	Growth rate
Food Crops	5.04
Non food crops	7.57
Dairy, poultry, Fishery and Other animal products	7.81
Primary products	11.58
Agro processing	10.53
Labour intensive manufacturing	7.58
Petro chemicals	8.90
Capital intensive manufacturing	14.42
Construction	16.76
Electricity	7.81
Transport	12.16
Other Services	13.68

It has been argued that India's reform initiatives were mainly targeted to industry and trade related policies and hence it has not helped agriculture sector. However due to intersectoral linkages, benefits of reforms in trade, industry and service sectors have benefited agriculture to some extent. It has also increased agriculture exports from India. Post reforms period was also characterised by significant decline in share of public investment in agriculture. Main reason being the high level of subsidy burden and the worsening of the fiscal gap in the government budget.

Diversification of agriculture from food to non food sectors is quite prominent in the last 2 decades in Indian agriculture. Experts believe this transformation was mainly demand driven. In fact, diversification has helped agriculture growth by increasing the overall productivity per unit of land. It has been reported that the productivity of horticulture crops moved up from 7.5 to 8.9 tons per hectare post reform till 2002-03 while that of food grains gained a meagre 0.2 unit, from 1.4 to 1.6 tons per hectare, during the same period. However the experts point out that the structural rigidities across the regions can prevent its further growth of horticulture because it requires a supportive measures such as marketing arrangements and infrastructure for processing and private sector participation.

3.2 Growth and its impact on poverty

Using the data of consumption surveys by National Sample Survey Organisation from 1951 to 1991, Ravallion and Datt (1996) derived a new series of poverty measures for urban and rural India. They went on to examine the impact of economic growth and sectoral composition on urban- rural poverty. It reemphasised the significant role of rural economic growth to overall poverty reduction. It was also found both rural and urban poor benefited from rural economic growth whereas urban growth not only work against poor in urban, it also has no sizable impact on rural poor. Sectoral classification of the analysis revealed that the secondary sector growth does not impact poor in both rural and urban, and growth of primary and tertiary sector in particular lead to poverty reduction in both rural and urban. The study concludes that urban economic growth fuelled by industrialisation is not going to benefit the poor. This reiterates the significance of agriculture sector growth for overall poverty reduction.

In another study, Datt and Ravallion (1998) have shown that agricultural growth did provide benefits to rural poor and the gain was mostly through wages and prices. They used the data of 24 rounds of National Sample Survey spanning 1958-94. Their results confirm that increase in the average farm yield help the poor in the form of higher agricultural wages and lower relative food prices. The study also found that the long run effects are much larger.

3.3 External sector development and its impact on income distribution

Using CGE model based on SAM for the year 2003-04, Kumar and Panda (2009) have analysed the impact of world economic slowdown on the Indian economy. The scenarios are : 1) aggregate exports decline by 10%, 2) foreign inflow decline by 29% 3) fall in world oil price. This has been analysed with counter measures such as rise in government consumption, cut in indirect tax and employment guarantee program to protect the income of rural poor. The findings are: when no counter measures are taken, a 10% export fall has led to 3.3% decline in GDP, real investment fell by 9.7% over the baseline scenario. Urban household faced higher income loss than the rural households. Reduction in exports along with the fall in foreign capital inflow has resulted in higher real income loss for all the households. With counter measures being taken in the form of government consumption, this has led to improvement in real income . However the gain for rural households is lower than that of urban households. Polaski et al. (2008) have analysed the impact of rise in the world price of rice by 25% and 50% using 1998-99 SAM . The rise in the world price of rice has led to positive results in most of the macroeconomic variables. In terms of real income, the bottom rural income group witness a real income increase of about 2% from a 25% price rise, Since the present analysis use the recent data and project it for the future years , it would be interesting to see the trend in these results.

4. Methodology , Approach and Data Base

A review of the existing literature shows that several researchers have built CGE models for India in the past. These models vary in the underlying theoretical framework (viz., Neo-classical or Structuralist), their focus (short-run versus long-run), treatment of domestic and foreign goods (perfect substitutes versus imperfect substitutes), and details of institutional features of the economy, especially pertaining to the agricultural sector. From amongst them,

four studies / models, viz., by Narayana *et. al* (1991), Parikh *et. al* (2002), Polaski *et. al* (2008) and Panda and Ganesh-Kumar (2008), can be identified as important studies.

The data Base for the study came from the Social Accounting matrix developed by Kumar and Panda (2010) for the year 2006-07¹. The recursive dynamic CGE model is built on the static CGE model based on the approach developed by Dervis, de Melo and Robinson (1982). A distinguishing feature of this approach is that it treats the domestically produced good and traded good in a particular sector as imperfect but close substitutes using the Armington specification, which avoids complete specialization that perfect substitution may entail, and permits cross-hauling.

4.1 Sectoral classification

All the existing national CGE models for India are deficient in the treatment of some of the high value sub-sectors of Indian agriculture, such as fruits and vegetables, dairy products, meat and poultry, fishery, etc., these sectors have shown lot of dynamism in recent times. These sectors are available separately in the Indian Input-Output table for 2006-07, and hence included as separate sectors in the data base.

In this model, the labor has been disaggregated into skilled urban, unskilled urban, skilled rural and unskilled rural. The capital is further divided into land, capital -agriculture and capital –nonagriculture. The household is further split into 6 different groups based on income (expenditure classes) and rural/urban.

The current model is a recursively dynamic model where the inter-period changes are analysed through a series of temporary equilibria. The inter-period adjustments consist of changes in capital accumulation, growth in population and labor supply, changes in total factor productivity, behavioral parameters, and changes in government expenditure and foreign inflow and outflow.

4.2 Social Accounting Matrix (SAM)

Social Accounting Matrix (SAM) is a matrix representation of the transactions, transfers, actual or imputed, that take place in a given accounting period, within an economy as well as with respect to rest of the world. The SAM used in the present study consists of 32 sectors, seven factors of production and six categories of households.

¹ I am thankful to Ganesh Kumar, Professor, Indira Gandhi Institute of Development Research for sharing with me the SAM of 2006-07.

The 32 sectors comprise 14 sectors from agriculture, 1 sector primary products , 4 sectors of agro-processing, 6 sectors of manufacturing and 7 sectors of services . The SAM is constructed at market prices of the commodities in 2006-07. The sectoral classification is presented in the Table 2. More details about the model and the sectoral classification are given in the Appendix.

Table 2 Sectors in SAM – 2006-07

Sl. No.	Agriculture (1 to 14)	Sl. No.	Manufacturing (20 to 26)
1	Paddy	20	Textiles & garments
2	Wheat	21	Petroleum products
3	Other Cereals	22	Fertilizers
4	Pulses	23	Pesticides
5	Sugarcane	24	Manufacturing-1 (labour intense)
6	Oilseeds	25	Manufacturing-2 (capital intense)
7	Cotton	26	Construction
8	Fruits		Services (27 to 32)
9	Vegetables		27 Electricity
10	Other crops		28 Water supply
11	Milk and milk products		29 Transport services
12	Poultry & Eggs		30 Storage and warehousing
13	Other animal products		31 Trade
14	Fishing		32 Other services
	Primary products (15)		
15	Primary products		
	Agro-processing (16 to 19)		
16	Sugar		
17	Vegetable oils		
18	Other food products		
19	Beverages & Tobacco		

4.3 Household

The model assumes a Linear Expenditure System (LES) of demand which allows for certain fixed component of consumption to be independent of the changes in income level and is termed as floor level consumption. The balance consumption varies with respect to net income after adjusting for floor level consumption.

Household is classified based on expenditure classes as below; 3 each for rural and urban. The classification is based on monthly per capita expenditure percentiles.

- 1) less than or equal to 30%
- 2) 30% - 70%
- 3) greater than 70%

4.4 International Trade

The international market is assumed to be large enough to absorb any quantities of goods produced in India and can satisfy any import demand of India. Trading partners are not modeled explicitly, but are addressed as 'Rest of World' (ROW). The demand by ROW represents India's export and its supply represents India's import. Imports, exports and domestic goods are treated as imperfect substitutes through Armington specification. It avoids complete specialization that perfect substitution may entail, and permit cross-hauling; i.e. simultaneous imports and exports in the same sector as observed in reality. The lower Armington elasticity means higher difference between the imported and domestic good and vice-versa. With the small country assumption, India faces elastic world supply at fixed world price. Also, the final ratio between imported good and domestic good is determined by the cost minimizing decision of the domestic demanders based on the relative prices of the imports and domestic goods.

4.5 Dynamic Version

The study adopts a recursive dynamic model where the inter-period changes are analysed through a series of temporary equilibria. The inter-period adjustments include capital accumulation, growth in population and labor supply, government expenditure and foreign inflow and outflow. With 2006-07 as base year, the research simulates the results for the future year 2019-20.

5. Results and Discussion

5.1 Baseline Scenarios

In this section the results of alternative growth scenarios are presented with discussion.

The 3 scenarios considered were 6%, 8% and 10% real GDP growth. The factor driving this different GDP growth was Total factor productivity. To move forward to future years, the structural changes are implemented through consumption parameters. Other parameters that have been considered for dynamic changes are: population, labour, foreign inflow and outflow and government consumption.

Real GDP composition under different GDP growth scenario in 2019-20 reveals that high growth scenario favour industries; agriculture and services share in total GDP have fallen by 2 - 3% when the GDP growth goes up from 8% to 10% (Figure1).

Figure 1 : Real GDP composition (%) 2019-20 under alternative GDP growth scenario in comparison with 2006-07



If we peruse the rural urban income composition data (Table 3) , it is found that 10% GDP growth does not favour rural due to dip in agriculture growth. Rural share has come down from 61% to 56% with GDP growth moving up from 8% to 10% . In 2019-20, even though 10% growth seems to benefit industries, it is not really benefitting rural industries. If we analyse by income groups, then 10%

growth is mostly benefitting urban high income groups. This confirms that the growth is not trickling down. In particular rural bottom 2 groups' real income growth have come down from 8% to 10% GDP growth scenario in 2019-20. This is also reflected in the real income per capita figures reported in Table 4.

Table 3 Rural-Urban Income Composition (%) by Household Type and Income Groups

HH	2006-07	2019-20 under alternative GDP growth		
		6%	8%	10%
rural1	5.65	5.46	5.47	4.60
rural2	14.79	14.92	14.89	12.87
rural3	37.70	41.22	40.84	38.95
urban1	3.18	2.46	2.43	2.78
urban2	9.80	8.16	8.26	9.38
urban3	28.89	27.78	28.10	31.42
Total	100.00	100.00	100.00	100.00
rural	58.14	61.60	61.21	56.42
urban	41.86	38.40	38.79	43.58

Note: Rural 1 pertain to bottom 30% of the population, Rural 2 middle 40% and rural 3, the top 30% of population. Urban counterparts follow the same criterion.

Table 4 Real Income per Capita – Annual income in indian ₹

HH	2006-07	2019-20		
		6%	8%	10%
rural1	8412	12024	16274	14298
rural2	16531	24645	33214	30022
rural3	56172	90784	121446	121131
urban1	12170	11389	15191	18206
urban2	28149	28386	38819	46081
urban3	110696	128874	176012	205829

Chhibber and Palanivel (2009) have simulated results based on SAM modeling for income distribution for the year 2009-10 for pessimistic scenario against the baseline and optimistic scenario (pre global financial crisis scenario) of 8% GDP growth in both the years 2009 and 2010 . For the pessimistic (post crisis) scenario, GDP is fixed at 5.4% for 2009 and 6.5% in 2010. The study finds that in the period of slower growth the maximum loss is for the category middle and upper middle class of households. The difference in the growth in income for these two classes in rural from historical period to 2009-10 is 5.6 % and 4.7% respectively. However, the distribution of income does not favour 'abjectly poor' and 'poor' category in rural. Out of the total income generated in rural areas, only 2 % reaches the 'abjectly poor' and 7.5 % to the 'poor' population. Together, the low income groups in rural areas have been getting less than 10 % of the total income generated in the rural sector. Comparing this with our results, we have found that middle income group is losing out more in the slow growth regime.

Real income per capita statistics confirm that from 8% to 10% growth regime, income is getting redistributed from rural to urban particularly in the lower and middle income groups. One can find reason in the fact that agriculture is not benefitted in the increasing GDP growth of 10%. The policies should adopt specific strategies to stimulate agriculture when the economy moves at a higher growth path. This will also help correct urban bias in the income distribution in the process of higher growth. It is also interesting to see how the income generation in the industry and services can be tapped to benefit rural by making use of sectoral linkages. In another study, Mythili and Harak (2012) found that in the non-agriculture sectors, agro processing sector generates the highest output and income multiplier effects for agriculture . In the wake of increasing demand for processed food and change in the consumption pattern of both rural and urban, modernisation of retail chains and private entry, the promotion of agro processing would certainly help agriculture by increasing forward linkage of agriculture with this sector. It was also found in this study that a unit exogenous expenditure in the agro processing sector among the non-agriculture sectors, generates highest income to rural areas.

5.2 Alternative Policy scenarios

This section describes the results of 5 alternative scenario of changes in the external sector either due to trade policies or development in the international arena.

- 1) Export demand fall by 10%
- 2) Foreign capital inflow fall by 20%

- 3) Import tariff reduction across the board by 10%
- 4) Import tariff reduction across the board by 20%
- 5) World rice price increase by 5%.

The results are compared with 8% GDP growth scenario for the year 2019-20. This is due to the fact that the other parametric assumption implemented in the scenario initialisation are comparable to 8% scenario assumptions. In all the scenarios, the GDP growth is not showing significant changes. It varies from 7.7% to 8.1%. The income distribution throws up interesting results (Table 5). Among all the scenarios, foreign inflow reduction is causing maximum loss to the rural bottom income group. Its share in total income of all households declined from 5.47 of baseline to 4.89. Rural income share is down by 2.6 % in this scenario. The scenario of reduction in export demand seem to be benefiting rural bottom income group as the income share has increased more as compared to the baseline. Urban bottom income group is not affected much in all the policy scenarios.

Table 5 Rural-urban income composition (% of each to total) - alternative scenarios

HH	Baseline	Export demand fall by 10%	Foreign inflow down by 20%	Import tariff cut by 10%	Import tariff cut by 20%	World rice price up by 5%
rural1	5.47	5.54	4.89	5.49	5.49	5.37
rural2	14.89	15.23	13.73	15.04	15.19	14.94
rural3	40.84	41.29	40.00	41.07	41.47	41.22
urban1	2.43	2.38	2.58	2.45	2.46	2.47
urban2	8.26	8.10	8.80	8.26	8.18	8.28
urban3	28.10	27.45	30.00	27.69	27.22	27.72
Total	100.00	100.00	100.00	100.00	100.00	100.00
rural	61.21	62.07	58.61	61.60	62.15	61.53
urban	38.79	37.93	41.39	38.40	37.85	38.47

If we refer real income per capita statistics (Table 6) with 2006-07 as the base year, then it is revealed rural bottom group clearly gains from import liberalisation scenarios. Income per capita is raised by about ₹ 300 to ₹ 400. It should be mentioned that in dollar

terms, the average real income per capita is less than 1 dollar per day for households in the poorest income group.

The percentage change in real income per capita as compared to the baseline scenario is reported in the Table 7. Foreign inflow reduction is certainly causing more damage to the economy as all the income groups, both rural and urban, suffer from this reduction. For the rural, the loss is in the range of 10 to 18%. Fall in foreign capital is expected to cause unemployment in both rural and urban and fall in both private and government consumption. Import liberalisation across the board in terms of tariff reduction render maximum gain for both rural and urban across all income groups. Export demand fall cause the maximum bias between rural and urban. While rural benefits from this policy, urban suffers the most. This is understandable because exports fall will affect urban employment negatively and hence the result. Increase in world rice prices, as expected, reported loss for the rural poor as they are the net buyers, and gain to all the other groups. Surprisingly this scenario reported gain even for urban poor groups. Increase in world price operates via the following route. Increase in price cause additional demand for the labour in the rice cultivation and this results in increased wages for rural labour and hence increased income.

Table 6 Annual Real Income per capita in Indian ₹ - Alternative scenario

HH	Baseline	Export demand fall by 10%	Foreign inflow down by 20%	Import Tariff cut by 10%	Import tariff cut by 20%	World rice price up by 5%
rural1	16274	16395	13264	16688	16611	16209
rural2	33214	33788	27949	34323	34475	33820
rural3	121446	122137	108497	124931	125526	124446
urban1	15191	14850	14755	15697	15660	15673
urban2	38819	37854	37724	39682	39095	39505
urban3	176012	170971	171429	177407	173486	176239

Table 7 Annual Real Income per capita % change over baseline - Alternative scenario

HH	Export demand fall by 10%	Foreign inflow down by 20%	Import Tariff cut by 10%	Import tariff cut by 20%	World rice price up by 5%
rural1	0.74	-18.50	2.54	2.07	-0.40
rural2	1.73	-15.85	3.34	3.80	1.82
rural3	0.57	-10.66	2.87	3.36	2.47
urban1	-2.24	-2.87	3.33	3.09	3.17
urban2	-2.49	-2.82	2.22	0.71	1.77
urban3	-2.86	-2.60	0.79	-1.44	0.13

6. Summary and Conclusion

India has been witnessing structural transformation in the post liberalisation regime across major sectors as well as within the sectors. In view of this, it is of interest to see the impact of domestic trade policies on the income distribution. This paper looks at these results using the recent data for which SAM is available, 2006-07. This data set so far has been little explored and analysed.

Alternative GDP growth scenarios give a clear picture that higher GDP growth does not favour agriculture sector. Hence rural income share has come down from 61% to 56%. It has a structural bias towards urban rich. This is a challenge for planners as they have to focus how to make agriculture progress when the economy is moving towards higher growth path.

Among the policy scenarios that impact external sectors, it is found that reduction in foreign capital inflow causes the most damage to rural areas. Government has been introducing a slew of measures to encourage foreign inflow. However they are not bringing in expected results. More comprehensive measures are needed to boost the FDI. In view of recent Euro crisis, export demand is expected to fall. It is shown that this scenario is bringing loss to urban households even though rural is benefiting. It is also revealed that continuing with the Import liberalisation policies is going to benefit all the households. However the agricultural sector is likely to continue in the 'special category' to insulate the producers from the fluctuations of the world market. The world food price inflation is, as expected, going to hurt rural poor.

Bibliography

- Chhibber, A and Palanivel T. (2009) “India Manages Global Crisis but needs serious Reforms for Sustained Inclusive Growth” Paper presented at the Tenth Annual Conference on Indian Economic Policy Reform, Oct 21-23, 2009, Stanford University.
- Datt and Ravallion (1998) “Farm Productivity and Rural Poverty in India”, *Journal of Development Studies*, 34:4, 62-85.
- Dervis, K., de Melo, J. and Robinson, S. (1982) *General Equilibrium Models for Development Policy* (Cambridge: Cambridge University Press).
- Kumar, Ganesh and Manoj Panda (2009) “Global Economic Shocks and Indian Policy Response: An Analysis using a CGE Model” in Kirit S. Parikh (ed), *Macro Modelling for the Eleventh Five Year Plan of India*, Academic Foundation, New Delhi.
- Kumar, Ganesh and Manoj Panda (2010) “ Social Accounting Matrix for India 2006-07”, unpublished material, Indira Gandhi Institute of Development Research. Mumbai.
- Mythili, G. and Nitin Harak, (2012) “ Sectoral Linkages, Multipliers and the Role of Agriculture” in *India Development Report* (Ed) S. Mahendra Dev, Oxford University press.
- Narayana, N.S.S., Parikh, K.S. and Srinivasan, T.N. (1991) *Agriculture, Growth and Redistribution of Income: Policy Analysis with a General Equilibrium Model of India* (Amsterdam: North Holland).
- Panda, M. and Ganesh-Kumar, A. (2008) “Trade Liberalization, Poverty and Food Security in India” , paper presented at the 11th Annual Conference on Global Economic Analysis, Helsinki, Finland, June 12-14, 2008, Indira Gandhi Institute of Development Research, Working Paper WP-2008-013
- Parikh, K.S., Ganesh-Kumar, A. and Darbha, G. (2002) Growth and Welfare Consequences of a Rise in Minimum Support Prices: An Applied General Equilibrium Analysis for India. *Report submitted to the Ministry of Finance, Government of India.*

Polaski, S. , Ganesh Kumar A., McDonald Scott, Panda Manoj and Sherman Robinson
(2008) *India's Trade Policy Choices : Managing Diverse Challenges*, Carnegie
Endowment for International Peace.

Ravallion and Datt (1996) "How Important to india's Poor is the Sectoral Composition of
economic Growth?" , *The World Bank Economic Review*, Vol 10, No.1, 1-25.

Virmani, Arvind, (2005) "Economic Performance, Power potential and Global Governance:
Towards a New International Order", ICRIER Working Paper No. 150.

Appendix

In the following, the model assumption on various parameters and the model features which describe the structure of base year SAM are presented:

Prices

To compute various prices such as import price, export price, domestic market price and producer price, information on government's tariffs on imports, export subsidies, and indirect taxes / subsidies for domestic goods are used. Administered prices were taken into account in deriving the domestic price of a commodity.

The price of imports (PM) is calculated by including any tariffs that might be placed on commodities entering domestic market. The interaction of domestic and import prices lead to formation of price of composite commodity (PQ). From the producer price of domestically produced commodity, it is possible to arrive at the export price (PE) by including any taxes/subsidy that might be imposed on exporting of the commodity.

Production

The five factors of production identified for the model are urban skilled labour, urban unskilled, rural skilled and rural unskilled and capital. We have also made an attempt to split capital into agricultural capital and non-agricultural capital. The agricultural capital is further divided into land and other capital. Producers in the model make decisions to maximize profits subject to constant returns to scale with choices between factors governed by constant elasticity of substitution (CES) function. The choice between the factors results in valued added composite. This value added composite then combines with fixed share of intermediate goods through a Leontief specification. The assumption behind Leontief specification is that the ratio of required intermediates per unit of output and the ratio of value added and intermediates is determined by technology rather than the decision making of the producers.

Substitution possibilities exist between production for domestic consumption and exports. This decision of producers is governed by the Constant Elasticity of Transformation (CET) function. The CET functions allows for differentiation of commodities produced for both the market thereby capturing the difference in the quality and or time between the two goods. The profit maximization allows producers to sell in those markets where they can achieve higher returns. The returns are based on the fixed world and domestic price. Under the small country assumption, India faces a perfectly elastic demand at fixed world price.

The level of final domestic demand comprises of household and government consumption demand, investment demand and the demand generated by domestic producers for intermediate inputs. This domestic demand is met through the supply of composite commodity formed by CES aggregation of imports and domestic production.

Value added in a sector is specified as a constant elasticity of substitution (CES) production function of capital and labour. Capital is non-mobile across agriculture and non agriculture sectors. Otherwise factors have free mobility. Demand for labour and capital are derived from the first order condition of profit maximization. Apart from output level, factor demands in a sector depend on ratio of price of value added and respective factor price.

Institutions

The institutions represented in the standard model are household, government and rest of the world. The details are described as below:

Households

The model distinguishes 6 household types based on expenditure classes, three each in rural and urban areas (Table 1), which help us to capture the distributional impacts of policy alternatives. The primary source of income for households is from returns from factors in the production and initial endowment distribution. The households and enterprises (government) earn factor incomes in proportion to their implied share that they control of each factor stock. Apart from the factor incomes, the households also receive transfers from the government and the rest of the world.

Household's disposable income is net of personal income (direct) tax and savings. The representative household's preferences are represented through the Linear Expenditure System (LES) of demand. Given the commodity prices and incomes, these demand function's defines household real consumption of each commodity. The relevant price here is the so-called "composite" price, which is a weighted average of the market price of the domestically produced good and import price.

Household Income and Expenditure

The factor income has to be allocated to households by income class. This has been done on the basis of initial endowment (factor income) in the SAM. The total wage and non-wage income thus derived is distributed to households in proportion to their initial endowments (wage and non-wage income). To the total wage and non-wage income thus derived, transfer payments by government and remittances from abroad are added to obtain the total nominal income of the households.

It is assumed that different household classes save different proportions of their income after payment of income taxes in fixed proportions. The total private consumption expenditure of the households is determined by income net of taxes and savings. Sectoral private consumption is modelled using the Linear Expenditure System (LES) with underlying Stone-Geary type of log-linear utility functions. Sectoral demand is thus a function of income and all the prices.

Government

In the model government earns most of the income from direct taxes, tariff revenue, domestic indirect taxes, non-tax revenue and foreign inflows on government accounts. On expenditure, the government spends on government consumption, transfers to households, subsidies for domestic goods and exports. The positive (negative) difference between government revenue and expenditure is its savings (budget deficit).

Rest of the World

The commodity trade with rest of the world is treated in the next section on international trade below, it is to be noted that all transfers from and to the rest of world are in fixed foreign currency. Foreign savings are derived as residual difference between foreign payment and receipts.

Factors

Given the static nature of the model, sectoral capital and labour supply are assumed to be fixed in the short run. Factors are mobile across sectors except that land and capital mobility for agriculture sector is restricted within agriculture and same is in case of non-agriculture sectors.

Savings

National savings are from three sources: private, government and foreign, the sum total of which determines aggregate investment in the economy. Sectoral composition of the demand for investment goods are determined by fixed proportions.

Equilibrium

1. Product Market Equilibrium

There are basically two goods in the economy viz. one produced domestically and sold domestically and goods produced domestically and sold in export market. We also assume that the imports and domestic goods are imperfect substitutes and therefore results in formation of composite goods. The product market determines the equilibrium between supply of composite good to meet the total demand (that of intermediate consumption, households and government consumption, changes in stock and investment demand).

2. Factor Equilibrium

In the factor market, the quantity supplied of each factor (labor categories) is fixed (i.e. labor is assumed to be fully employed). An economy wide wage variable is free to adjust to ensure that the sum of factor demand from all the sectors is equal to the factor supply.

3. Government Balance

The model assumes that government savings are flexible residual derived as difference between government revenue and expenditure keeping all tax rates fixed.

4. Foreign Exchange Balance

Though two options are available for treatment of foreign exchange balance, we prefer the one where we hold foreign savings fixed and allow the exchange rate to adjust. A fall in foreign savings would induce depreciation of the real exchange rate and this would result in fall in imports and rise in exports until the trade balance is restored. The second option is to hold the exchange rate fixed while the level of foreign saving is flexible.

5. Market equilibrium

We consider market equilibrium conditions for product market, foreign exchange market, labour market and sectoral capital market.

6. Model Closure

The closure occurs on two accounts viz. saving-investment balance and trade equilibrium. The main difference with regard to saving-investment balance is whether the savings are assumed to be investment driven or whether investment is savings-driven. Thus, in the investment driven economy the saving rate adjusts to maintain a fixed level of investment.

In our case, the model does not have an investment schedule that relates the level of investment to its rate of return. However, we assume that the value of investment equal to the value of aggregate savings. The constraints are so setup that in the investment-driven economy the adjustment in absorption is confined to investment only.

5. Changes for the Dynamic Blocks-Parameters

1. Population growth rates

The population growth rates are taken from the projected population data for India by Office of Registrar General and Census Commissioner, India. The population projections are till 2026, which have been extrapolated to 2030. The total population is expected to increase from 1130 million in 2006-07 to 1439 million by 2029-30. The population growth rates drop from 1.36% per annum in the first block to 0.712% per annum during the last block.

The urban population constitutes nearly 28 % of the total population in 2006-07. After accounting for rural-urban migration during the period, the urban population is expected to increase to 34 % of the total population by 2029-30. The increase in population is assumed to be uniform across all the household categories.

2. Labor Supply Growth

India's young population is expected to increase with a declining dependency ratio. According to most population projections, the share of working age population in total

population will continue to rise for the next 30 years or so. These demographics point to a large potential for higher growth through augmented supply of labour and savings.

The total labor endowment therefore increases at a specified rate that takes into account not only the demographic dividend but also the rural-urban migration effect. Addition to labour force (in the age group 15-59) is expected to grow at more than 10 million per year for the first decade and approx. 10 million during the second decade.

3. Government consumption

The government consumption is expected to grow at 12 % per annum during the first block (2007-10) due to increased expenditure during the recent meltdown (2008). Thereafter, the government consumption is expected to grow at 9 % per annum based on the growth rates at constant prices during the last decade.

4. Investment

Since the model is to be solved at 5-year frequencies, detailed specification of capital is not done. Instead, simple projections based on time trends are used to specify the total stock of capital in the economy and its sectoral composition. Initially, the capital factor (rental value) is increased at a growth rate of 9.0 % . Considering the high growth rate in capital investment during the last decade, we expect the same trend to continue for the future blocks. Accordingly, the capital factor grows nearly at 9.5 % for the remaining period.

Since, the changes in stock during the period do not follow any trend, we have maintained the same proportions as in the base year.

5. International Trade Account

The international trade account represents the payments made and received by government and household with respect to the rest of the world (ROW) account in US dollars. For the period, FY 2006-07 to 2009-10, the financial flows have grown at CAGR as per actual. However, considering the trend over the last decade, we see that the growth rate in these payments is varying over period. We therefore assume similar trend to continue but adjust for the levels already reached by 2009-10 and therefore growth rates for the future periods are adjusted to have a realistic view on their growth.

6. Government Transfers to households

The government transfers to households are expected to grow at minimum of 2% per annum representing a small increase in direct spending by government. However, the transfers to households through other social welfare schemes is expected to grow like the National Rural Employment Guarantee Programs, Food Subsidy, *etc* and hence direct transfers have grown at marginally higher growth rate than the growth rate in population.