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Trade Liberalization, Poverty and Food Security in India

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Abstract

This paper attempts to assess the impact of trade liberalization on growth, poverty, and food security in India with the help of a national level computable general equilibrium (CGE) model. It shows that GDP growth and income poverty reduction that might occur following trade liberalization need not necessarily result in an improvement in the food security / nutritional status of the poor. Evidence from simulations of (partial) trade reforms reflecting a possible Doha-like scenario show that the bottom 30% of the population in both rural and urban areas suffer a decline in calorie and protein intake, in contrast to the rest of the population, even as all households increase their intake of fats. Thus, the outcome on food security / status with regard to individual nutrients depends crucially on the movements in the relative prices of different commodities along with the change in income levels. These results show that trade policy analysis should consider indicators of food security in addition to overall growth and poverty traditionally considered in such studies.

Trade Liberalization, Poverty and Food Security in India[1]

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1. Introduction

After experimenting with a mixed economy model for more than four decades, India adopted wide ranging economic reform measures in 1991 to liberalize investment and trade activities in the economy. The liberalization process has continued in a steady manner since then. The economy has been substantially opened up as indicated by rise in share of merchandise trade from 14 per cent of GDP in 1990-91 to 33% in 2005-06. The reform process has paid rich dividends in terms of GDP growth which has averaged above 6.5% per annum during the last one and a half decade. Indeed, the overall economic activities have accelerated further recording 8-9 per cent growth during the last five years.

India's GDP stood at US$ 793 billions in 2005. Considering a population of 1.1 billion, per capita income continues to be low at $720 in 2005 at market exchange rate compared to world average of $6280. When adjusted for purchasing power parity (PPP), per capita income works out to $PPP 3450. The level of living as reflected in purchasing power of an average Indian is roughly one third of world average and one tenth of the developed high-income countries. Hence, along with economic growth, faster poverty reduction and food security for the masses have been the basic objectives of reforms. Indeed, 'growth with social justice' has been the stated guiding principles of economic policy formulation for about 6 decades in India since its independence.

Against this background, we attempt to assess the impact of trade liberalization on poverty, and food security in India with the help of a computable general equilibrium (CGE) model. The next section reviews the broad developments in the spheres of growth, poverty and nutrition in India during recent decades. Section 3 describes the salient features of the CGE model used here. Section 4 describes the design of scenarios. Section 5 discusses the main results. Section 6 makes some concluding remarks.

[1] This paper has been prepared for the International Policy Analysis Network (IPAN) project of the Markets, Trade, and Institutions Division of the International Food Policy Research Institute (IFPRI). Thanks are due to Antoine Bouet, Betina Dimaranan and Simon Mevel for discussions and providing MIRAGE results used in the simulations here. All errors are ours.

2. Indian Economic Developments: Growth, Poverty and Food Security

2.1 Growth

Table 1 gives average annual growth rates in national income for 3 broad sectors - agriculture, industry and service - for various periods spanning over 1951-2006. The Indian economy grew at an average rate of 3.5 per cent per annum for about 3 decades till 1980. Triggered by an expansionary fiscal policy, GDP growth moved into a higher growth trajectory of above 5.5% during the 1980s. Economic reforms undertaken since early 1990s helped to continue this growth rate and further improve on it. Average annual growth rate in per capita income jumped from about 1.5 per cent during the period 1951-1980 to 3.5 per cent or more after 1980. National income has accelerated further resulting in a growth rate of about 7 per cent per annum since 2000. The acceleration process has been driven mostly by growth in the non-agricultural sectors, particularly that in the service sector. A sustained increase in average level of living of about 4 per cent per annum for more than a quarter of a century marks a break from the historical trends of average level of living over several centuries.

Table 1: Average Annual Growth Rates in Real GDP (%)

	1951-5 2 to 1980-81	1981-82 to 1990-91	1991-92 to 1999-2000	2000-01 to 2006-07
Agriculture	2.6	3.8	3.0	2.5
Industry	5.3	7.0	5.7	7.8
Service	4.6	6.7	7.9	8.5
GDP (total)	3.6	5.6	5.8	6.9
Per Capita GDP	1.4	3.4	3.6	5.2

2.2 Poverty

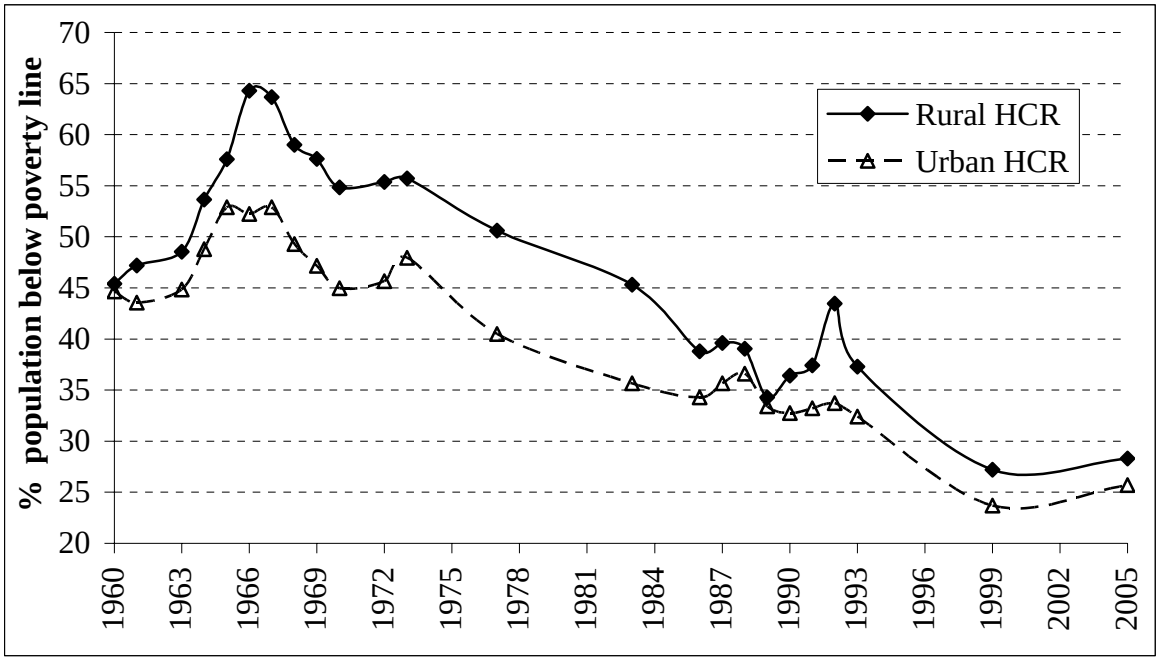
While the overall growth has been impressive since the reforms, wide spread and intense poverty among a large section of the population still persists in India. The benefit of fast growth in national income has not reached some sections of the population[2]. Poverty is commonly measured with the help of a poverty line which is a benchmark income or consumption level to distinguish the poor from the non-poor. The Millennium Development Goals of the United Nations use an international poverty line of PPP$ 1 a day. About 35% of Indian population remain below this poverty line. The Planning Commission, Government of India has defined the poverty line as a monthly per capita consumption expenditure (MPCE) of Rs. 49 and Rs. 56 at 1973-74 prices for rural and urban India respectively corresponding to a calorie intake level of 2400 and 2100. Updated by suitable price indices, the poverty lines for 2004-05 referred to MPCE of Rs.356 for rural areas and Rs. 539 for urban areas. The

[2] International evidence indicates that poverty effects of growth, including trade led growth, is very much circumstance specific. See, for example, a recent the review article by Winters et. al (2004)

most commonly used poverty index is the 'head count ratio' (HCR) which refers to the proportion of total population falling below the poverty line.

Figure 1 shows the long-term trends in head count ratio of poverty in rural and urban areas during the period 1960-61 to 2004-05.Incidence of poverty fluctuated till early 1970s without any upward or downward trends. Low per capita growth coupled with near invariance of the distribution parameter led to little improvement in the level of living of the poor till then. There was, however, a clear a declining trend in both rural and urban areas after 1973-74 when the economy moved up to a phase of higher economic growth of 5 per cent or above. The HCR fell from 56 per cent to 34 per cent in rural India between 1973-74 and 1989-90 and from 48 per cent to 33 per cent in urban India. The developments during the 1990s indicate that poverty rose a bit immediately after the reforms, but started falling later. The proportion of population below the poverty line came down to 28 per cent in rural areas and 26 per capita in urban areas in 2004-05. The number of persons below the poverty line is 302 millions by official estimates.[3] India accounts for about a quarter of the poor in the world and thus would pose a major challenge for meeting the first Millennium Development Goal which aims at reducing poverty to half the 1990 level by 2015.

Figure 1: Trends in Head Count Ratio (HCR) of Poverty, Rural and Urban India



It may be noted that higher economic growth has not led to a commensurate fall in poverty as expected earlier. Between 1993-94 and 2004-05, HCR fell by only 22 per cent

[3] The estimates for 2004-05 are based on uniform recall period of 30 days comparable to 1993-94 data. Estimates based on the 1999-2000 survey are not strictly comparable to those for other years due to the controversy over the mix-up of the recall period.

while per capita real income grew by 62 per cent. The implied elasticity of poverty with respect to per capita income (NNP) is less than 0.40 which is not very encouraging, to say the least. Accentuation of inequality might have partly neutralized the potential poverty reducing effects of growth.

2.3 Food Security

The poverty lines meet the nutritional norms in the base year and are updated for other years using suitable price indices to ensure the same purchasing power. But, the poverty measures do not directly reflect nutritional adequacy and food security. Consider, for example, the official poverty line in India defined as an income level that is just adequate to meet the average calorie norm in the base year 1973-74. This definition does not imply that (i) all persons above the poverty line meet the calorie intake norm and (ii) all persons below the poverty line are calorie deficient. Generally speaking, there is an increasing relationship between calorie intake and income or consumption expenditure. Per capita income is a major determinant of calorie intake, but there are also other factors like household composition, share of food expenditure, tastes and preferences, availability of types of food that determine food consumption and energy intake. Hence, the ranking of households by per capita income (or, total consumption expenditure) and per capita calorie intake are not necessarily identical. As Table 2 reveals about 12.5 per cent of the total population who lie above poverty line did not meet the required calorie norm in rural India in 1977-78 and an almost equal percent of the population from below poverty line were above the calorie norm.

Table 2: Incidence of Poverty Vs Under Nutrition: Rural India, 1977-78 (% of population)

	Below poverty line	Above poverty line	Total
Below calorie norm	45.32	12.47	57.79
Above calorie norm	12.31	29.21	42.21
Total	57.63	42.37	100

Sources:-Government of India (1993).

Further, the quantified relationship between calorie intake and income need not be very stable over time. Income level good enough to meet the calorie norm in the base year need not do so in subsequent years if consumption pattern changes due to changes in tastes and preferences, relative prices and other factors. Indeed, there has been considerable diversification in consumption pattern of people from food to non-food items, within food group from cereals to non-cereal food items, and within cereals from coarse to fine cereals. As Table 3 reveals proportion of expenditure on food has been going down over time in both rural and urban areas. Particularly note worthy is that share of cereals in total consumption expenditure has reduced by more than half over the last 3 decades. This has been accompanied by a fall in calorie intake per capita per day in both rural and urban population

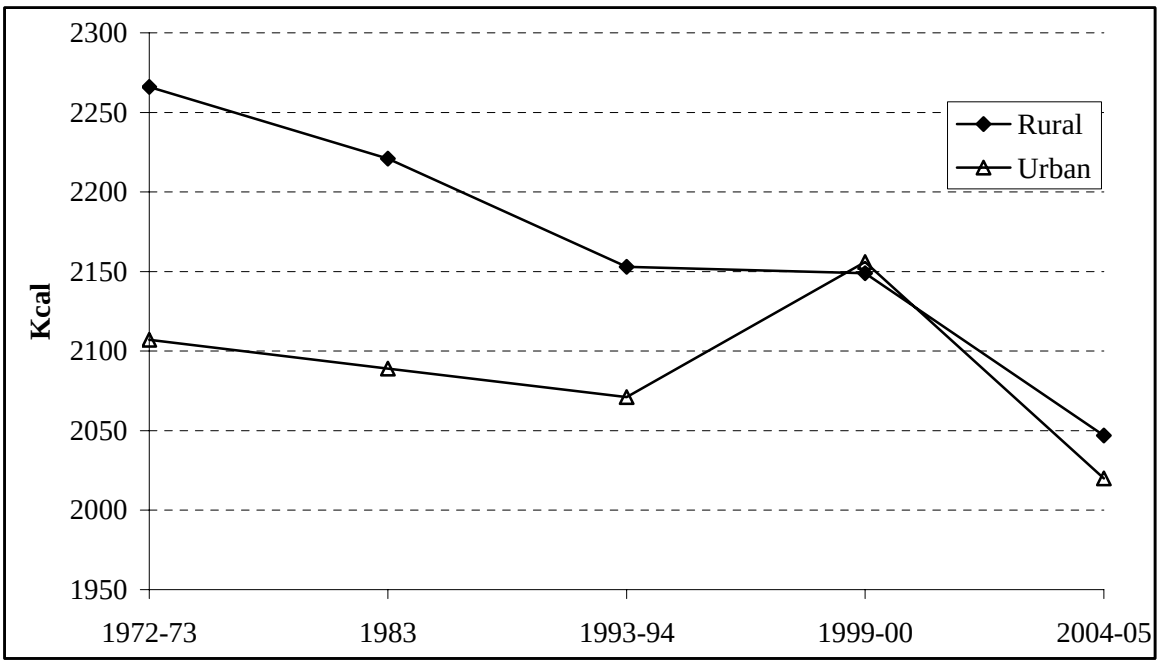
(Figure 2). Per capita intake of protein has also been falling, though fat intake has risen over the years (Figure 3).

Table 3: Changes in Consumption Pattern in Rural and Urban India

Item group	Expenditure on specific group as % of total consumer expenditure			
	1972-73	1983	1993-94	2004-05
RURAL				
Cereals	40.6	32.3	24.2	18.0
other food	32.3	33.3	39.0	37.0
Food total	72.9	65.6	63.2	55.0
Non-food total	27.1	34.4	36.8	45.0
Total expenditure	100.0	100.0	100.0	100.0
URBAN				
Cereals	23.3	19.4	14.0	10.1
other food	41.2	39.7	40.7	32.4
Food total	64.5	59.1	54.7	42.5
Non-food total	35.5	40.9	45.3	57.5
Total expenditure	100.0	100.0	100.0	100.0

Source: National Sample Survey Organisation, various Rounds.

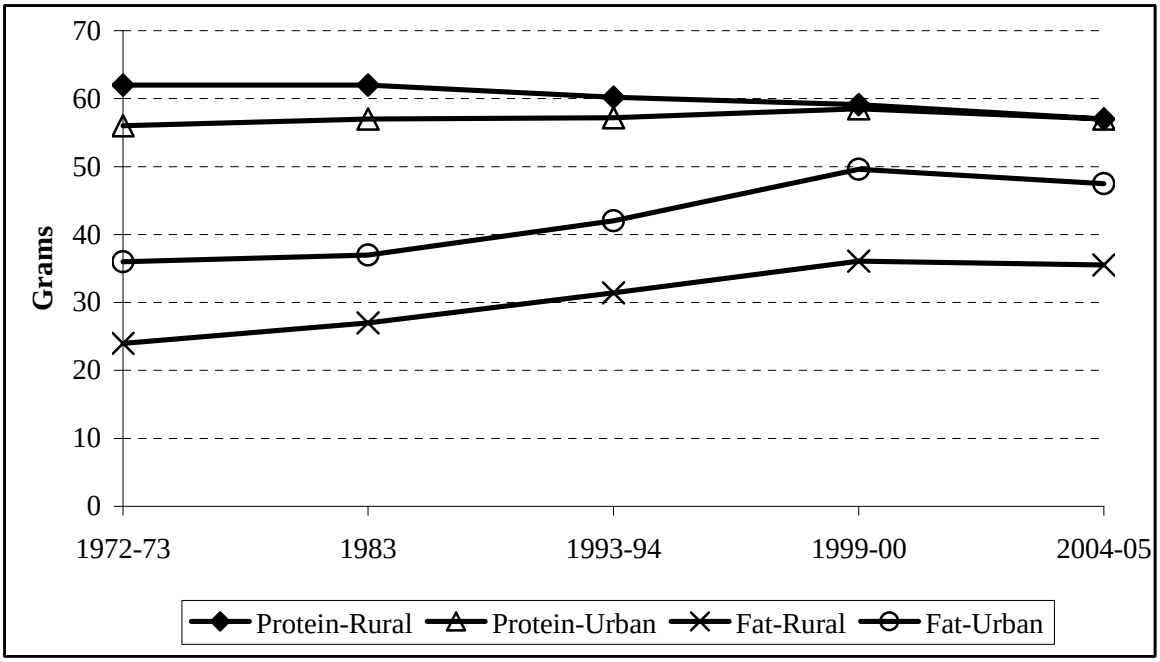
Figure 2: Calorie Intake Per Capita Per Day (kcal)



Source: National Sample Survey Organisation.

Note: Estimates based on the 1999-2000 survey data are not strictly comparable to those for other years due to the controversy over the mix-up of the recall period.

Figure 3: Protein and Fat Intake Per Capita Per Day (grams)

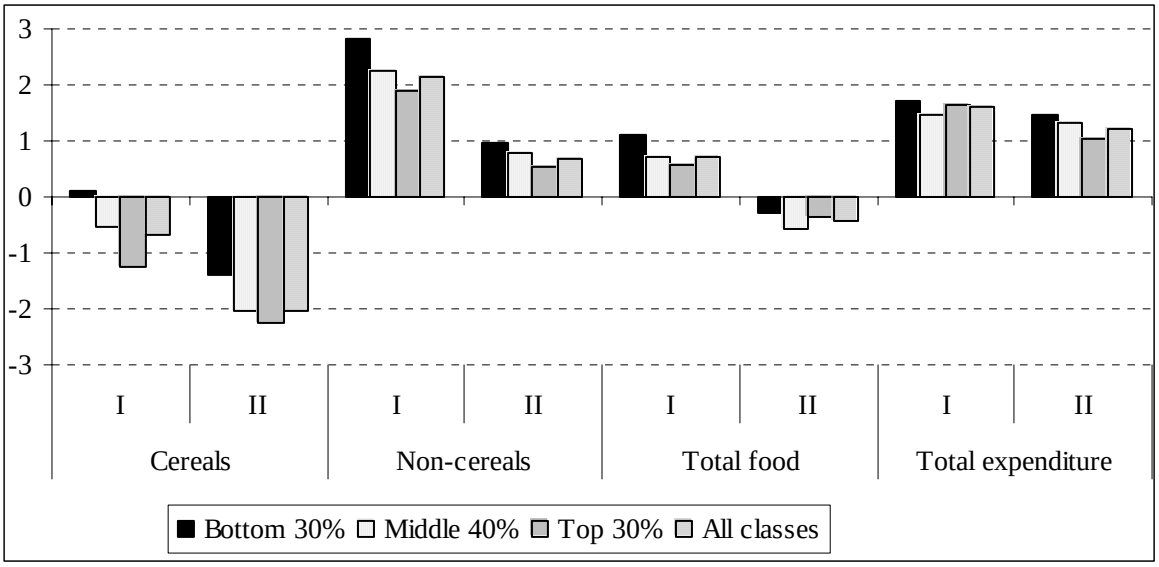


Source and Note: Same as in Figure 2.

Radhakrishna (2005) notes that the per capita cereals consumption in India has been on a declining trend during the last three decades. According to the NSSO data, per capita cereals consumption in rural areas fell from 15.3 kg per month in 1970-71 to 12.7 kg in 1999-2000 and in urban areas from 11.4 kg to 10.4 kg.

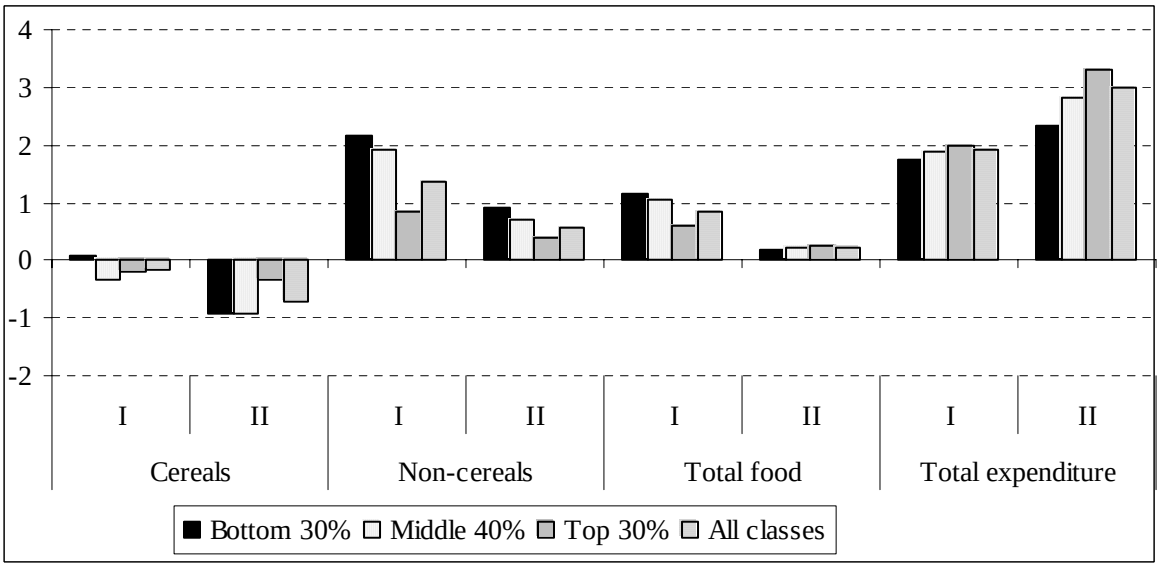
While per capita cereal consumption and calorie intake is expected to reach a plateau at a high enough income level, one does not expect it at or around the poverty line. Examining the available Indian evidence, Radhakrishna (2005) finds that per capita calorie intake of bottom 30% of population nearly stagnated, but that of middle 40 per cent substantially declined (Figures 4 and 5). The low per capita calorie intake of 1600-1700 kcal a day of the bottom 30 per cent of the population considerably falls short of the required norm. Food diversification at certain stage of development might be expected from a nutritional angle too if it increases non-calorie nutrients. But, as noted above, protein intake too has been falling in India.

Figure 4: Annual Compound Growth Rate in Per Capita Real Expenditure, Rural (%)



Source: Radhakrishna et al (2005).
Note: Period I - 1970-1989; Period II - 1990-2001.

Figure 5: Annual Compound Growth Rate in Per Capita Real Expenditure, Urban (%)



Source and Note: Same as in Figure 4.

Nutritional developments noted above have meant that households at the poverty line have substantially less calorie intake than the norms in recent years. Panda and Rath (2004) explain the divergence between calorie based poverty line and price updated poverty line in terms of consumer behaviour due to changing relative prices. They compute population below calorie based poverty line, which corresponds to average consumption expenditure required to meet the calorie norm in each year, and price updated poverty line, which is the

standard official procedure. Table 4 shows substantial divergence between the two procedures; for example, 65 per cent of rural population remained below the calorie based poverty line in 1993-94 while only about half of this population were below the price updated poverty line.

Table 4: Divergence Between Calorie Based Poverty and Price Updated Poverty for Rural India

Year	Calorie based poverty line		Price updated poverty		
	millions	(%)	million	(%)	Calorie intake
1973-74	48.7	54.7	48.7	54.7	2400
1977-78	62.9	61.0	60.9	58.9	2341
1983	113.9	64.4	100.7	55.5	2188
1987-88	154.4	64.0	126.5	47.8	2084
1993-94	330.8	65.6	222.5	34.1	1870

Source: Panda and Rath (2004)

The above evidence suggest that GDP growth and poverty reduction does not necessarily mean improved food security. From welfare point of view, trade policy analysis should consider indicators of food security in addition to overall growth and poverty. We now turn to description of a CGE model that is used for analyzing poverty and food security issues for India in the context of the Doha agenda.

3. Model Structure

We have used here a CGE model for India which is broadly in the Dervis, de Melo and Robinson (1982) tradition of trade focused models incorporating Armington type imperfect substitution formulation between domestically produced goods and foreign goods[4]. A distinctive feature of our model lies in its consideration of income distribution and expenditure pattern in some details. This helps in direct examination of changes in income and nutritional intake status of the poor as well as the rich.

The model is based around a slightly modified version of the Social Accounting Matrix (SAM) for the year 2003-04 prepared by Saluja and Yadav (2006). The modifications over Saluja and Yadav (2006) pertain to sectoral aggregation, and the merging of private and public enterprise accounts with households and government accounts, respectively. Further, the indirect collections reported by Saluja and Yadav (2006) have been broken down into import tariffs and domestic indirect taxes. The SAM used here distinguishes 37 commodity / sectors

[4] Subramanian (1993), Panda and Quizon (2001) and Polaski et.al (2008) have developed CGE models for India with Armington assumptions. Taylor (1983), de Janvry and Subbarao (1986), Narayana et al (1990), Sarkar and Panda (1990), Storm (1993), Ganesh-Kumar et. al (2006) are some other CGE models for India.

(12 agriculture and allied sectors, 16 industrial sectors and the rest services), 2 factors (labour and capital), 10 household classes (5 each in rural and urban areas), besides government and rest of the world. Appendix Table 1 lists the sectoral and household disaggregations in the SAM/CGE model. The macro data in the SAM is consistent with the National Accounts Statistics prepared by the Central Statistical Organisation (CSO) of the Government of India. The consumption patterns across household classes are derived from the large scale consumption surveys of the National Sample Survey Organisation (NSSO) of the Government of India.

The equations of the model arranged in various blocks are given in the Appendix. We briefly describe below the various blocks.

Prices: The first set of equations refers to different types of prices in the model. The first equation defines the price paid by consumers for imported good (PM) as exogenously given world price (PWM) times the exchange rate (EXR) inflated by the import *tariff* rate (tm). The second equation defines the price producers receive for exports on similar basis; the variable te here is export *subsidy* rate. The composite price (PQ) prevailing in the domestic market which is a weighted sum of domestic price (PD) and import price (PM) with corresponding shares in total absorption (Q) as weights. Unit sales price (PS) received by producers is a weighted sum of domestic sales prices and export prices. Net price is defined as sales price less sum of intermediate cost.

Sectoral domestic prices play the equilibrating role in bringing about supply and demand balance in each sector. The overall domestic price (PD) is exogenously given and serves as a numeraire. All prices determined by the model, including wage and exchange rates, are thus relative prices - relative to the given overall domestic price. The wage and exchange rates are real variables in this sense.

Production: Output in a sector is specified through a CES production function with labour and capital as arguments. Given the static character of the model, capital stock is assumed to be sector specific, but labour is mobile across sectors. Labour demand is derived from the first order condition of profit maximization with respect to labour use.

Factor Income: Sectoral wage income is determined based on factor employment and market clearing wage rate. The total supply of labour is assumed to be fixed. Capital (non-wage) income in a sector is taken as value added less the wage bill. The non-tax revenue of the government (which mostly consists of earnings from the public sector undertakings) is deducted from capital income to compute the component accruing to households. Further, net factor income from abroad (NFI) is added to both wage and non-wage income of households.[5]

Household Income and Expenditure: The next task is to allocate factor income determined above to households by income class. This step plays a crucial role in discussion of results of

[5] In recent years, NFI has been negative for both wage and capital income in India.

various simulation experiments. As already stated, we consider 10 income classes with rural and urban population divided into 5 groups each. The link from factor income to rural and urban household class by size of per capita income is established by considering initial endowment (factor income) in the SAM. This link is represented by the parameter sy_{hf}, the share of household h from factor income of category f. The total wage and non-wage income thus derived is distributed to households in proportion to their initial endowments (wage and non-wage income). In addition, households receive transfer payments by government (TRANS) and remittances from abroad (REM).

Turning now to uses of income, different household classes save different proportions of their income after payment of income taxes in fixed proportions. Income net of taxes and savings determines the total private consumption expenditure of the households. Sectoral private consumption is modeled 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. The parameters of the LES are class specific so that consumption pattern differences across classes are captured adequately in demand estimates. The implied Engel elasticities for different household groups are based on available econometric studies on consumer behaviour based on household consumption surveys data by the National Sample Survey in India. The estimates given by Radhakrishna and Ravi (1992) for various rural and urban quartile groups have been helpful guide in this regard. Consumer price index (CPI) is computed for each income class as a weighted average of the sectoral composite prices, the weights being class specific base consumption weights. Real income for each household class is then determined by deflating quartile income by the class specific CPI.

International Trade: International trade specifications follow Armington assumption that goods produced by the same sector at home and abroad are close but not perfect substitutes. Domestic output and import (or export) in a sector are thus two different goods. The Armington formulation defines demand in terms of a composite commodity which is a CES aggregation of the demand for domestically produced good and the level of imports. The ratio of imports to domestic demand is obtained as a function of ratio of domestic price (PD) and import price (PM) using the first order conditions. Similarly, total output produced is specified as a CET aggregate of exports and domestic demand. Ratio of domestic supply and exports depends on ratio of exports and domestic prices. Note that this formulation is based on small country assumption in so far as it assumes a horizontal export demand curve at given world prices.

Investment: The model follows the neoclassical closure where total capital formation (TINV) is determined by total savings in the economy. Savings are from three sources: private savings (S_p), government savings (S_g) and foreign savings (S_f). Investment by sector of origin is determined from total investment by applying fixed base proportions on total investment. Since the model is a static one, it considers investment by origin only and not by destination.

Government Account: The government account does not involve any behavioral relation. Total government revenue is sum of direct tax, domestic indirect tax, import tariff and non-tax revenue such as profit from public sector undertakings. Government total current expenditure consists of consumption expenditure, transfer payments, interest payments and subsidies. The difference between current revenue and current expenditure gives government savings.

Equilibrium Conditions: The final block of equations contains market equilibrium conditions for product market, labour market and foreign exchange market. The product market equilibrium condition is stated in terms of demand for composite commodity and its supply as defined in the trade block. Demand for composite commodity consists of intermediate demand, private consumption demand, government consumption demand, and investment demand. In the product market, domestic prices play the equilibrating role to achieve demand and supply balances. The demand and supply balance for foreign exchange is obtained by variations in the exchange rate. Lastly, wage rate clears the labour market with exogenously given total labour supply and labour demand from the production block.

4. Scenarios

Base Scenario: The Base scenario reflects the structure of the Indian economy as described in the SAM for 2003-04. Thus, in this scenario the tariff rates correspond to the collection rates prevailing in 2003-04.

Policy Scenario: We study the impacts of a "Doha Trade Liberalization" as per IFPRI's specification of the possible outcome of the Doha round negotiations. As per this specification, India is likely to implement less than full reduction in tariffs in all the sectors. Appendix Table 2 reports the tariff reductions carried out in various sectors. These percentage reductions were provided to us by IFPRI from their simulations using the MIRAGE model, in which the sectoral disaggregation match our sectors used in the India SAM/model. Two variants of this Doha trade liberalization scenario are carried out as follows:

Experiment 1: Unilateral trade liberalization by India. That is, we implement the tariff cuts mentioned in Appendix Table 2, but in a background where no other country has implemented any tariff cuts. Accordingly, in this variant the world prices are kept the same as in the Base scenario.

Experiment 2: This is a multilateral Doha Trade Liberalization scenario, in which all countries cut tariffs albeit at different rates, which affects trade flows and prices globally. These global level price changes are estimated by IFPRI using the MIRAGE model as noted above. From those results, the world prices applicable to India's imports and exports are reported in Appendix Table 2. These changes in world prices are incorporated in our national model to study the impacts on key macro and household distributional indicators. The

impacts are reported below as percentage changes in the variables of interest from their base values.[6]

5. Results

5.1 Macro Impacts

Table 5 reports the impacts of the above experiments on key macro indicators. It is seen that the limited trade reforms studied here have a negligible impact on the country's GDP. This is in contrast to some of the earlier studies that reported about 0.5 to 1% additional GDP gain due to tarde liberalization by India.[7] The difference between our results, specially in Experiment 1, and that of earlier studies can be attributed to two reasons., First, the tariff rates for 2003-04 used here are much lower than those used in the other studies which pertain to an earlier period. This reflects the fact that India has already carried out substantial tariff reforms and GDP gains from further liberalization could indeed be small. Second, we carry out only a partial trade reforms here, whereas some of the earlier studies examined full trade liberalization. We might note that national models generally assume given world prices unlike the changes considered here in Experiment 2.

Table 5: Macro Impacts (% change from base levels)

	Base	Exp1	Exp2
GDP	25243.8	0.005	0.003
GDP Agriculture	5738.1	0.022	0.119
GDP Non-agriculture	19505.7	-0.001	-0.031
Private Consumption	18724.9	0.36	0.12
Investment	6099.2	3.54	2.48
Exports	4409.9	-0.39	-5.14
Imports	4339.0	5.22	3.01
CPI Rural	1.0	0.14	0.18
CPI Urban	1.0	0.22	0.20
CPI Cereals	1.0	0.46	0.30
CPI Non-cereal food crops	1.0	0.54	0.39
CPI Dairy meat fish	1.0	0.72	0.42
CPI Processed foods	1.0	0.24	0.30
CPI Non-food	1.0	-0.08	0.06
Wage rate	1.0	0.82	0.43

At a disaggregate level, it is the agricultural GDP that contributes to the marginal increase in overall GDP especially under a multilateral Doha scenario (Experiment 2), while non-agricultural GDP hardly changes in both the experiments. This result again is in contrast to

[6] The base values are in Rupee Billion at 2003-04 prices for the quantity variables, while prices are normalised to 1.

[7] See for example, Parikh et al 1997; Panda and Quizon, 2001, Ganesh-Kumar et al., 2006, Polaski et al, 2008.

the earlier studies mentioned above, all of which reported that GDP gain was dominated by non-agricultural expansion. The near invariance of non-agricultural GDP is because of the decline in exports (especially in Experiment 2) along with a rise in imports. This expansion in net-imports neutralizes the expansion in domestic demand due to investments and private consumption.

Trade reforms as considered in the two experiments result in a rise in consumer prices as well as the wage rate. The rise in consumer prices is larger in urban areas than in rural areas. Further, food items become relatively costlier following trade liberalization, which could have adverse implications for the food security of the poorer households. Wage rate increases in both experiments, though the increase in Experiment 2 is only about half of that in Experiment 1. With labour supply being fixed, this essentially reflects the increase in labour demand due to the expansion of labour intensive agricultural production. In Experiment 2, the contraction in non-agricultural output mutes the increase in labour demand, and hence the wage rate increases by a lesser amount.

Details of sectoral output and price changes are reported in Appendix Table 3. In general output expansion is seen for most agricultural sectors and some service sectors, while most of the manufacturing sectors contract. Further, expansion (contraction) of output is generally more (less) in Experiment 2 than in Experiment 1. Changes in composite prices also show a similar pattern across the two experiments.

5.2 Distributional Impacts

The impact of the two trade liberalization scenarios on the distribution of income across different household classes are reported in Table 6. For each household real income is defined as its nominal income deflated by the household specific consumer price index (CPI). CPI for a household is computed as the weighted average of composite prices, with weights being the base consumption shares across different commodities for that household.

Table 6: Income Distribution (% change from base levels)

	Real income			Nominal income		CPI	
	Base value	Exp1	Exp2	Exp1	Exp2	Exp1	Exp2
Rural 1	311.8	0.43	0.05	0.60	0.25	0.17	0.20
Rural 2	1054.6	0.47	0.06	0.66	0.27	0.18	0.21
Rural 3	3707.4	0.35	0.32	0.54	0.54	0.19	0.22
Rural 4	4430.8	0.48	0.18	0.54	0.29	0.07	0.11
Rural 5	6198.7	0.41	0.03	0.56	0.21	0.14	0.18
Urban 1	175.6	0.41	0.07	0.67	0.30	0.26	0.23
Urban 2	678.3	0.46	0.09	0.72	0.32	0.26	0.23
Urban 3	2823.5	0.45	0.25	0.69	0.46	0.24	0.22
Urban 4	3347.8	0.47	0.16	0.69	0.36	0.22	0.20
Urban 5	4827.3	0.47	0.11	0.67	0.30	0.20	0.19

Turning to the results on income changes, it is seen that under both experiments all households enjoy a rise in real incomes. In other words, these results point towards a decline in income metric poverty in India as a result of these partial trade reforms, whether carried out unilaterally (Experiment 1) or as part of a multilateral agreement (Experiment 2).[8] These results also show that the real income gains are larger for all households in Experiment 1 than in Experiment 2. Amongst rural households, no obvious shift in the distribution of real incomes is seen in Experiment 1, while in Experiment 2 the gains are relatively larger for rural household classes 3 and 4 (i.e., households falling between 4th and the 9th deciles in ascending order of income distribution). In urban areas, however, the results point to a mild rise in income inequality even as poverty declines in both experiments. Do the increase in real incomes across all classes and decline in income poverty result in an improvement in food security / nutritional status of households? The answer would depend on the changes in prices of commodities that are important in the consumption basket of the households.

The results on changes in CPI show that rural households in general face higher prices in Experiment 2 than in Experiment 1, while it is the reverse for urban households. Further, under both experiments, the bottom three classes in both rural and urban areas face somewhat higher prices for the items in their consumption basket than the top two classes. As will be seen in the next section, this has important implications for food security / nutrition status of the lower classes in both rural and urban areas.

5.3 Impacts on Household Food Security

To assess the impact on food security at the households, we need to examine the changes in consumption pattern consequent to the policy changes. Given tastes and preferences of consumers, changes in consumption pattern can be expected following (i) a rise in real income levels, and (b) changes in relative prices of different commodities. We have seen earlier that real incomes of all households, including the poor, have risen. The price changes, however, have been less favourable to the poor as seen in the household specific CPI reported in Table 6. Further, as seen earlier, price of food items have increased relatively more compared to non-food items in the two experiments (Table 5). Within food items, the rise in price of processed foods (which includes vegetable oils and other processed foods) is lower than that of cereals, non-cereal food crops, dairy, meat and fish. It may be noted that processed foods are a major source of fat, while cereals, non-cereal food crops, dairy, meat and fish are major sources of calories and proteins. The impact of these changes on the consumption pattern of all the household classes is reported in Table 7 (Experiment 1) and Table 8 (Experiment 2).

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[8] The household classes here are defined in terms of population percentiles. Fall in income gap measures of poverty is directly evident from the rise in mean income of the bottom households. If one were to use an absolute poverty line and compute the proportion of people below that poverty line, the resulting head count ratio would obviously fall due to income mobility of all the classes.

Table 7: Percentage Changes in Real Consumption, Experiment 1

Sector	Rural 1	Rural 2	Rural 3	Rural 4	Rural 5	Urban 1	Urban 2	Urban 3	Urban 4	Urban 5
1. Paddy	-0.05	-0.07	0.03	0.05	0.03	-0.03	-0.03	0.03	0.02	0.00
2. Wheat	-0.07	-0.09	0.06	0.06	0.06	-0.03	-0.02	0.09	0.08	0.05
3. Other cereals	0.05	0.07	0.04	0.06	0.03	-0.04	-0.08	0.04	0.04	0.02
4. Oth crops	-0.07	-0.11	0.04	0.02	0.02	-0.06	-0.03	0.05	0.03	0.00
5. Sugarcane	0.04	0.08	0.01	-0.02	-0.02	0.03	0.09	0.02	0.00	-0.03
6. Oilseeds	0.06	0.10	0.03	0.01	0.01	0.05	0.11	0.04	0.03	-0.01
8. Anml prdts	-0.03	0.03	0.00	-0.03	-0.01	-0.02	0.00	0.00	-0.01	-0.04
9. Dairy	0.01	0.04	-0.03	-0.06	-0.02	-0.01	0.02	-0.02	-0.04	-0.07
10. Forestry	0.07	0.11	0.04	0.01	0.01	0.06	0.12	0.05	0.03	0.00
11. Fishing	0.04	0.09	0.02	-0.01	-0.01	-0.05	0.01	0.02	0.01	-0.03
12. primary products	0.00	0.00	0.00	0.00	0.00	1.21	1.38	1.44	1.47	0.00
13. vegetables, oils and fats	0.13	0.20	0.42	0.37	0.40	0.15	0.22	0.38	0.36	0.31
14. food products	0.15	0.18	0.32	0.26	0.28	0.23	0.21	0.34	0.31	0.24
15. Sugar	-0.16	0.21	0.09	0.02	0.02	0.03	0.18	0.06	0.04	-0.01
16. Textiles	1.10	1.32	1.18	1.12	1.22	1.06	1.31	1.20	1.19	1.13
17. wearing apparel	2.08	2.44	2.30	2.25	2.46	2.04	2.40	2.33	2.34	2.30
18. Leather products	1.12	1.32	1.24	1.20	1.31	1.09	1.30	1.26	1.26	1.22
19. wood products	0.00	0.00	0.00	1.55	1.70	0.00	0.00	1.60	1.62	1.58
20. paper pdts	1.82	2.10	2.05	2.03	2.21	1.78	2.05	2.08	2.10	2.08
21. petroleum pdts	1.58	1.85	1.74	1.69	1.85	1.54	1.82	1.77	1.77	1.73
22. chemicals	1.54	1.76	1.76	1.75	1.90	1.51	1.72	1.78	1.81	1.80
23. mineral pdts	3.15	3.57	3.63	0.00	3.97	0.00	0.00	0.00	3.75	3.76
26. metal pdts	1.24	1.46	1.38	1.35	1.47	1.21	1.43	1.40	1.41	1.37
27. transport eq	0.89	1.07	0.97	0.93	1.01	0.87	1.06	0.99	0.98	0.93
28. Oth manuf	2.81	3.19	3.22	3.23	3.52	2.78	3.11	3.26	3.33	3.33
29. Utilities	0.56	0.69	0.58	0.54	0.59	0.53	0.69	0.60	0.59	0.54
31. trade	0.13	0.22	0.07	0.01	0.01	0.11	0.24	0.08	0.05	-0.02
32. transport	0.43	0.56	0.43	0.38	0.41	0.41	0.56	0.44	0.42	0.36
33. communication	0.00	0.00	0.14	0.09	0.10	0.00	0.28	0.15	0.13	0.07
34. financial services	0.11	0.19	0.06	0.01	0.00	0.09	0.20	0.07	0.04	-0.02
35. Oth services	0.39	0.50	0.39	0.35	0.38	0.37	0.50	0.40	0.39	0.34
36. public administation	0.14	0.22	0.09	0.04	0.04	0.12	0.23	0.10	0.07	0.01
37. dwellings	0.00	0.00	0.01	-0.08	-0.09	0.09	0.27	0.03	-0.02	-0.13

Table 8: Percentage Changes in Real Consumption, Experiment 2

Sector	Rural 1	Rural 2	Rural 3	Rural 4	Rural 5	Urban 1	Urban 2	Urban 3	Urban 4	Urban 5
1. Paddy	-0.07	-0.06	0.01	0.03	0.01	-0.02	-0.02	0.05	0.04	0.03
2. Wheat	-0.05	-0.04	0.04	0.03	0.01	-0.02	-0.01	0.08	0.12	0.06
3. Other cereals	-0.01	-0.01	0.02	0.01	0.01	-0.02	-0.01	0.10	0.02	0.01
4. Oth crops	-0.06	-0.04	0.04	0.05	0.08	-0.04	-0.02	0.09	0.03	0.07
5. Sugarcane	-0.05	-0.04	0.10	0.04	-0.01	-0.04	-0.02	0.04	0.03	0.06
6. Oilseeds	-0.03	-0.01	0.08	0.04	-0.01	-0.03	-0.04	0.05	0.10	0.09
8. Anml prdts	-0.03	-0.02	0.05	0.09	0.00	-0.02	-0.04	0.01	0.10	0.09
9. Dairy	-0.04	-0.05	0.08	0.09	0.07	-0.02	-0.03	0.01	0.08	0.08
10. Forestry	-0.12	-0.11	0.02	0.12	0.17	-0.11	-0.09	0.07	0.11	0.15
11. Fishing	-0.03	-0.03	0.09	0.03	0.09	-0.01	-0.01	0.03	0.09	0.05
12. primary products	0.00	0.00	0.00	0.00	0.00	0.24	0.30	0.39	0.34	0.00
13. vegetables, oils and fats	0.14	0.16	0.17	0.12	0.28	0.22	0.18	0.40	0.41	0.41
14. food products	0.02	0.05	0.23	0.12	0.12	0.01	0.08	0.37	0.40	0.32
15. Sugar	-0.13	-0.09	0.38	0.10	0.19	-0.06	-0.02	0.09	0.04	0.09
16. Textiles	0.42	0.53	1.01	0.59	0.54	0.45	0.58	0.75	0.64	0.56
17. wearing apparel	1.20	1.41	2.05	1.54	1.56	1.24	1.44	1.73	1.61	1.55
18. Leather products	0.55	0.65	1.04	0.72	0.71	0.57	0.68	0.84	0.77	0.71
19. wood products	0.00	0.00	0.00	2.30	2.45	0.00	0.00	2.41	2.38	2.37
20. paper pdts	0.56	0.67	1.08	0.73	0.72	0.58	0.70	0.86	0.78	0.72
21. petroleum pdts	0.74	0.88	1.39	0.97	0.95	0.77	0.91	1.12	1.02	0.96
22. chemicals	0.78	0.90	1.22	0.99	1.02	0.79	0.90	1.08	1.03	1.00
23. mineral pdts	1.88	2.13	2.63	0.00	2.46	0.00	0.00	0.00	2.41	2.39
26. metal pdts	0.56	0.67	1.06	0.73	0.72	0.58	0.69	0.86	0.78	0.73
27. transport eq	0.27	0.35	0.71	0.38	0.34	0.29	0.38	0.51	0.42	0.36
28. Oth manuf	1.45	1.66	2.12	1.81	1.89	1.47	1.65	1.92	1.88	1.85
29. Utilities	0.07	0.12	0.42	0.13	0.08	0.09	0.16	0.25	0.17	0.11
31. trade	-0.09	-0.05	0.26	-0.06	-0.14	-0.07	-0.01	0.07	-0.03	-0.10
32. transport	-0.08	-0.04	0.28	-0.04	-0.12	-0.05	0.01	0.08	-0.01	-0.08
33. communication	0.00	0.00	0.27	0.00	-0.07	0.00	0.04	0.11	0.03	-0.03
34. financial services	-0.11	-0.08	0.19	-0.09	-0.16	-0.09	-0.04	0.02	-0.06	-0.13
35. Oth services	-0.14	-0.12	0.15	-0.13	-0.21	-0.12	-0.08	-0.02	-0.10	-0.17
36. public administation	-0.08	-0.04	0.23	-0.05	-0.12	-0.06	0.00	0.06	-0.02	-0.08
37. dwellings	0.00	0.00	0.39	-0.09	-0.20	-0.10	-0.01	0.10	-0.04	-0.14

Looking first at the results of Experiment 1, it is seen that the rise in real incomes across all households seen above does not result in a rise in consumption of all commodities for all the household classes (Table 7). Indeed several household classes witness a decline in their consumption of important food items such as paddy rice, wheat, coarse cereals, other crops (which include pulses an important source of proteins in the Indian context), animal products (meat), dairy products, and fish, even as they increase the consumption of vegetable oils, and (processed) food products. The results for Experiment 2 (Table 8) are qualitatively similar but different only in the magnitude of change. The rise in real incomes suggests a decline in

income poverty, while the decline in consumption of several important food items suggest that food security / nutritional status of several household classes might actually have turned worse in this scenario.

To assess this we compute the intake of calories, proteins and fats, for all the households implied in their consumption of different food items. The National Sample Survey Organisation (NSSO) provides information on the percentage distribution of intake of calories and proteins (but not for fats) sourced from different food groups for different household classes. This information is used to compute commodity-wise weights in the intake of calories and proteins by different households. In the case of fats, uniform weights across households are specified for various food items. Changes in the intake of calories, fats and proteins in the two experiments over the base levels are then computed.

As expected, the changes in the intake of nutrients vary across households and across nutrients themselves (Figures 6 and 7). In both the experiments, the bottom two classes in both rural and urban areas witness a decline in the intake of both calories and proteins, while the rest of the population increase their intake of these two nutrients. In contrast, all households witness a rise in intake of fats. Between the two experiments, the decline (rise) in intake of calories and proteins (fats) by the bottom two rural households is less (more) in Experiment 1 than in Experiment 2 (see Table 9). Reverse is the case across the two experiments for the bottom two urban cases. For the top three classes in rural areas, the increase in intake of all the three nutrients is less in Experiment 2 than in Experiment 1, which is opposite to that of the top three urban classes. These differences in the nutritional intake across rural and urban, and within each across different households, and also across the different nutrients themselves are consistent with the relative prices changes seen earlier.

Figure 6: Changes in Nutrient Intake, Experiment 1

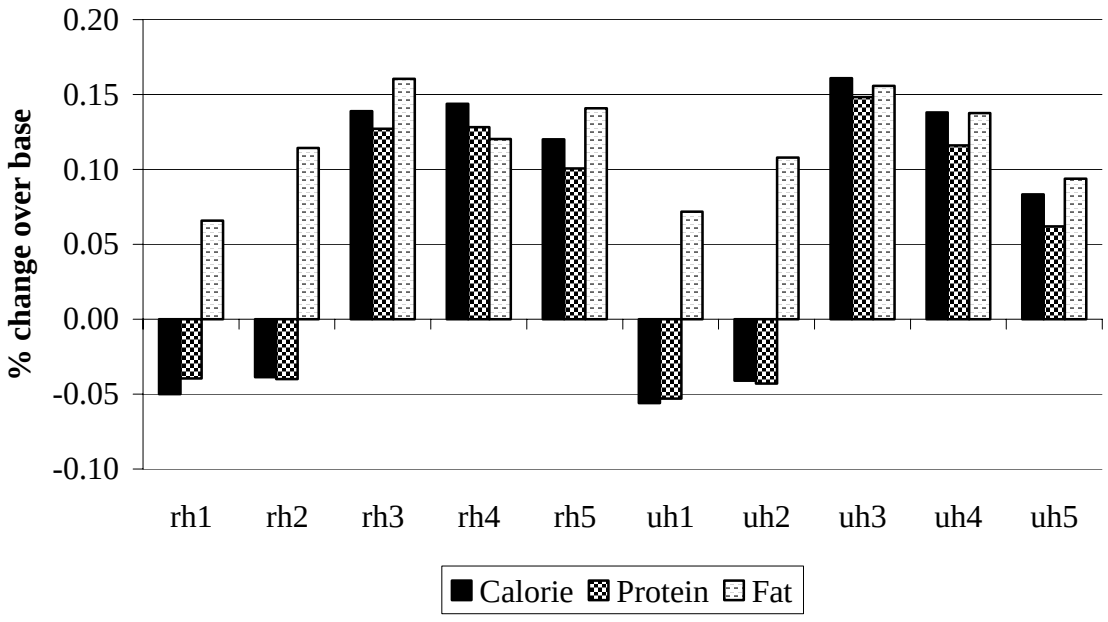

Figure 7: Changes in Nutrient Intake, Experiment 2

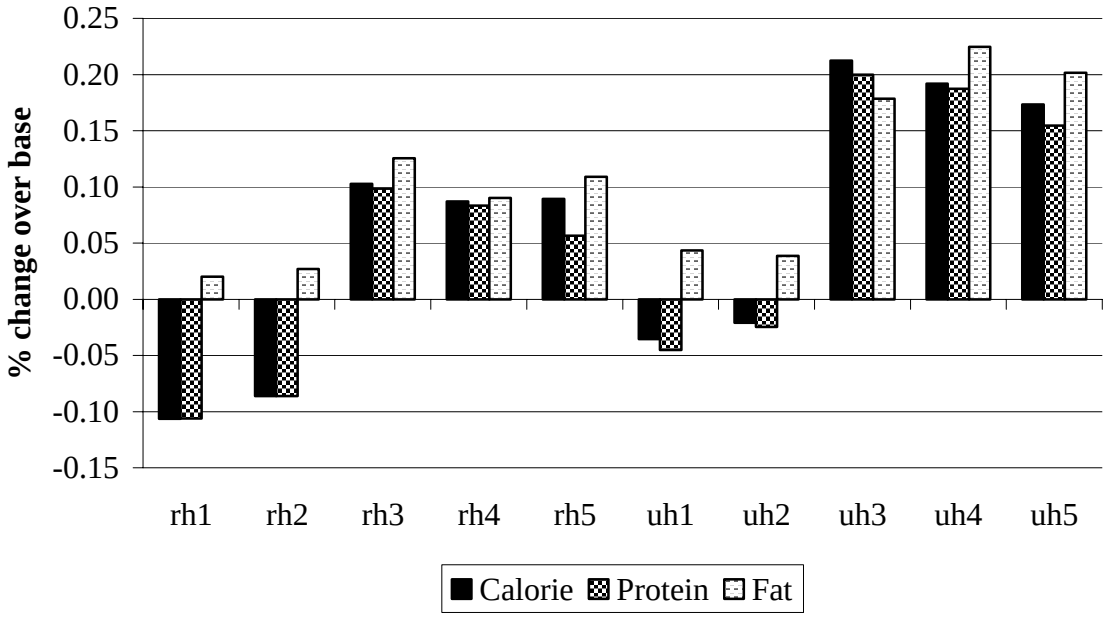

Table 9: Nutrients Intake (% change from base levels)

	Exp1			Exp2		
	Calorie	**Protein**	**Fat**	**Calorie**	**Protein**	**Fat**
Rural 1	-0.05	-0.04	0.07	-0.11	-0.11	0.02
Rural 2	-0.04	-0.04	0.11	-0.09	-0.09	0.03
Rural 3	0.14	0.13	0.16	0.10	0.10	0.13
Rural 4	0.14	0.13	0.12	0.09	0.08	0.09
Rural 5	0.12	0.10	0.14	0.09	0.06	0.11
Urban 1	-0.06	-0.05	0.07	-0.04	-0.05	0.04
Urban 2	-0.04	-0.04	0.11	-0.02	-0.02	0.04
Urban 3	0.16	0.15	0.16	0.21	0.20	0.18
Urban 4	0.14	0.12	0.14	0.19	0.19	0.22
Urban 5	0.08	0.06	0.09	0.17	0.15	0.20

6. Conclusions

This paper attempts to assess the impact of trade liberalization on growth, poverty, and food security with the help of a computable general equilibrium (CGE) model built for India. It argues that GDP growth and income poverty reduction that might occur following trade liberalization need not necessarily result in an improvement in the food security / nutritional status of the poor. in order to examine this, the impact of a possible Doha-like (partial) trade liberalisation scenario is studied here. Two experiments are carried out, one in which India unilaterally undertakes limited tariff cuts in several commodities, while in the second experiment these tariff cuts are carried out in the background of a multilateral agreement that results in a change in world prices that India faces. The tariff cuts and the changes in world

prices specified here were provided by IFPRI based on simulations using the MIRAGE model. The experiments studied here are carried out using a national CGE model based on a social accounting matrix for the year 2003-04 with tariff rates as prevailing in that year.

The simulation results show that (partial) trade liberalisation representing a Doha-like agreement has only a negligible impact on GDP growth. Significantly, it is agriculture that shows some small gains in GDP (about 0.02% under unilateral liberalisation and about 0.12% under multilateral liberalisation). In contrast, non-agricultural GDP remains invariant under unilateral liberalisation, and in fact declines by about 0.03% under multilateral liberalisation. The decline in non-agricultural GDP is primarily due to the simultaneous decline in exports and sharp rise in imports. The limited trade reforms results in rise in consumer prices, more sharply in urban areas than in rural areas. Further, the price of all food commodities in general rise relative to non-food commodities. With wage rates increasing faster than prices, real incomes of all household in both rural and urban areas rise, suggesting a decline in income poverty in the country. The magnitude of change in real incomes and relative prices are such that several household classes reduce their consumption of important food items such as paddy rice, wheat, coarse cereals, other crops (which include pulses an important source of proteins in the Indian context), animal products (meat), dairy products, and fish, even as they increase the consumption of vegetable oils, and (processed) food products. Consequently, the impacts in terms of intake of major nutrients (calories, proteins and fats) vary across households and across nutrients themselves. In both the experiments, the bottom two classes in both rural and urban areas witness a decline in the intake of both calories and proteins, while the rest of the population increase their intake of these two nutrients. In contrast, all households witness a rise in intake of fats.

The above results provide evidence that a rise in real incomes / decline in income poverty following trade reforms need not necessarily translate into improved food security / better nutritional status for households. The outcome on food security / nutritional status depends crucially on the movements in the relative prices along with the change in income levels. The results show that trade policy analysis should consider indicators of food security in addition to overall growth and poverty traditionally considered in such studies.

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Appendix – Model Equations

Price Block

1. $PM_i = PWM_i \cdot EXR \cdot (1 + tm_i)$

2. $PE_i = PWE_i \cdot EXR \cdot (1 + te_i)$

3. $PQ_i = (XD_i / Q_i) \cdot PD_i + (M_i / Q_i) \cdot PM_i$

4. $PS_i = (XD_i / X_i) \cdot PD_i + (E_i / X_i) \cdot PE_i$

5. $PN_i = (PS_i / (1 - t_i)) - \sum_j a_{ji} \cdot PQ_j$

6. $\bar{P} = \sum wx_i \cdot PD_i$

Production

7. $X_i = \alpha_i [\, d_i L_i^{-\rho n} + (1 - d_i) K_i^{-\rho n} \,]^{-1/\rho n}$

8. $L_i = X_i \cdot \alpha_i^{\sigma_i - 1} \left[\frac{d_i \cdot PN_i}{W_i} \right]^{\sigma_i}$

Factor Income

9. $YF_w = \sum w L_i + NFI_w \cdot EXR$

10. $YF_k = \sum (PN_i X_i - w L_i) - GNTR \cdot \bar{P} + NFI_k \cdot EXR$

Household Income and Expenditure

11. $YH_h = \sum YF_f \cdot ENDOW_{h,f} + TRANS_h * \bar{P} + REM_h * EXR$

12. $CPI_h = \sum wCh_i \cdot PQ_i$

13. $YHR_h = YH_h / CPI_h$

14. $S_h = \alpha_{sh} + \beta_{sh} \cdot YH_h (1 - td_h)$

15. $TC_h = YH_h (1 - td_h) - S_h$

16. $CH_{ih} = \theta_{ih} + \left[\frac{m_{ih}}{PQ_i} \right] \cdot [TC_h - \sum_j \theta_{jh} \cdot PQ_j]$

17. $C_i = \sum_h CH_{ih}$

International Trade

18. $Q_i = \alpha_{qi}\left[d_{qi} M_i^{\rho_{qi}} + (1 - d_{qi}) XD_i^{\rho_{qi}} \right]^{1/\rho_{qi}}$

19. $\frac{M_i}{XD_i} = \left[\frac{d_{qi} \cdot PD_i}{(1 - d_{qi}) \cdot PM_i} \right]^{\sigma_{qi}}$

20. $X_i = \alpha_{xi}\left[d_{xi} E_i^{\rho_{xi}} + (1 - d_{xi}) XD_i^{\rho_{xi}} \right]^{1/\rho_{xi}}$

21. $\frac{E_i}{XD_i} = \left[\frac{(1 - d_{xi}) \cdot PE_i}{d_{xi} \cdot PD_i} \right]^{\sigma_{xi}}$

Investment

22. $S_p = \sum_h S_h$

23. $TINV = S_p + S_g + S_f \cdot EXR$

24. $Z_i = wz_i \cdot TINV$

Government Account

25. $GR_d = \sum t_{dh} \cdot YH_h$

26. $GR_m = \sum PWM_i \cdot tm_i \cdot EXR \cdot M_i$

27. $GR_t = \sum_i t_i \left(\sum_j a_{ji} PQ_j X_i + PN_i X_i \right)$

28. $GR = GR_d + GR_m + GR_t + GNTR \cdot \overline{P}$

29. $GS_{ex} = \sum te_i \cdot PWE_i \cdot EXR \cdot E_i$

30. $GS = GS_a + GS_e$

31. $GE = \sum G_i \cdot PQ_i + TRANS \cdot \overline{P} + GINT \cdot \overline{P} + GS$

32. $S_g = GR - GE$

Market Equilibrium Conditions

33. $Q_i = \sum_j a_{ij} X_j + C_i + G_i + Z_i$

Labor Demand and Supply

34. $\sum L_i = \overline{L}$

35. $\sum PWM_i \cdot M_i = \sum PWE_i \cdot E_i + \sum NFI_h + \sum REM_h + S_f$

Glossary

Endogenous Variables

PM_i = Price of imports in domestic currency

PE_i = Price of exports in domestic currency

PQ_i = Composite price paid by domestic users

PS_i = Composite sales price received by producers

PN_i = Net price received by factors of production

PD_i = Domestic price of domestic produce

X_i = Output level

L_i = Labour demand in sector i

W = Wage rate

YF_f = Income of factor income category f

YH_h = Income of household class h

CPI_h = Consumer price index for household class h

YHR_h = Real income of household class h

S_h = Savings of household class h

TC_h = Total consumption expenditure of household class h

CH_{ih} = Consumption on item i by household class h

C_i = Consumption of item i by all households

Q_i = Composite demand commodity i

M_i = Import demand

XD_i = Demand for domestically produced good

E_i = Export

S_p = Private savings

S_g = Government savings

S_f = Foreign savings

Z_i = Investment demand by sector of origin

GR_d = Government revenue from direct tax

GR_m = Government revenue from import tariff

GR_t = Government revenue from indirect taxes

GR = Government revenue total

GS = Government subsidy

GE = Government expenditure total

Exogenous Variables and Parameters

PWM_i = World price of imports in foreign currency

PWE_i = World price of exports in foreign currency

EXR = Exchange rate

G_i = Government consumption

$\overline{P}$ = Overall price index

$\overline{L}$ = Total labour supply

TRANS = Transfers from government to households

REM = Remittances from abroad

GNTR = Government non-tax revenue

NFI = Net factor income from abroad

K_i = Capital stock in sector i

tm_i = Import tariff rate

te_i = Export subsidy rate

t_i = Indirect tax (or subsidy) rate

a_{ij} = Input-output coefficient

wc_{ik} = Consumption weights in consumption basket of class k

wx_i = Output weight in overall price index

sy_{hf} = Share of household h in factor income category f

m_{ih} = Marginal budget share of item i by househld h

θ_{ih} = Committed consumption of sector i by household h in the LES system

β_{sh} = Marginal propensity to save by household h

Appendix Table 1: Sectoral and Household Disaggregations in the SAM/model

Sectors	
1. Paddy	20. paper pdts
2. Wheat	21. petroleum pdts
3. Other cereals	22. chemicals
4. Oth crops	23. mineral pdts
5. Sugarcane	24. ferrous metal
6. Oilseeds	25. metal nec
7. Plant based fibers	26. metal pdts
8. Anml prdts	27. transport eq
9. Dairy	28. Oth manuf
10. Forestry	29. Utilities
11. Fishing	30. construction
12. primary products	31. trade
13. vegetables, oils and fats	32. transport
14. food products	33. communication
15. Sugar	34. financial services
16. Textiles	35. Oth services
17. wearing apparel	36. public administation
18. Leather products	37. dwellings
19. wood products	

Households	
1. Rural 1	Bottom 10% of rural population in terms of monthly mean per capita expenditure
2. Rural 2	10-30% of rural population in terms of monthly mean per capita expenditure
3. Rural 3	30-70% of rural population in terms of monthly mean per capita expenditure
4. Rural 4	70-90% of rural population in terms of monthly mean per capita expenditure
5. Rural 5	Top 10% of rural population in terms of monthly mean per capita expenditure
6. Urban 1	Bottom 10% of urban population in terms of monthly mean per capita expenditure
7. Urban 2	10-30% of urban population in terms of monthly mean per capita expenditure
8. Urban 3	30-70% of urban population in terms of monthly mean per capita expenditure
9. Urban 4	70-90% of urban population in terms of monthly mean per capita expenditure
10. Urban 5	Top 10% of urban population in terms of monthly mean per capita expenditure

Appendix Table 2: Percentage Change in Tariffs and World Prices Applicable for India

Sector	Base tariff rates	Tariff cut (%)	PW-imports	PW-exports
1. Paddy	0.0176	-32.03	-0.52	-0.91
2. Wheat	0.1319	-19.62	1.09	-1.61
3. Other cereals	0.1657	-21.02	2.79	-1.88
4. Oth crops	0.1771	-5.36	0.21	-1.75
5. Sugarcane	0.0206	0.00	-0.61	-1.80
6. Oilseeds	0.1897	-0.85	2.57	-1.77
7. Plant based fibers	0.0310	-2.44	0.68	-0.78
8. Anml prdts	0.0410	-12.46	1.46	-1.72
9. Dairy	0.0364	-0.62	4.66	-1.99
10. Forestry	0.0196	-40.00	-0.04	-2.67
11. Fishing	0.0740	-47.03	-0.02	-2.94
12. primary products	0.4412	-3.10	-0.06	-5.35
13. vegetables, oils and fats	0.3131	-25.44	-0.11	-2.49
14. food products	0.2467	0.00	0.22	-2.73
15. Sugar	0.1401	-48.59	1.39	-2.36
16. Textiles	0.1663	-53.10	-0.79	-3.06
17. wearing apparel	0.1415	-44.84	-1.42	-3.26
18. Leather products	0.1727	-45.32	-1.04	-3.65
19. wood products	0.1097	-43.16	-0.10	-2.95
20. paper pdts	0.0886	-39.63	0.02	-3.88
21. petroleum pdts	0.1524	-49.35	-0.15	-6.66
22. chemicals	0.1720	-50.27	-0.07	-4.66
23. mineral pdts	0.1848	-43.31	-0.02	-4.10
24. ferrous metal	0.1770	-51.79	-0.04	-4.26
25. metal nec	0.1808	-46.54	-0.06	-5.60
26. metal pdts	0.1008	-63.52	-0.07	-4.73
27. transport eq	0.1390	-55.39	-0.15	-4.48
28. Oth manuf	0	0	-0.04	-4.80
29. Utilities	0	0	-0.07	-3.92
30. construction	0	0	0.09	-3.52
31. trade	0	0	0.23	-2.91
32. transport	0	0	0.04	-3.77
33. communication	0	0	0.11	-3.07
34. financial services	0	0	0.11	-2.86
35. Oth services	0	0	0.09	-3.52
36. public administation	0	0	0.01	-2.59
37. dwellings	0	0	0.15	-3.01

Appendix Table 3: Sectoral Impacts (% change from base levels)

Sector	Sectoral real output			Composite price	
	Base	Exp1	Exp2	Exp1	Exp2
1. Paddy	903.8	0.213	0.342	0.523	0.364
2. Wheat	602.5	0.032	0.078	0.376	0.217
3. Other cereals	188.9	0.039	0.046	0.432	0.249
4. Oth crops	2317.1	-0.040	0.068	0.536	0.383
5. Sugarcane	235.8	0.103	0.126	0.639	0.369
6. Oilseeds	530.3	0.155	0.472	0.562	0.455
7. Plant based fibers	207.2	-0.081	-0.006	0.385	0.231
8. Anml prdts	716.5	0.095	0.161	0.678	0.459
9. Dairy	1143.2	-0.005	-0.006	0.766	0.417
10. Forestry	304.7	-0.178	0.031	0.540	0.627
11. Fishing	316.9	-0.038	0.039	0.626	0.344
12. primary products	822.4	-1.657	-0.608	-2.695	-0.514
13. vegetables, oils and fats	530.6	0.084	0.340	0.036	0.668
14. food products	1991.0	0.252	0.150	0.256	0.194
15. Sugar	240.9	0.255	0.302	0.560	0.352
16. Textiles	1002.2	-0.404	-0.448	-0.559	-0.367
17. wearing apparel	606.2	-0.497	-0.734	-1.265	-1.036
18. Leather products	145.6	-1.379	-1.606	-1.029	-0.735
19. wood products	147.9	-0.872	-1.615	-1.378	-2.653
20. paper pdts	460.6	-1.742	-0.912	-1.919	-0.684
21. petroleum pdts	1697.5	0.153	-0.131	-1.138	-0.752
22. chemicals	2604.1	-1.858	-1.482	-2.537	-1.552
23. mineral pdts	501.9	-2.996	-3.085	-4.114	-2.816
24. ferrous metal	1315.7	-0.717	-0.650	-1.346	-0.789
25. metal nec	498.7	-2.803	-2.169	-5.155	-3.341
26. metal pdts	441.1	-0.210	-0.514	-1.217	-0.754
27. transport eq	839.4	1.492	1.289	-0.660	-0.281
28. Oth manuf	2500.8	-0.271	-0.177	-3.589	-2.141
29. Utilities	1468.4	-0.168	-0.217	-0.253	0.024
30. construction	3809.8	2.217	1.273	-0.260	0.869
31. trade	4563.1	-0.026	-0.019	0.570	0.318
32. transport	3866.5	0.187	0.106	0.049	0.293
33. communication	596.4	-0.003	-0.040	0.436	0.237
34. financial services	2242.4	-0.043	-0.040	0.575	0.384
35. Oth services	3695.5	0.176	0.279	0.019	0.448
36. public administation	4066.3	0.023	-0.013	0.525	0.314
37. dwellings	1276.3	-0.022	-0.036	0.663	0.314