Distributional Effects of Tariff Reforms in India

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Abstract

I evaluate the distributional impact of tariff reforms in India using household survey data. The main objective of this paper is to examine whether increasing inequality in recent years could be attributed to trade openness. Tariff reforms trigger several general equilibrium effects which eventually affect household consumption and wage income. I estimate all these effects separately and find that all income groups have significant welfare gains. In addition, it appears that tariff reforms have pro-poor distributional effect in rural areas and pro-rich distributional effect in urban areas.

Keywords: Tariff reforms; Distributional effects; Household welfare

JEL Classification: F14; F15; F16; D30

1 Introduction

As a democratic state with socialist goals, Indian policy-makers have always been concerned with income distribution from the early years of planning. The

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government has favoured more state intervention with the sole intention of more equitable distribution and rapid poverty reduction. However, the "Hindu growth rate" in the first three decades of planning were not adequate to pull the masses out of the poverty trap. Whenever some (un)favourable conditions led to policy change, the debate centred around the distributional impact. It was during the mid-eighties that the government gradually adopted market-oriented economic reform and begun to loosen its grip on import licensing. However, the process was slow and ad hoc. In 1991, India initiated comprehensive measures of global economic integration compelled by international monitoring bodies to bridge the huge gap in the internal as well as the external balance. The debate on economic policy reform, which started in the eighties, continues to draw our attention today. The left wing of policy analysts perceive the reform as a shift of focus away from state intervention for more equitable distribution towards capitalistic exploitation under the free market economy. However, the literature is unable to deliver an unequivocal verdict.

Tariff reduction and elimination of some non-tariff barriers were two important components of the liberalising process in the 1990s. The general presumption about trade liberalisation is that it would lead to higher GDP growth rate, productivity and efficiency. Apart from these macroeconomic impacts, the estimation of the distributional effects is also important to understand whether higher macroeconomic performances are realised at greater social costs. If gains from reform do not reach all sections of the population, we need some complementary strategy to combat the widening gap between the rich and the poor. The distributional impact of trade policy reforms in India is an under-studied problem. In the literature where distributional impact has been considered, the main focus remains on labour market outcomes (Kumar and Mishra, 2008). The general equilibrium effects of trade reform on income(or expenditure) distribution is difficult to predict in a complex real world. Trade theory suggests that in developing countries, abundant unskilled labour would benefit most from trade, and thus inequality would fall. However, these predictions are challenged by new theories (Davis, 1996) and extensive empirical studies produce contradictory results. Therefore, the distributional impact of trade policy reform cannot be generalised to all developing countries. The period of rapid economic liberalisation in India also witnessed erratic trends in consumption inequality. A number of studies reveal mixed evidence on consumption and income inequality during this period (Pal and Ghosh, 2007). My own estimates of district-level Gini, based on National Sample Survey consumption data, show a downward trend from 1988 to 2000 that sharply increased in 2004-05. Thus, it is important to ask whether the increasing consumption inequality could be attributed to trade openness. The causal impact of trade reform on poverty and inequality is largely understudied in developing countries for two reasons: 1) the lack of data and 2) the difficulty of finding a suitable empirical strategy to identify the causal relation. Recently, Topalova (2007) solved these two problems by constructing a unique district-level panel of trade exposure for India. It is found that tariff reforms led to higher poverty rates and a higher poverty gap in rural districts. She also found that district inequality is unaffected by tariff reform. The main drawback of this approach is that it does not clearly track all possible general equilibrium effects of tariff reforms which eventually affect income distribution. One of the possible links between income distribution and tariff changes is expressed as a change in relative sectoral factor returns due to a change in relative output prices. As pointed out by Topalova (2007), it is mainly labour market adjustment that is identified as the primary mechanism in India. However, there are other general equilibrium effects, viz., the effect of relative output prices on consumption, which can potentially affect poverty and inequality measures. Therefore, it is important to consider all possible links, and not only the labour market adjustment, to estimate the overall distributional impact of tariff policy changes.

In this chapter I estimate the general equilibrium distributional impact of tariff reforms in India using the empirical method of Porto (2006). This method enables me to find each channel separately through which poverty and inequality could be affected by tariff changes. The reform causes domestic prices of traded goods to change and it triggers two general equilibrium effects: 1) changes in the prices of non-traded goods and 2) changes in factor incomes. By combining the estimates of consumption effects due to changes in the prices of traded and non-traded goods and labour income effects due to labour market adjustment, I am able to find the overall distributional impact. Using National Sample Survey data I find that all income groups have a significantly positive welfare gain, but the overall distribution is affected differently in the rural and urban sectors. Unlike Topalova (2007), I found that gains for the poor are relatively higher in rural areas and that for the rich is higher in urban areas. Since I estimate each effect separately, this method also helps me to explain why inequality is affected by tariff reforms and the relative contribution of labour market adjustment and adjustment in consumption spending. The consumption effects and labour income effects in the rural sector have offsetting effects along income distribution. But the labour market effect is pro-poor and relatively stronger in the rural sector. Therefore, the aggregate effect of tariff reforms is pro-poor in the rural sector. On the other hand, the labour market effect is similar across all groups and the consumption effect is relatively higher for richer households in the urban sector. Thus, the total gain as a percentage of household expenditure is higher for richer households.

The remainder the chapter is organised as follows. In Section 2, I briefly describe the trade liberalisation process and some important aspects of the tariff structure. Section 3 describes the empirical strategy developed by Porto (2006), while section 4 presents the data used for this exercise. In Section 5, the results are derived. Section 6 concludes.

2 Trade reform in India

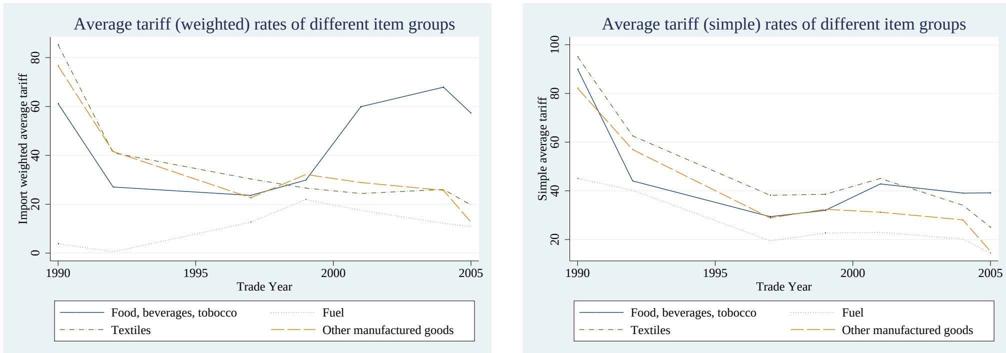
During the first three decades (1950-80) of planning, India grew at a slow but steady rate of three and a half percent. After that, the growth rate almost doubled. The blame for the relatively slow growth during the first half is attributed to microeconomic distortions and state intervention that severely restricted private entrepreneurship (Panagariya, 2004). Investment licensing restricted competition in the domestic market and import licensing eliminated foreign competition. This was during the mid-eighties, when India started some ad hoc external reform measures followed by comprehensive economic liberalisation in 1991. The reform in India in 1991 was unique in the sense that it was drastic and came as a surprise to policy-makers. The exogenous nature of the trade liberalisation measures in 1991 helps analysts to establish a causal relationship between reform measures and economic outcomes (Topalova, 2007). The earlier phases of external sector reforms were driven by the economic situation. The literature traces three distinct phases of trade policy in India (Panagariya, 2004). The first period is identified as a trend towards protectionism culminating in virtual autarky (1950-1975). The proportion of licences going to traders (not actual users of imported goods) had diminished from 61% of all licenses issued in 1951-52 to less than 3% in 1970-71 (Bhagwati and Srinivasan, 1975). The structure of imports had shifted towards capital goods, intermediate goods and raw materials through *actual user* licences (food grains were the only significant major consumer goods imported). According to Panagariya (2004), the trade regime was so restrictive by the mid-1970s that the share of import of non-oil and non-food grains in GDP fell to 3% in 1975-76. In the late seventies, the healthy accumulation of foreign exchange reserves due to remittances from the Middle East and increased export performances raised the comfort level of policymakers. Industrialists began to lobby for less restrictive import licensing for capital goods. Against the backdrop of this development, the second phase of the trade regime started in 1976 with the re-introduction of Open General Licensing (OGL). The articles scheduled in OGL no longer required a licence from the Ministry of Commerce. More and more articles were included in this list and by April 1990 the value of OGL imports was approximately 30 percent of total imports. Improved agricultural productivity and the discovery of oil fields made it possible to expand non-oil and non-food imports. However, tariff rates were raised substantially during this period. Moreover, the tariff codes were so complex and obscure that even trade specialists had problems interpreting the information. By the end of 1990, the average tariff rate was 83.7% and the maximum tariff rate was 521% (Table 1). The liberalisation process in the 1980s was complemented by an expansionary fiscal policy which was supported by internal and external borrowing. The external borrowing was unsustainable and the Gulf War in 1990 led to a swelled import bill for oil. The balance of payment deficit was so severe that the total foreign exchange reserve could merely finance two weeks' imports. Political uncertainty, mainly due to the short span of two consecutive coalition governments, undermined the confidence level of investors. The newly elected Congress government in 1991 used the crisis as an opportunity to led the country towards a new phase of trade regime (third phase). The budget in July 1991 was a clear shift towards an outward-oriented, market-based economy. Import licensing on all but consumer goods, some intermediate inputs and capital goods were removed. After rounds of deliberation at the WTO, consumer goods were freed of licensing in 2001.

Table 1: Tariff structure in India

Year	Mean	SD	Max
1990	83.7	51.99	520.93
1992	58.08	22.99	355.00
1997	30.63	14.63	260.00
1999	33.67	12.55	230.00
2001	34.87	26.54	586.91
2004	30.38	15.04	232.39
2005	19.45	16.85	232.39

All statistics are calculated using import weighted average MFN tariff rates of 6 digit HS item group.
(source: Trade Analysis and Information System, UNCTAD)

After gradual de-licensing in the external sector during the 1980s, high import tariffs were an effective source of trade protection before 1991. Therefore, tariff rates were drastically reduced as part of a comprehensive liberalisation process in 1991. Table 1 shows the significant change in MFN (Most Favoured Nations) tariff rates during the early phase. The mean tariff rate fell from 83.7% in 1990 to 58.1% in 1992 and gradually reduced to 19.5% in 2005. The standard deviation of the import weighted average tariff rates of 6-digit (HS code) item groups is only 16.9% in 2005 compared to a very high degree of dispersion in 1990.



(a) weighted (b) simple

Figure 1: Simple and weighted average tariff of different consumption item groups

Figure 1(a) shows the weighted average tariff rates of different consumption item groups. From 1990 to 1992, both the simple and weighted averages of food, textiles and other manufactured goods fell sharply and then followed a steady declining trend except for food, beverages and tobacco products. The simple average tariff rate for fuel and fuel products had a declining trend, but import weighted tariffs did not show a uniform trend. It is clear from the plots that the first part of the 1990s witnessed the sharpest drop in tariff rates. Though there are some reversal in later periods, the general direction of tariff reform is towards liberalisation. As a result, trade shares in GDP have increased at a much higher rate after 1991 (fig. 2). The drastic change in tariff rates in 1991 and subsequent gradual changes have several general equilibrium effects on prices and wages. The next section outlines the empirical strategy to identify welfare effects of tariff changes incorporating all these general equilibrium effects.

3 Empirical strategy

Trade liberalisation is a broad concept encompassing variety of phenomena that reflect increased interdependence between countries, flow of goods and services across border, movement of capital and labour, etc. Some aspects of trade reforms are easier to measure and therefore, received more attention in empirical research. Detailed information of trade barrier is often not easily available for

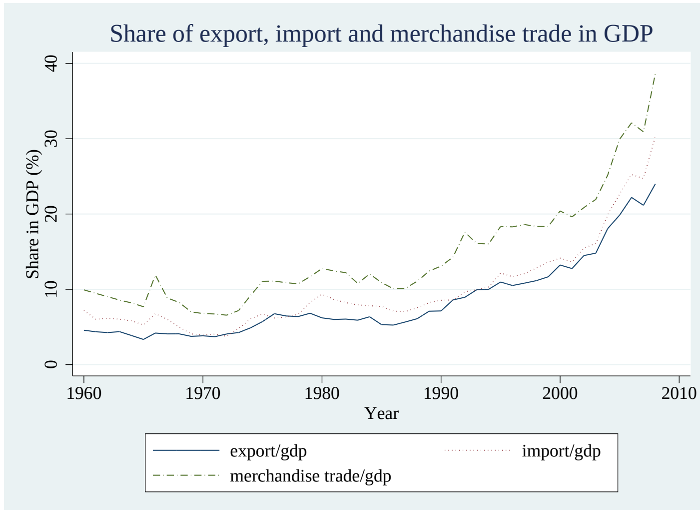


Figure 2: Share of export, import and merchandise trade in GDP

developing countries. The episodes of reductions in tariff barriers are commonly studied mechanism of trade liberalisation for various reasons. First, tariffs are relatively easier to measure and readily available. Second, it is mostly ad valorem and therefore, it reflects price based trade protection. My study focuses on tariff reform.

Co-evolution of income or consumption distribution and trade policy is a common phenomenon. However, establishing a causal link between reform and inequality by providing credible evidences poses several challenges apart from the issue of endogeneity of reform measures. The main challenge is to isolate the effects of tariff reform from other contemporary changes that might have influenced change in the consumption (income) distribution. Governments in developing countries often undertake several reforms in external sector as well as in internal sector simultaneously. Any study that attempts to identify the overall impact of tariff reform thus demands a strong empirical methodology with proper identification assumptions. Goldberg and Pavcnik (2007) discuss two broad approaches to the problem: 1) general equilibrium approach (Porto (2006)) and 2) differential exposure approach (Topalova (2007)). The main advantage of the general equilibrium approach is that it explicitly accounts for all possible major channels through which reform affects distribution of income or consumption expenditure in a country. However, the predictions of this approach depend on reliability of estimates of certain crucial parameters that are typically unknown: 1) elasticity of wages with respect to prices, 2) elasticity of prices of non-traded goods with respect to prices of traded goods and 3) degree of pass-through from tariff changes to product prices. These parameters are difficult to estimate when many other policies change contemporaneously with tariff reform. The second approach exploits the cross sectional variation in trade protection to examine whether a region or industry that were more exposed to trade protection experienced higher/lower change in inequality (wage, income or consumption) compared to a less exposed region or industry. Given a trade policy at the industry level within a country, exposure to trade protection of a geographical region depends on industry concentration in that area. The main advantage of this approach is that it requires much weaker identification assumptions than the general equilibrium approach. However, such approaches can only identify the extent of region/industry specific deviation from the aggregate trend that could be attributed to the reform measures. It can not identify the role of reform in explaining the trend itself. It also can not shed light on composition of the welfare change due to reforms - whether the driving force of such changes is labour market adjustment or strong inter-linkages between the traded and the non-traded industries. I take the general equilibrium approach for two reasons: 1) explicitly account for all linkages and 2) comparing results derived from my exercise with that of differential exposure approach.

I follow the Porto (2006) to identify the distributional impact of tariff reforms at the household level. I briefly discuss the main elements of the Porto (2006) model which is adapted from the small open economy models of Dixit and Norman (1980) and Woodland (1982). Let us assume that total family income is equal to total family expenditure on different consumption goods and services (no saving). I also assume that total family income consists of factor incomes and some exogenous income. Therefore,

$$e^j(\mathbf{P_T}, \mathbf{P_{NT}}, u^j) = x_0^j + \sum_m w_m^j + k^j \tag{1}$$

where $e^j(.)$ is the expenditure function of household j. The expenditure function depends on price vectors of traded goods($\mathbf{P_T}$), non-traded goods ($\mathbf{P_{NT}}$) and required household utility u^j. Household's total income consists of household capital income (k^j), sum of individual labour incomes (w_m^j) and some exogenous income (x_0^j).

In a small open economy the domestic price of traded goods (p_i) depends on exogenous international price (p_i^*) and imposed tariff rate (τ_i). I can express the domestic price of traded goods as

$$p_i = p_i^*(1 + \tau_i). \tag{2}$$

It is assumed that domestic firms in the traded good sector produce under constant returns to scale and competitive market. Thus, the prices of these goods are equal to unit production costs

$$p_i = c_i(\mathbf{w}), \tag{3}$$

where $c_i(.)$ is the unit production cost and $\mathbf{w}$ is the vector of factor prices. The system of equations in 3 determines the general equilibrium relationship between factor prices and commodity prices. When prices of traded goods change, the factor reallocation takes place for the given economy-wide factor endowment. As a result, factor prices adjust. In a two-good and two-factor model the relationship is described by the Stolper-Samuelson theorem. However, for a multi-dimensional set-up, there is a correlation among prices of goods and prices of factors (Dixit and Norman, 1980).

The total expenditure of a household consists of spending on traded goods and spending on non-traded goods. The prices of non-traded goods is derived from demand and supply interaction in the domestic market. Using Roy's identity the demand for non-traded good is derived as a derivative of expenditure function $e^j(.)$ with respect to the price of that good. Similarly, using Hotelling's lemma I get the supply of non-traded good as a derivative of GDP with respect to the price of that good. That is,

$$\sum_j \frac{\partial}{\partial p_k} e^j(\mathbf{p_T}, \mathbf{p_{NT}}, u^j) = \frac{\partial}{\partial p_k} r(\mathbf{p_T}, \mathbf{p_{NT}}, \mathbf{v}, \phi) \tag{4}$$

where $r(.)$ is GDP function of the economy, $\mathbf{v}$ is factor endowments and ϕ is some measure of technology. The equilibrium prices of non-traded good is determined by

$$p_k = p_k(\mathbf{p_T}, \mathbf{v}, \phi, \mathbf{u}) \tag{5}$$

where $\mathbf{u}$ is a vector of utilities for all households.

When there are changes in tariff rates, they affect the domestic prices of traded goods (equation 2). The changes in domestic prices of traded goods induce two adjustments: changes in factor returns (equation 3) and changes in prices of non-traded goods (equation 5). These adjustments capture the general equilibrium effects of tariff reform. I assume that capital income for the majority of households is negligible. Thus, I consider labour income as the only source of factor income. The welfare effects caused by the change in prices of traded goods and non-traded goods are called *consumption effects* and the welfare impact caused by changes in labour income is called *labour income effects* (Porto, 2006).

The change in household welfare due to change in tariff rates is computed using compensating variation measures (CV). CV is the amount of money needed to compensate a household to achieve the same level of utility before the price change. From the household budget (equation 1), I derive the change in exogenous income x_0^j so that the family gets the same pre-reform utility level. Taking the total differential of Equation 1 for an exogenous change in domestic price of traded good i (p_i) and assuming zero capital income,

$$dx_0^j = \frac{\partial e^j(.)}{\partial p_i} dp_i + \sum_{k \in NT} \frac{\partial e^j(.)}{\partial p_k} \frac{\partial p_k}{\partial p_i} dp_i - \sum_m \frac{\partial w_m^j}{\partial p_i} dp_i. \tag{6}$$

The change in domestic price of traded good is induced by an exogenous change in tariff rate. Therefore,

$$dp_i = \frac{\partial p_i}{\partial \tau_i} d\tau_i. \tag{7}$$

Dividing both sides of equation 6 by total expenditure e^j, CV is expressed as a share of total household expenditure,

$$\frac{dx_0^j}{e^j} = \left(s_i^j + \sum_{k \in NT} s_k^j \frac{\partial ln(p_k)}{\partial ln(p_i)} - \sum_m \theta_m^j \varepsilon_{w_m p_i}^j \right) \frac{\partial ln(p_i)}{\partial ln(\tau_i)} dln(\tau_i) \tag{8}$$

where s_i^j is budget share spent on traded good i by household j, s_k^j is budget share spent on non-traded good k, θ_m^j is the wage income share of member m in total family expenditure and $\varepsilon_{w_m p_i}^j$ is wage-price elasticity of household member m. The wage-price elasticity, $\varepsilon_{w_m p_i}^j$ captures the proportional change in wage earned by member m due to a change in the price of traded good, p_i.Since I am measuring CV for a reduction in tariff rate, the welfare effect in Equation 8 is *negative* of compensating variation. As a result, a positive estimate of CV in Equation 8 means a welfare gain.

The equation 8 shows that the total welfare effect of each household has three components: a direct effect through the consumption of traded goods and general equilibrium effects through non-traded sectors and the labour market. To estimate the overall impact of trade policy reform, I estimate each of these three components. It is also noted that Equation 8 captures only first order effects. The higher order effects deal with estimating own price and cross-price elasticities. Following Porto (2006), I ignore higher order effects because the price elasticities will be irrelevant for distributional effects if price elasticities are assumed to be same for all income levels. Since all higher order effects are ignored, the absolute measures of welfare effects are distorted. However, the relative distributional effect will not be affected by ignoring higher order effects. Similarly, the assumption of a competitive market is crucial for estimating the absolute measure of welfare gain. I assume that if these distortions affect the general equilibrium prices and wages, it will affect all income groups equally. Using consumption survey data, I estimate the consumption effects of traded and non-traded goods. Employment survey data is used to estimate household-level labour income effects.

The assumptions considered above need some caveat. I have assumed that there is perfect pass-through from tariff rate changes to domestic price changes and there is no change in world price due to domestic policy change. In a small open economy this is quite reasonable to assume fixed international price. However, there are some empirical evidences from developing countries that demonstrate significant change in price behaviour of international exporters due to tariff and exchange rate reforms. If pass-through rates are imperfect and industry specific, the results derived in this paper need more qualification. I do not consider imperfect pass-through analysis due to data limitation. I also assume that household saving is negligible. This assumption need not be valid if there is strong presence of financial market. In presence of significant linkages between tariff rates and capital market adjustment, the results are biased. Data limitation prohibits us to estimate elasticity of rate of return from capital with respect to product prices. As I have mentioned before, there are several contemporaneous changes in Indian economy. The combined effect of such changes could lead to more competitive labour and capital markets. How could we minimise the bias introduced by such contemporaneous changes? One important aspect of these policy changes is that they occurred during same period, i.e. after 1991. While estimating the parameters (to be used in general equilibrium analysis) we explicitly control for time dummy to minimise such biases.

4 Data

The purpose of the chapter is to estimate household-level welfare effects and compare them across different income groups. To estimate the welfare effects of tariff reform, I need tariff data over the reform period as well as information on disaggregated household-level consumption and individual wages. The National Sample Survey Organisation (NSSO), set up by the Government of India, conducts large quinquennial rounds of survey to collect socio-economic data. The consumption schedule collects information on household consumptions on different goods and services. The employment and unemployment schedule collects individual information on education and wages. I use the 61st consumption schedule as the base survey to estimate household budget shares of traded and non-traded goods. The cross-section of households gives detailed information on the value of consumption of disaggregated items. I classify those items in the traded and non-traded categories based on import data (HS code and its description). The employment and unemployment survey rounds are used to estimate wage-price elasticity. I use the five latest quinquennial rounds (1983, 1987-88, 1993-94, 1999-2000 and 2004-05) to get pooled cross-section data of individual wage, age, sex, education and other characteristics. These surveys cover the whole geographical area of India except for some areas of Jammu & Kashmir and Andaman & Nicobar Islands. The NSSO uses a complex stratified sampling design to select the ultimate stage unit (households) in both the urban and rural sectors.

The tariff data is extracted from the UNCTAD - TRAINS (Trade Analysis and Information System) database. Detailed information by sub-headings on tariffs and value of imports is available on the World Integrated Trade Solution (WITS) website. The data portal obtained Indian tariff rates from the Customs Tariff Schedule 2004-2005, Directorate of Publicity and Public Relations, and Customs and Central Excise. I use MFN (Most Favoured Nation) tariff rates to find the import weighted average tariff rates from 1990 to 2005 of different item groups. It also reports the calculation of ad valorem equivalents of non-ad valorem tariffs. The domestic prices are collected from various publications of the Central Statistical Organisation (CSO). The CSO publishes wholesale price indices (WPI) of disaggregated items for the all-India level. The prices of non-traded goods (mostly services) are not covered in the WPI data published by the CSO. However, I use GDP deflator to estimate the price indices of non-traded goods. The nominal and real GDP are collected from various publications of the CSO. I use sector-wise GDP deflators to find the price indices of different non-traded categories. Therefore, the creation of non-traded item groups is based on the availability of GDP deflator data for that category. I discuss each of these variables in detail in the estimation section (section 5).

5 Estimation

The household-level welfare effects of tariff policy are summarised by Equation 8. In this section I first estimate the change in domestic prices of traded goods due to tariff reform. Then, I estimate the general equilibrium effects: consumption effects in traded goods, non-traded goods and labour income effects. The impact of tariff reduction on domestic prices is estimated as the change in import weighted tariff rates. The TRAINS dataset provides a 6-digit level classification of MFN tariff rates with import values. The goods are classified in four traded groups: 1) Food (primary and manufactured), beverages and tobacco products (FFBT), 2) Fuel, power, light & lubricants(FPLL), 3) Textile(TXTL) and 4) Other manufactured goods(OMFG). Although the classification is based on the availability of time series of wholesale prices, this is quite a reasonable classification given household budget shares and import values.

5.1 Price change of traded goods

I estimate the average tariff rates of the four groups using import values as weights.

$$\tau_{i,t} = \sum_{s \in i} \mu_{s,t} \tau_{s,t} \tag{9}$$

where $\tau_{i,t}$ is the average tariff of group i(FFBT, FPLL, TXTL and OMFG) in year t, μ_s is the import share(value) of good s in group i and $\tau_{s,t}$ is the tariff rate of good s in year t. The average tariff is estimated using this formula for all four traded goods. I use the import weighted average instead of the simple average because India maintained non-tariff barriers for a host of goods in the early period of liberalisation. The Indian authorities first lifted the regulations on capital goods, basic goods and intermediate goods. In the late nineties consumer non-durables and agricultural products were slowly liberalised. Since liberalisation started in 1991 and still continues, my period of analysis is from 1990 to 2005. The earliest available tariff data on TRAINS is 1990 and the latest round of the NSSO survey was conducted in 2004-05. Therefore, I consider the total change in tariffs from 1990 to 2005. I assume a unitary pass-through rate from tariff to price so that any change in tariff will have a proportional impact on prices. The exogenous change in the price of traded good i due to tariff reduction is given by the following formula:

$$dln(p_i) = ln(1 + \tau_{i,2005}) - ln(1 + \tau_{i,1990}). \tag{10}$$

Table 2 shows the structure of tariffs in 1990 and 2005. I report both the simple average as well as the weighted average of tariff rates. There is an excessive degree of protection just before the reforms in 1990. The average tariff rates (simple) for all traded goods declined drastically within this period. However, the weighted tariff rates actually increased for fuel, power, light & lubricants. Textiles and other manufactured goods show the maximum change in tariff rates. Food items, beverages and tobacco products are still protected (41% average tariff) compared to other categories.

Using the formula 10, I compute the average change in prices of four traded goods. The price of FFBT decreased by 6.4% whereas the prices of TXTL and OMFG have gone down by 174% and 143%, respectively. However, the price of FPLL has increased by 90% within this period. All these changes are measured in terms of weighted average to take care of the importance of each of the goods in total import value. Since the import values of different agricultural products

Table 2: Tariff structure in 1990 and 2005

Traded good	**1990**		**2005**	
	Weighted	Simple	Weighted	Simple
Food, beverages & tobacco	61.17 (77.14)	94.71	57.31 (28.61)	40.63
Fuel, power, light & lubricants	3.86 (20.05)	45.89	10.9 (8.22)	14.82
Textile	85.26 (33.8)	96.37	19.7 (24.72)	25.47
Other manufactured goods	76.66 (51.78)	81.97	12.66 (6.93)	15.18

The numbers in parenthesis report standard deviation of tariff rates within each groups.

are less due to quantitative restrictions, the actual impact of tariff reduction in such commodities will be realised less in terms of changes in domestic prices. During the reform period, not only did the average tariff rates decrease, but the dispersion was also reduced to a large extent (standard deviations are reported in parentheses). This is the estimate of first order or direct impact of tariff reduction on domestic prices of traded goods. As I discussed earlier, the higher order effects will be realised through own price and cross-price elasticities. The limitation of data will hinder us in estimating such higher order effects. Since I am concerned with distributional impact, the higher order effects are not important. The changes in the prices of traded goods affect the prices of non-traded goods and wages through labour market adjustment. The general equilibrium relationships are captured in Equations 5 and 3. In section 5.2 and 5.3, I estimate the consumption effects of traded and non-traded goods. The labour income effects are estimated in Section 5.4.

5.2 Consumption effects of traded goods

The consumption effects of traded goods depend on expenditure shares and changes in prices. The term $s_i^j \frac{\partial ln(p_i)}{\partial ln(\tau_i)} dln(\tau_i)$ captures the consumption effect of household j due to a change in tariff of good i. I need household-level data on consumption items to estimate the budget shares s_i^j. The NSSO 61$^{\text{st}}$ round provides detailed household-level expenditure data for the period 2004 to 2005. I categorise the goods and services in four different traded groups. Multiplying the budget share by change in price due to tariff change, I estimate household-level welfare change. Summing over all traded goods, I get the total consumption effect of all traded goods. I have 124,644 households in the cross-section. To get the distributional effect, I need to summarise the household welfare effects in different income groups. A non-parametric method is used to summarise the welfare effects as a function of household expenditure. The Fan (1992) method of locally weighted regression is used to estimate welfare along different points of monthly per capita expenditure. Practically, I run a linear regression of the estimated household welfare effects (y) on the log of monthly per capita household expenditures at 50 grid points (x) instead of all values of the independent variable (Deaton, 1997). For each grid point, first I calculate a series of weights for each data point (MPCE) within a given bandwidth (h). This is done using a suitable kernel function

$$\theta^j(x) = \omega^j K\left(\frac{x - x^j}{h}\right) \tag{11}$$

where $\theta^j(x)$ is the weight for household j at grid point x which depends on household survey weights ω^j and a kernel function $K(.)$. The estimated parameters of the weighted regression at each grid point x is given by

$$\hat{\beta}(x) = [X'\Theta(x)X]^{-1}X'\Theta(x)Y \tag{12}$$

where $\Theta(x)$ is a diagonal matrix of weights of each households($\theta^j(x)$), X is matrix of two columns (ones in first column and MPCE in second column) and Y is the vector of welfare effects of households. . For each grid point, I estimate two parameters (intercept and slope). The predicted value of welfare effect at each grid point is thus given by

$$\hat{m}(x) = \hat{\beta}_1(x) + \hat{\beta}_2(x)x. \tag{13}$$

The summarised consumption effects of traded goods are plotted in Figure 3. I measure the average welfare gain as a percentage of MPCE along the vertical axis and the log of per capita expenditure along the horizontal axis. The dotted lines give a 95% confidence band. The standard errors are calculated using the bootstrap method. I replicate the estimation 200 times, taking random samples with replacement. The randomness comes only from household consumption expenditures.

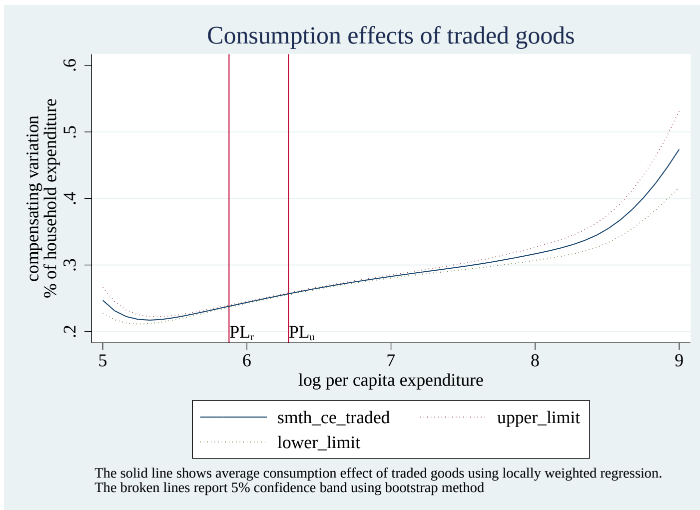
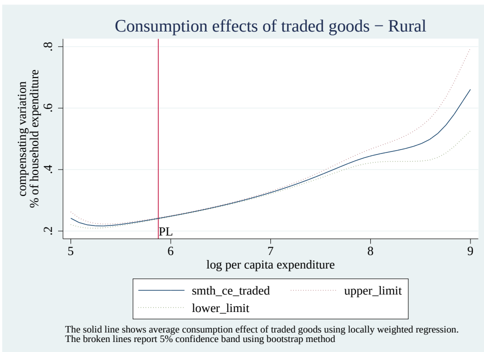


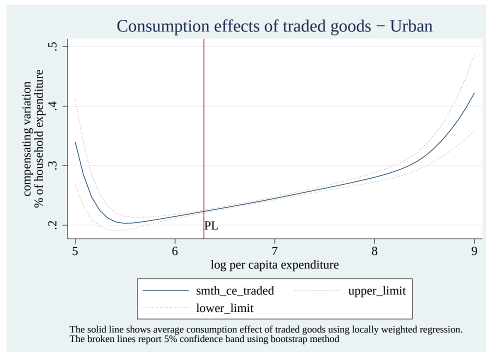
Figure 3: Consumption effects of traded goods

I get an upward sloping distributional effect for traded goods with some exception at the lowest range. The horizontal axis measures the log of real monthly per capita expenditure (MPCE) and the vertical axis measures compensating variation as a proportion of MPCE. The vertical lines give all-India poverty lines for the rural ($\mathrm{PL_r}$) and urban ($\mathrm{PL_u}$) sectors. All expenditure groups have welfare gain due to a reduction in tariff rates. The extreme poor section has a downward sloping welfare gain, *i.e.*, as the household gets richer, the welfare gain is lower. But this downward trend is associated with higher standard errors. The richest section has the highest welfare gain. It should be noted that the welfare gain is expressed as a percentage of the monthly per capita household expenditure. The consumption effect ranges from 0.23% to 0.47%.

The rural-urban breakup of consumption effect is given in Figures 4(a) and 4(b). All geographical regions have a similar pattern of welfare gains coming from adjustment in the consumption of traded goods. In general, percentage welfare gains are higher for richer households except for extremely poor households. As noticed earlier, this segment of the downward sloping relation is associated with higher standard errors due to fewer observations. Households below the poverty line have welfare gains between 0.2% and 0.25%. The important aspect is that these gains are statistically significant as depicted by the confidence band around the line.



(a) Rural



(b) Urban

Figure 4: Consumption effects of traded goods -rural, urban

The shape of the curve is determined by the budget shares of income groups. As it is known from Engel's law, the proportion of expenditure on food falls as the household gets richer. The poorest section has the highest budget shares on FFBT, but the price has reduced by only 6.4%, whereas textiles and other manufactured goods have larger budget shares for higher income groups. The prices of these two groups of articles have been affected mostly due to tariff reforms.

5.3 Consumption effects of non-traded goods

The change in prices of traded goods have a general equilibrium effect on the prices of non-traded goods. In this section, I measure the compensating variation due to change in prices of non-traded goods. The term

$$\sum_{k \in NT} s_k^j \frac{\partial ln(p_k)}{\partial ln(p_i)} \frac{\partial ln(p_i)}{\partial ln(\tau_i)} dln(\tau_i) \tag{14}$$

in Equation 8 captures the consumption effect(non-traded) of household j for change in tariff of good i. Summing over all traded goods, I estimate the total change in welfare of non-traded goods. I use the NSSO consumption survey to estimate the expenditure shares of non-traded goods (s_k^j). The items are classified in three non-traded goods based on the availability of price data. I use sector-specific GDP deflators to estimate the price series of non-traded goods. The GDP deflators are calculated from nominal and real GDP figures in three main sectors: 1) Real estate, ownership of dwelling & business services (ROB), 2) Transport, storage & communication (TSC) and 3) Health, education and other services (HEO). These sectors are mainly non-traded sectors except for the later part of the reform period when the government allowed some foreign capital. Despite that, the classification is a close approximation of non-traded sectors. Using the matching description of items in the consumption survey, I classify three broad non-traded goods (ROB, TSC and HEO).

In Equation 5, I show that the endogenous prices of non-traded goods have a general equilibrium relationship with the exogenous prices of traded goods. Therefore,

$$p_k = p_k(p_{FFBT}, p_{FPLL}, p_{TXTL}, p_{OMFG}, \mathbf{X}) \tag{15}$$

where p_{FFBT}, p_{FPLL}, p_{TXTL} and p_{OMFG} are the prices of traded goods and the vector $\mathbf{X}$ is all other exogenous variables. I assume a simple distributed-lag model to estimate the relationship. In what follows, I estimate

$$\begin{aligned} ln(p_{kt}) &= a_0 + \sum_{i \in T} a_{0i} ln(p_{it}) + \sum_{i \in T} a_{1i} ln(p_{it-1}) + \sum_{i \in T} a_{2i} ln(p_{it-2}) \\ &+ \sum_{i \in T} a_{3i} ln(p_{it-3}) + \sum_{i \in T} a_{4i} ln(p_{it-4}) + \mathbf{X_t}\gamma + \mu_t. \end{aligned} \tag{16}$$

where μ_t is the error term and $\mathbf{X}$ is the vector of other control variables. I have regressed the annual prices of each non-traded good on current as well as lagged prices of all traded goods. Time trend is included to capture technological changes over the years. I also include a liberalisation dummy to capture any differences between the pre-liberalisation and post-liberalisation periods. The annual price series of traded goods are taken from the wholesale price index published by the CSO. The non-traded goods' prices are calculated using GDP deflator. I use the period 1953 to 2008 to estimate the relationship. The raw series show the characteristics of integrated of order one; thus I estimate Equation 16 in the first difference. Theoretically, the relationship should follow homogeneity of degree one in prices. Therefore, I impose the following restriction

$$\sum_{l=0}^{4} \sum_{i \in T} a_{li} = 1. \tag{17}$$

Table 3 shows the response of prices of non-traded goods for exogenous changes in prices of traded goods. Since all prices are expressed in logarithm, the coefficients are interpreted as elasticities. Once I estimate Equation 16, the elasticities are calculated as the sum of coefficients of all lagged prices and the current price for each traded good. Therefore, the significance of the elasticities are tested using F-test statistics of the sum of the coefficients of the lagged prices and the current price. Since the estimated equation captures a complex, general equilibrium relationship, there are no theoretical predictions (Porto, 2006). In a multidimensional model, there are no clear predictions about the signs of these elasticities (Dixit and Norman, 1980).

The price of Transport, storage & communications (TSC) is positively associated with other manufactured goods (OMFG) and negatively associated with Fuel, power, lights & lubricants (FPLL). The prices of other traded goods are not correlated with TSC. The relationship between fuel price and transport price is surprising. Usually, they should be positively correlated: as fuel price goes up, transport price should go up as well. The intuitive interpretation is that the transport and communications sector is highly subsidised by government

Table 3: Response of prices of non-traded goods

	Non-traded goods		
Traded goods	TSC	ROB	HEO
Food, beverages & tobacco	0.40	**0.36**	0.14
	(1.58)	(1.85)	(0.97)
Fuel, power, light & lubricants	**-0.71**	-0.23	0.09
	(-2.27)	(-0.94)	(0.47)
Textile	-0.49	**-0.49**	**0.45**
	(-1.35)	(-1.76)	(2.11)
Other manufactured goods	**1.80**	**1.36**	0.32
	(2.64)	(2.59)	(0.79)
Price change due to tariff reform	**-2.38**	**-1.31**	**-1.17**
(t-test for price change)	-2.98	-2.13	-2.47
R^2	0.73	0.26	0.79

The F test statistics of the significance of all lagged prices are in parenthesis.

agencies. Therefore, the prices households face do not really reflect the actual cost of operations. Textile price is also negatively associated with TSC though it is insignificant. The second column gives the elasticities of ROB (real estate, ownership dwelling & business services). Textile price is negatively correlated, but other manufactured goods is positively correlated. The price of FFBT (food, beverages and tobacco products) has a positive effect on the price of ROB. The effect of fuel price is not significant for this sector. The price of HEO (health, education and other services) is positively associated with textiles, but all other prices do not have any significant correlation with the price of this sector. The intuitive reason is that health and education are very much state-controlled except in some urban areas. Therefore, the costs of health and education do not really reflect the prices of all other goods. I should emphasise that these elasticities are merely correlations in the general equilibrium sense, and are not causal relationships. Therefore, the signs are not always interpreted using theoretical explanations. The total changes in prices of non-traded goods due to changes in tariff rates in all traded goods are reported with t-statistics. Though there are some opposing effects on prices, the total changes in prices of all non-traded goods are negative. The highest reduction is in TSC (2.38%) and the lowest is in HEO (1.17%).

The elasticities in Table 3 give the percent changes in prices of non-traded goods for a one percent change in the prices of traded goods. Therefore, the total change in prices of non-traded goods is measured by the product of these elasticities and the change in prices of traded food due to tariff reform (Section 5.1). Using Expression 14, I estimate household-level consumption effects of non-traded goods. I use the same base survey of NSSO 2004-05 to estimate the welfare effects of non-traded goods so that all the effects are comparable. Once household-level consumption effects of non-traded goods are estimated, I use the same non-parametric procedure in Section 5.2 to summarise the welfare change along expenditure lines. The locally weighted regression gives the average distributional impact of non-traded goods in Figure 5.

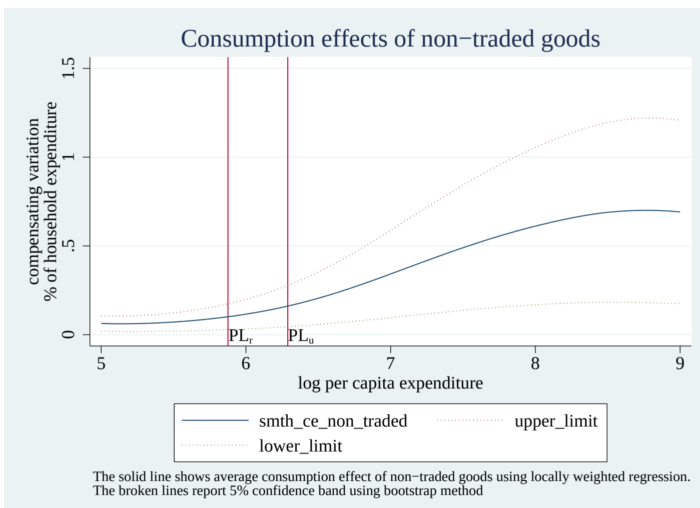
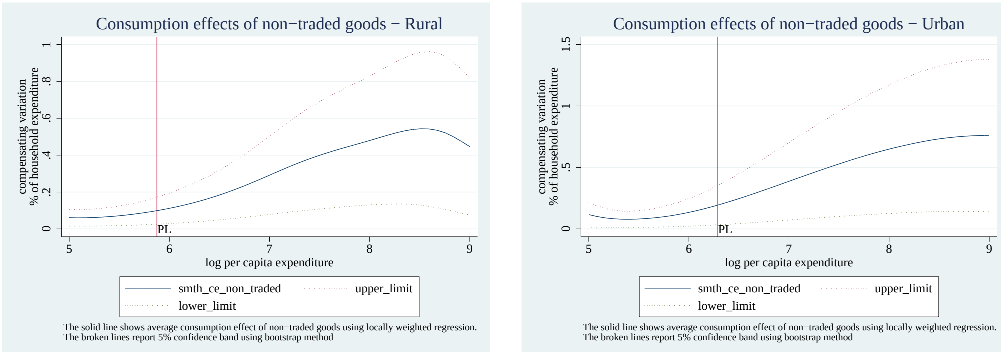


Figure 5: Consumption effects of non-traded goods

The solid line in Figure 5 gives the average effect and the dotted lines give the 95% confidence band. The standard errors are calculated using bootstrapping. The randomness in this estimation has two sources: 1) price elasticities, and 2) estimated household budget shares. I replicate the estimation of expenditure shares 200 times using random samples with replacement, keeping the rural-urban stratification from the cross-section of households. To get the randomness in price elasticities I select random samples from a normal distribution with estimated mean and standard errors of price elasticities. Theoretically, the estimated parameters $\hat{\boldsymbol{\beta}}$ in Equation 16 follow an asymptotic normal distribution, so that $\hat{\boldsymbol{\beta}} \xrightarrow{d} N(\boldsymbol{\beta}, \boldsymbol{\Omega})$, where $\boldsymbol{\beta}$ is the true vector of parameters and $\boldsymbol{\Omega}$ is its asymptotic variance. In practical computation, I do not have the true vector of parameters and its variance matrix. Therefore, I use a Cholesky decomposition of estimated $\hat{\boldsymbol{\Omega}}$ variance-covariance matrix. If $\boldsymbol{\beta_0}$ is a randomly drawn vector from $N(\mathbf{0}, \boldsymbol{I})$ and $\boldsymbol{R}$ is the Cholesky decomposition of $\hat{\boldsymbol{\Omega}}$, then $\boldsymbol{R}\boldsymbol{\beta_0} + \hat{\boldsymbol{\beta}} \sim N(\hat{\boldsymbol{\beta}}, \hat{\boldsymbol{\Omega}})$. In each replication, I computed the welfare effects of randomly selected households, using randomly selected elasticities and then summarised the average welfare effects along the log of monthly per capital household expenditure using locally weighted regression. The standard errors are calculated using these 200 estimated values.

The consumption effects of non-traded goods show a monotonous relationship with per capita expenditure. As a family gets richer, the welfare effect (as a percentage of household expenditure) is higher. However, the standard errors also increase with household expenditure. The shape is somewhat similar to that of traded goods (Figure 3). Households below the poverty line do not have statistically significant welfare gains from a change in the prices of non-traded goods. Figure 6(a) and 6(b) show a similar trend across all geographical regions. The top quantiles in the urban sector have relatively higher welfare gains compared to the rural sector, whereas in the rural sector, the richest quantiles have falling welfare gains. It is also noted that the 95% confidence band is wider compared to that of traded goods. In this case, there are two sources of randomness, whereas for traded goods there is only one source of randomness. The non-traded goods are mostly services and, therefore, the budget shares are larger for the richer class. Tariff reduction in other manufactured goods (OMFG) leads to lower prices in Transportation, storage and communication (TSC) and Real estate, ownership dwelling and business services (ROB). Since the budget



(a) Rural (b) Urban

Figure 6: Consumption effects of non-traded goods -rural, urban

shares for these two groups are higher for the richer class, the welfare gain is also higher for them. Lower textile prices also lead to a higher welfare gain for them through the price adjustment in health, education and other services (HEO). The average compensating variations of non-traded goods are positive and significantly different from zero for all income levels above the poverty line. However, I emphasise the distributional effect, and not its magnitude. When I compare the consumption effects of traded and non-traded goods with the labour income effect, the opposite trends offset each other and the total effects are subdued. Now I need to compute labour income effects to complete the estimation of the overall distributional impact.

5.4 Labour income effects

The labour income effects are measured by the expression

$$\sum_m \theta_m^j \varepsilon_{w_m p_i}^j \frac{\partial ln(p_i)}{\partial ln(\tau_i)} dln(\tau_i) \tag{18}$$

in Equation 8. To estimate the labour income effects, I first estimate the wage-price elasticities ($\varepsilon_{w_m p_i}^j$). The NSSO employment and unemployment surveys collect information on individual wage, education and other socio-economic characteristics. I regress wage on prices of traded goods and other characteristics of the individual to find the response of wages due to changes in price levels. Equation 3 gives a general equilibrium relationship between factor prices and the prices of traded goods. Therefore, wages could be expressed as a function of the prices of traded good ($\boldsymbol{p_T}$) and other individual characteristics ($\boldsymbol{Z}$):

$$w_m^j = w_m^j(\boldsymbol{p_T^j}, \boldsymbol{Z}_m^j) \tag{19}$$

The NSSO employment rounds 38, 43, 50, 55 and 61 give a pooled cross-section of individual wages and other individual characteristics. I exploit the time variability of prices over the years to find the response of wages for different skill levels. The estimating equation is

$$\begin{aligned} logw_m^j &= \sum_{i \in T}(\beta_{1i} logp_i * edu1 + \beta_{2i} logp_i * edu2 + \beta_{3i} logp_i * edu3) \\ &+ \gamma_2 edu2 + \gamma_3 edu3 + \delta_1 age_m^j + \delta_2 age_m^{2j} + \sigma gender_m^j + \varepsilon_m^j \end{aligned} \tag{20}$$

where w_m^j is wage of individual m in household j, p_is are prices of traded goods, edu_1, edu_2, edu_3 are three skill dummies based on level of education. I also include gender, age and age squared in the regression. The usual error terms are represented by ε_m^j. The coefficient β_{1i} is the elasticity of wage with respect to prices of traded good i for individuals with skill level $edu1$. Similarly, $\beta_2 i$ and $\beta_3 i$ are the elasticities for the other two skill levels. The lowest skill $edu1$ is for unskilled labours (below primary), $edu2$ is for semi-skilled labour (below secondary) and $edu3$ is for skill labour (secondary and above). I impose homogeneity of degree one in prices for each skill. The restrictions are

$$\sum_{i \in T} \beta_{1i} = 1, \quad \sum_{i \in T} \beta_{2i} = 1, \quad \sum_{i \in T} \beta_{3i} = 1. \tag{21}$$

The estimated results are shown in Table 4. Model 1 does not control for individual characteristics, whereas Models 2 and 3 control for individual characteristics. The standard errors are corrected for year-specific cluster effects in Model 3. I use the estimated results in Model 3 in my analysis. The table gives the total 12 wage-price elasticities, three for each traded good. All the elasticities are significantly different from zero when I take care of age and gender effects. However, the prices of fuel, power, lights and lubricants (FPLL) and textiles (TXTL) become insignificant for all skill demands when I correct the standard errors for clustering effects. The wages for all skill types have a positive correlation with the price of Food, beverages and tobacco (FFBT). When the prices of goods in this group increase, the wages for unskilled labour increases the most. On the other hand, an increase in the prices of other manufactured goods has a negative effect on wages for unskilled labour. Interestingly, wages for all skill types are negatively correlated with prices of all other manufactured goods. I have already mentioned that this regression captures the complex, general equilibrium effects of prices on wages, and thus there is no theoretical prediction. However, there are some intuitive explanations for the negative correlation. Topalova (2007) argues that trade liberalisation has led to higher productivity growth in the manufacturing sector. However, this increased productivity does not led to higher reduction in poverty level in the urban sector where the share of employment in the manufacturing sector is larger. The hypothesis put forward by Topalova (2007) is that the gain in productivity did not increase the wage share; instead it helped the capital income share to grow. In my estimation, in fact, the wages of all types of skills have a negative correlation with the prices of traded goods. When the prices of manufacturing goods fall, productivity rises in the manufacturing sector and it helps wages to grow.

The only channel through which prices have a positive significant effect on wages is the FFBT sector. However, the magnitude of tariff reduction in this sector is very low. Therefore, the negative impact of tariff reform on wages of all skill types (and all sectors) is dampened.

The labour income effects of households are estimated using Expression 18. For each member of a household I compute the share of wage in total family income[1]. The wage-price elasticities ($\varepsilon^j_{w_m p_i}$) from the regression Equation 20 is

[1]I approximate the share of wage income in monthly per capita household expenditure by $w^j_m / \sum_{m \in j} w^j_m$ because I do not have comparable expenditure data in the employment survey. If total household expenditure is not less than total household labour income, the approximated θ^j_m will be upper bound for true θ^j_m. Therefore, the estimated labour income

Table 4: Regression of log wage on prices interacted with education dummies

	Model 1	Model 2	Model 3
	b/se	b/se	b/se
$edu1 * ln(p_{ffbt})$	2.348***	2.279***	2.279***
	(0.03)	(0.03)	(0.17)
$edu2 * ln(p_{ffbt})$	2.035***	2.047***	2.047***
	(0.06)	(0.05)	(0.39)
$edu3 * ln(p_{ffbt})$	1.741***	1.698***	1.698***
	(0.06)	(0.06)	(0.36)
$edu1 * ln(p_{fpll})$	0.231***	0.085***	0.085
	(0.02)	(0.02)	(0.21)
$edu2 * ln(p_{fpll})$	-0.163	-0.084*	-0.084
	(0.04)	(0.03)	(0.47)
$edu3 * ln(p_{fpll})$	0.259	0.315***	0.315
	(0.04)	(0.04)	(0.43)
$edu1 * ln(p_{txtl})$	-0.041	-0.143***	-0.143
	(0.03)	(0.03)	(0.26)
$edu2 * ln(p_{txtl})$	-0.206	-0.165***	-0.165
	(0.05)	(0.05)	(0.58)
$edu3 * ln(p_{txtl})$	0.220	0.218***	0.218
	(0.06)	(0.05)	(0.54)
$edu1 * ln(p_{omfg})$	-1.538***	-1.221***	-1.221***
	(0.04)	(0.03)	(0.30)
$edu2 * ln(p_{omfg})$	-0.665	-0.798***	-0.798
	(0.06)	(0.06)	(0.67)
$edu3 * ln(p_{omfg})$	-1.219*	-1.230***	-1.230*
	(0.06)	(0.06)	(0.62)
$edu2$	0.747***	0.555***	0.555***
	(0.01)	(0.01)	(0.01)
$edu3$	1.697***	1.433***	1.433***
	(0.01)	(0.02)	(0.01)
age		0.055***	0.055***
		(0.00)	(0.00)
age^2		-0.001***	-0.001***
		(0.00)	(0.00)
$gender$		0.529***	0.529***
		(0.00)	(0.02)
$constant$	-5.147***	-6.515***	-6.515***
	(0.00)	(0.01)	(0.06)
R^2	0.5865	0.643	0.643

* p<0.05, ** p<0.01, *** p<0.001

The standard errors are in parenthesis.

effects overestimate the welfare effects.

multiplied by wage share (θ_m^j) and change in price of traded good i to get the labour income effect of each household member. Summing over all household members and all traded goods I find household-level income effects. Locally weighted regression is used to find the average effects for different income groups. The estimated average income effects are derived from different surveys which are not comparable with the base household expenditure survey 2004-05. To make it comparable I find matching percentile-wise distributional effect in the base survey. The result is shown in Figure 7. The standard errors are calculated using bootstrapping. The sources of variation are: 1) estimated share of wage in total family income and 2) the estimated wage-price elasticities. To deal with variance in share of wage, I re-sample the households 200 times keeping the cluster structure of the original pooled cross-section. The estimated coefficients of Equation 20 follow an asymptotic normal distribution, *i.e.*, $\hat{\boldsymbol{\beta}} \xrightarrow{d} N(\boldsymbol{\beta}, \boldsymbol{\Omega})$. I use the same procedure as in consumption effects to get random samples of wage-price elasticities.

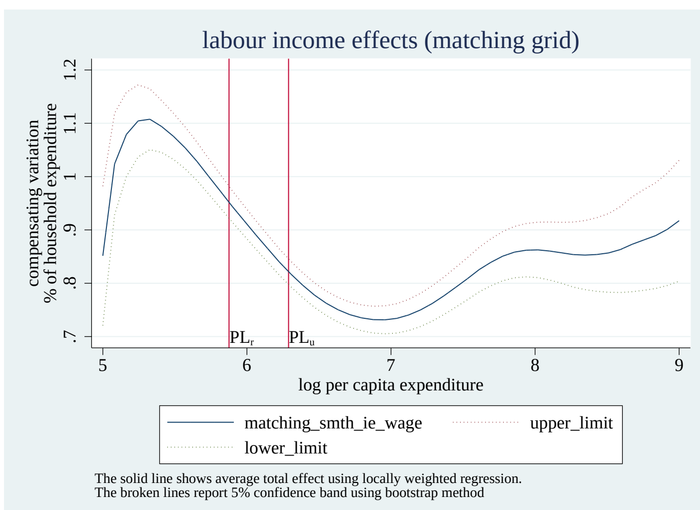
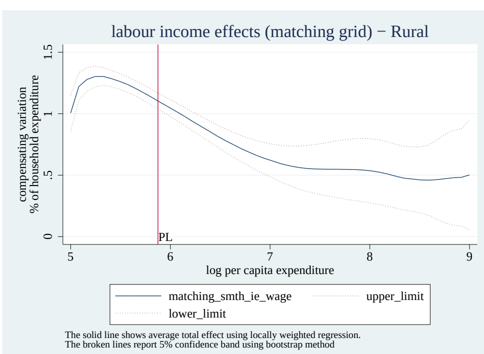


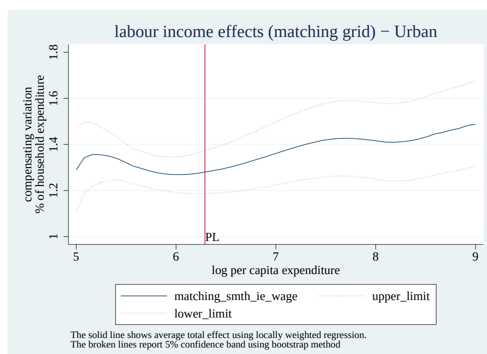
Figure 7: Labour income effects

Figure 7 plots the average labour income effects as a percentage of total expenditure for change in prices of all traded goods. I find that tariff reform has a significantly positive effect for all income groups. However, the relationship is not monotonous. The poorest group shows a rising labour income effect. Households below the poverty line, on average, show the maximum gains from labour market adjustment. After some threshold, the labour income effects fall as the household gets richer. At the higher tail of income distribution, the income effects have an increasing trend though higher standard errors are observed. The maximum gain is more than one percent of the total monthly household expenditure, whereas the minimum is approximately 0.75 percent for middle income groups. All income groups have statistically significant labour income effects.

The labour income effects are different in the rural and urban sectors (Figure 8). Poor households in the rural sector have significantly higher gains compared to their urban counterparts, whereas in the urban sector, all income groups have almost similar gains. Moreover, labour income effects are significantly greater compared to consumption effects. It appears that poor households in the rural sector, classified by the official poverty lines (depicted as vertical lines in Figure 8), have greater gains from labour market adjustment that help to offset the uneven gains from consumption effects.



(a) Rural



(b) Urban

Figure 8: Labour income effects -rural, urban

5.5 *Total distributional effect*

The main result of this exercise is depicted in Figure 9. All the effects are added to find the overall distributional impact of tariff reforms in India. The welfare gains are statistically significant for all income groups. However, the total effects are non-monotonous with income level. The richest section has a rising trend but with higher standard errors. The figure also gives the estimated kernel density function of monthly per capita household expenditure. Households below the poverty line have almost similar percentage gains except for the extreme lower quantiles. Figure 10(a) and 10(b) depict the rural-urban breakup.

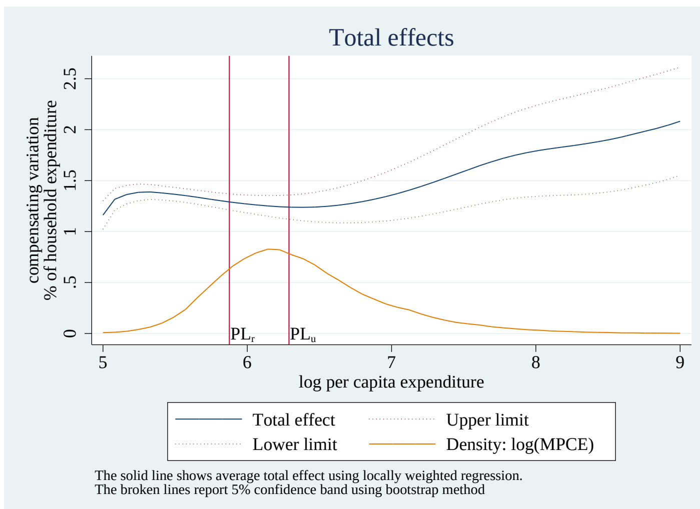
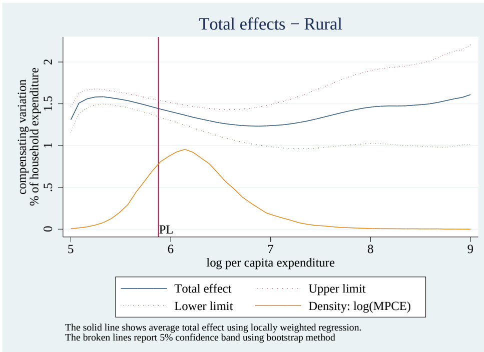
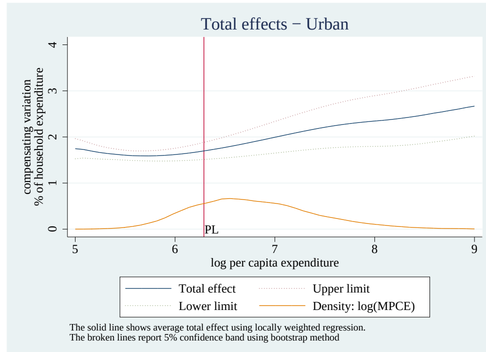


Figure 9: Total effects

In the rural sector poor households have relatively higher welfare gains compared to middle income groups. Extremely rich households in the rural sector have upward rising welfare gains, but it comes with higher standard errors. The welfare gain monotonically increases with income level in the urban sector. Therefore, the tariff reforms have a pro-poor effect in the rural sector and a pro-rich effect in the urban sector. These differentiated effects are linked to the fact that labour market adjustment in the rural sector has resulted in relatively higher gains for the poor. Given the upward trend in inequality in recent years, this result must be put in the proper context. My analysis only explains that part of inequality



(a) Rural



(b) Urban

Figure 10: Total effect -rural, urban

which could be attributed to tariff reforms from 1990 to 2005. There are several other reasons for increasing inequality, particularly in the urban sector. Topalova (2007) finds that district-level inequality is unaffected by tariff reforms. My results explain that distributional impact could be different for rural and urban areas. In fact, the inequality measures are affected by tariff reforms.

Topalova (2007) used two measures of inequality in her analysis: 1) standard deviation of log consumption expenditure and 2) the mean logarithmic deviation of consumption. Both these inequality measures are unchanged if consumption level for each household increases proportionately. In my result, compensating variations as a percentage of initial household expenditure for all households are not similar across income groups. If $CV^j/e^j = c$ (some constant) for all households, the welfare gain expressed in terms of monetary value for each household is constant, *i.e.*, $dx/x = c$ for any consumption expenditure x. It is easy to show that the new inequality measures remain the same as long as welfare gain as a percentage of total income is the same across income groups. If change in consumption expenditure is $dln(x)$, the variance of log of consumption expenditure after reform is given by

$$\begin{aligned} var\left(ln(x) + dln(x)\right) &= var\left(ln(x)\right) + var\left(dln(x)\right) + 2cov\left(ln(x), dln(x)\right) \\ &= var\left(ln(x)\right) \end{aligned}$$

since $dln(x) = dx/x = c$ (constant). Similarly, the other measure (generalised entropy coefficients) of inequality is unchanged when dx/x is constant. The mean logarithmic deviation of consumption is given by

$$I(0) = \int \frac{x}{\mu} ln \left(\frac{\mu}{x}\right) f(x)dx$$

where μ is mean expenditure. After tariff reforms, if the log of consumption expenditure changes to $ln(x) + dln(x)$, the new expenditure is mx and the new mean expenditure is $m\mu$ where $m = e^c$. It is straight forward to see that the inequality measure $I(0)$ is unchanged for a proportionate increase in income. In this analysis, I find some explanations for increasing inequality, specifically in the urban sector, due to tariff reforms in India. The welfare gain as a percentage of initial expenditure is different across income levels. In other words, tariff reforms lead to uneven gains.

I find that all income groups have positive and statistically significant welfare gains. This is contrary to the findings in Topalova (2007). The most interesting result of Topalova (2007) is that the urban poverty is unaffected, but the rural poverty ratio and poverty gap reduced less rapidly due to tariff reforms. The districts which were more exposed to trade reforms have a negative correlation between district poverty and reform measures in rural areas. The contradictory outcome in my exercise demands further research on this question. My approach (general equilibrium) and that of Topalova (2007) are completely different and therefore, it is hard to identify the sources of this contradictory result. As I have mentioned earlier, the general equilibrium methodology of evaluating policy change has several advantages. It can explicitly show the gains and losses originating from product market and factor market adjustments. However, the results crucially depend on precise estimates of certain parameters. In my approach, I have ignored some factors and that might be a reason of differentiating results. The passthrough rates of tariff adjustment are different for different product groups depending on market structure and other policies like exchange rate regime. If passthrough rates are very low and it is even lower for food group then my estimate of total welfare gain is over estimated. Similarly, the estimates of wage price elasticity and elasticity of the price of non-traded goods with respect to the price of traded goods crucially depend on estimating assumptions. For example, while estimating the elasticities, I have ignored all other internal and external policy changes (exchange rate, non-tariff barriers, deregulation in internal sector, promotion of competitiveness through delicencing, etc). All these contemporaneous changes may be correlated with some of the explanatory variables. Though I have used a dummy for the liberalisation period, this misspecification leads to biased estimates of elasticities. Suppose all the excluded variables have co-movement with tariff rate in same direction. Theoretically, delicencing may improve labour productivity through competitiveness and improved technological investment. This in turn increases wage rate. Therefore, under the above postulations, omitted variable specification leads to underestimation of the wage price elasticity. Similarly, if the prices of non-traded goods are positively related with the excluded variables (i.e. more deregulation leads to lower prices of non-traded goods) then the estimates of the price elasticities of non-traded goods with respect to the price of traded goods will be biased upward. I find that there are positive welfare gains for all income groups. This does not mean that the gains are large enough to pull the large mass above the poverty line. The gains shown in the figures are in percentage of total expenditure. Therefore, in terms of absolute gain the poorer section still gets the least advantage from tariff reforms. It is also important to note that the district level poverty measures are sensitive to the choice of poverty lines. In the differential exposure approach of Topalova (2007), the results, therefore, may suffer from this problem. Whereas, my approach is more robust.

6 Conclusion

In this chapter I have used household survey data to find the distributional impact of tariff reforms in India. In 1991 India adopted comprehensive measures of internal and external reforms. The most important aspect of external reform was drastic reduction in tariff rates with some other liberalisation measures. The literature suggests that growth, productivity, competitiveness and efficiency are positively affected by reform measures. However, the question of distributional impact is largely unanswered. If gains from reform do not reach all sections in equal proportions, we need some complementary strategy to combat the widening gap between the rich and poor. The modelling and econometric techniques, which are useful to find the macroeconomic impact of trade policy, are sometimes hard to apply in this context. I estimate general equilibrium consumption effects and labour income effects at the household level. The distributional effects are derived for different income groups using locally weighted regression. The individual consumption effects of traded goods and non-traded goods and labour income effects have different magnitudes for the richer and poorer groups. The overall effects show quite a different pattern in the rural and urban sectors. The distributional effect of tariff reforms in India is pro-poor in the rural sector and pro-rich in the urban sector. The contradictory results in the literature require further analysis on this question.

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