Inequality and Trade Policy: Pro-Poor Bias of Contemporary Trade Restrictions

Beyza Ural Marchand *

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Abstract

This paper studies the pro-poor bias of trade policy in India by estimating the household welfare effects of removing the current protection structure. The elimination of a pro-poor trade policy is expected to have a negative differential welfare effect at the low end of the distribution. The paper first constructs trade restrictiveness indices for household consumption items and industries using both tariffs and non-tariff barriers. The results indicate that Indian trade policy is regressive through the expenditure channel as it disproportionately raises the cost of consumption for poorer households, while it is progressive through the earnings channel. Based on the net welfare effects, the elimination of the current trade protection structure is estimated to reduce inequality. These results indicate that a trade policy that is progressive through the earnings channel may induce a price effect that is regressive through the expenditure channel.

Keywords: Trade Protection, Consumption Inequality, Poverty.

JEL Classification: D31, F14, I30, O12

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*Department of Economics, University of Alberta, 7-12 Tory Building, Edmonton, AB, T6G 2H4, Canada. E-mail: beyza.ural@ualberta.ca. I would like to thank the participants of IARIW-ICRIER Conference in Delhi, India in November, 2017; Empirical Investigations in Trade and Investment (EITI) Conference in Tokyo, Japan in February, 2018; Institutions, Trade and Economic Development (InsTED) Workshop at Syracuse University in May 2018; Department of Economics, Ryerson University in May, 2018, and Western Economic Association International (WEAI) Conference in June 2018. The project is funded by Shastri Indo-Canadian Institute and with the assistance of the Government of Canada. The usual disclaimer applies.

1 Introduction

This paper empirically evaluates the pro-poor bias of current trade protection structure in a developing country, India. There is a large literature on the impact of international trade on inequality in developing countries.[1] However, there is little known about the pro-poor bias of contemporary trade policies. This paper aims to determine the distributional properties of the existing trade protection structure by estimating the impact of eliminating all tariff and non-tariff barriers and moving to a free trade regime.

Within the last three decades, world trade has expanded rapidly from 36% of global GDP in 1986 to 56% in 2016 (World Bank, 2016). The integration of developing countries has played an important part as they now account for 43% of world exports (World Trade Organization, 2016). This rapid expansion in world trade was accompanied by negative changes in the attitudes towards trade, especially in developed countries, and this pushback against free trade appears to result from inequality concerns (Pavcnik, 2017; Frankel, 2018). It is, therefore, important to understand whether the current trade policy exacerbating or mitigating to the inequality levels within countries. This paper answers the question: what would be distributional impact if the country moves from the current trade policy to free trade? If the existing trade policy is pro-poor, a complete trade liberalization should lead to higher welfare losses for poor individuals, or in case of gains, they should experience smaller gains, and as a result, inequality should increase (Nicita et al., 2014).

Most of the literature on trade and inequality studies the sharp changes in trade policies such as trade liberalization or free trade agreements. However, trade policies have evolved since countries went through major trade liberalization episodes, especially developing countries such as China and India. The textbook predictions based on the Heckscher-Ohlin model suggests that developing countries should experience a reduction in poverty and inequality as a result of trade liberalization. This is based on the prediction that an unskilled labor abundant country would protect their skilled labor-intensive sectors. In that case, removal of this protection would lower relative returns to skilled labor, thus lowering inequality. However, in some developing countries, including Mexico, Morocco and Colombia, the initial structure of protection was not consistent with this premise as their trade liberalization actually involved bigger tariff declines in unskilled labor-intensive industries, leading to an increase in inequality (Goldberg and Pavcnik, 2007). Given their initial protection structure, the increase in inequality observed in these countries was consistent with the Stolper-Samuelson theorem. This implies that predictions about trade and inequality that ignore the initial protection structure potentially miss a crucial element that is driven by political economy mechanisms within that

[1] See Goldberg and Pavcnik (2007), Goldberg and Pavcnik (2016), and Winters et al. (2004) for extensive reviews of the literature.

country, or other dynamics not included in the model.

Following the literature on household welfare impacts of trade, the paper examines the impact on households through their earnings and expenditures in a unified framework in order to evaluate the contribution of these channels in the overall pro-poor bias of trade policy (Deaton, 1997; Nicita, 2009; Nicita et al., 2014; Porto, 2006; Ural Marchand, 2012). Changes in trade policy affect domestic prices, which in turn influence production and consumption outcomes at the household level. While the effect on wages is extensively studied, the effect on household consumption is often overlooked (Han et al., 2016; Goldberg and Hellerstein, 2013). This is a crucial component for household welfare, as the reduction in consumer prices may overcompensate reduction in incomes so that the net welfare effect may imply a larger consumption set for the household. The distributional impact through these two channels may also be different, where a trade protection structure may be pro-poor through its effect on household income and pro-rich through its effect on household consumption. For instance, a trade policy that is designed to protect unskilled labor may raise the prices of unskilled-labor intensive goods which have a higher budget share among poorer households. The net effect is therefore determined by the relative magnitudes of these two channels across the distribution.

This paper starts with the construction of trade restrictiveness indices for India that accounts for heterogeneity in trade protection at the tariff line level. For household expenditure items, the index value is constructed using the trade protection level, import demand elasticity, and tariff variance within each composite product group. These indices represent a uniform tariff rate applied to imports instead of the current structure of protection that would keep the country's welfare at its current level (Kee et al., 2009). In order to account for other protectionist tools such as quotas and subsidies, an alternative trade restrictiveness index is constructed using both tariffs and the ad-valorem equivalent of non-tariff barriers (NTBs). Results indicate that the highest levels of trade restrictiveness are observed in the food categories, particularly in grains, followed by durables and energy. The level of trade restrictiveness is higher when NTBs are incorporated, with the highest difference again observed in the food categories, implying that non-tariff policy tools are used intensively in this category.

Two separate nationally representative micro surveys from the National Sample Survey Organization (NSSO) are used for the welfare analysis. The NSSO Consumer Expenditure Survey is used for the consumption component of household welfare, which provides quantities and costs of detailed consumption items for each household. The earning component is analyzed using the NSSO Employment and Unemployment Survey, which records wage incomes and industry affiliations of individuals at the activity level. Through household expenditure, the welfare analysis shows that Indian trade policy is pro-rich in the sense that the elimination of the current protection structure would benefit poorer individuals more than rich individuals. The welfare gains in rural areas are estimated to be around 14% for the poorest quintile if all tariffs are removed, and this effect decreases to 10% for the richest quintile. If both tariffs and NTBs are eliminated, these effects are estimated to be 21% and 14% for the poorest and richest quintiles, respectively. The urban households experience similar expenditure effects, albeit slightly smaller in magnitude. While the structure of protection within the manufacturing sector is pro-poor, the effect through this sector is much smaller due to its small budget share and lower levels of current protection.

The earning component of the welfare is estimated by assessing the impact of tariff removals on the wage incomes of workers with different education levels. Thus, it incorporates differential skill levels across the income distribution. The results suggest that the earnings component of the trade policy is pro-poor urban areas, while it is neutral in rural areas, with lower magnitude in rural areas due to relatively unresponsive wages of unskilled workers. Overall, the removal of all protection is estimated to reduce earnings by 1.9% and 1.7% in rural and urban areas, respectively.

The net household welfare effect of trade protection structure through earnings and expenditure channel is estimated to be regressive. Total dismantlement of tariffs is estimated to increase the welfare of households by 13% in the poorest quintile and 9% in the richest quintile with respect to initial household expenditure levels. When both tariffs and NTBs are eliminated, these effects are estimated to be 19% and 14% for poorest and richest quintiles, respectively, with about 2 percentage points lower effects in urban areas across the distribution. The overall welfare gain from the elimination of trade protection is estimated to be 16% in rural areas and 15% in urban areas, on average. Consistent with these estimates, the measures of welfare inequality, including Theil's Entropy Index, the Gini Coefficient and the Atkinson Index are estimated to decrease following the elimination of trade protection. The index for pro-poor bias, proposed by Nicita et al. (2014), shows that the contribution of expenditure channel to inequality is substantially higher when compared to the contribution of earnings channel.

The paper is organized as follows. Section 2 lays out the framework to analyze the effect of trade policy on household welfare. Section 3 describes the data used in the paper, and presents descriptive results, while Section 4 discusses the construction of trade restrictiveness indices for India. Section 5 present the results for the expenditure and earnings components, respectively, and Section 6 shows the impact on inequality indicators. Section 7 concludes the paper.

2 Impact of Trade Policy on Households

The theoretical framework for this paper follows the seminal work of Deaton (1989, 1997), which was later extended by Porto (2006, 2010), Nicita (2009) and Ural Marchand (2012). Suppose the indirect utility function of household h is given by:

$$u_h = v_h(y_h, \mathbf{p}) \quad (1)$$

where household utility is a function of income y_h, price vector is given by $\mathbf{p} = (p_1, p_2, ...p_n)$, and n is the number of products. Total differentiation yields:

$$du_h = \sum_i \left(\frac{\partial u_h}{\partial p_i}\right) dp_i + \frac{\partial u_h}{\partial y_h} dy_h \quad (2)$$

Applying Roy's identity and dividing through y_h: m

$$\frac{du_h}{y_h} = -\sum_i x_{ih} \frac{\partial u_h}{\partial y_h} dp_i + \frac{\partial u_h}{\partial y_h} dy_h \quad (3)$$

where x_{ih} is the consumption of product i by household h.[2] Household income from industry i is given by $y_h = \sum_i w_{ih}$ where w_{ih} is wages income from the production of i. Therefore:

$$dW_h = \frac{du_h}{y_h} = \left(-\sum_i \theta_{ih} \frac{dp_i}{p_i} + \sum_i \gamma_{ih} \varepsilon_{ih} \frac{dp_i}{p_i}\right) \frac{\partial u_h}{\partial y_h} \quad (4)$$

where $\theta_{ih} = x_{ih} p_i / y_h$ is the share of expenditure on product i and $\gamma_{ih} = w_{ih}/y_h$ is the share of income from product i in the total household income. The elasticity of wage income w_{ih} with respect to the price p_i is given by ε_{ih}. The effect on the household welfare, dW_h, is defined as the negative compensating variation of price changes. In case of a welfare loss, it reflects the amount by which households need to be compensated in order to have the same utility they had prior to the price change.

Changes in trade policy affect prices, and thus households both through their consumption basket and income sources. The first term in the parenthesis is the welfare effect of price changes through the expenditure channel. This term enters negatively in the welfare function, as an increase in prices increases the net expenditure of a household for a given consumption basket, thus reducing welfare. Each price change affects household welfare proportional to the budget share of the corresponding consumption good, θ_{ih}. The second term defines the welfare impact through earnings and enters positively in the welfare function. The effect of an income change on household welfare is proportional to the importance of the income from industry i in the total household expenditure, γ_{ih}.

In this paper, the trade-induced price changes are based on the removal of trade restrictions. If dW_h is estimated to be positive for household h, this implies that the current protection structure is associated with a welfare loss as the elimination of trade protection benefits the household. Similarly, if the poor households are estimated to have a higher dW_h than the rich households, it implies that the current trade policy is

[2] By Roy's identity, $\frac{\partial u_h}{\partial p_i} / \frac{\partial u_h}{\partial y_h} = -x_{ih}$.

regressive, as a complete trade liberalization would be more beneficial to poor households (Nicita et al., 2014).

3 Data and Stylized Facts

3.1 Matching the Trade Data

The data for tariffs and imports for the year 2016 are obtained from the United Nation's TRAINS Database. Ad-valorem equivalents of NTBs and import demand elasticities are from Kee et al. (2009). All trade data is obtained at the 6-digit Harmonized System (HS6) level. The implementation of the welfare measures requires aggregating tariffs in a way that matches the household expenditure items defined in the household survey. The household budget includes products that are not internationally tradable, such as rent, utility charges, health, education, and other locally obtained services. The tariff schedule of India also includes items that are not in the household budget, such as heavy machinery. When there is an overlap, the household expenditure items are often more broadly defined than the import tariffs and NTB.[3]

Given these considerations, a concordance table is constructed between HS6 categories and the expenditure categories in the household survey, by hand-matching each expenditure item to the HS6 items that are a direct counterpart, a variation that is not defined elsewhere, an input that can be turned into the final product by the household. [4] This concordance produced 133 composite categories for tradable goods with 65 food items, 7 energy items, and 60 manufacturing items.

3.2 Consumer Expenditure Survey

The expenditure shares of households for the composite categories are computed from the 66^{th} NSS Consumer Expenditure Survey. This survey reports the quantity and value of consumption goods for 100,683 households. It is a nationally-representative sample for India, and sampling weights are used in all estimations to ensure that the results are consistent estimates for the population. The survey has varying recall periods for different consumption items. Following the guidelines in the survey, all the expenditures

[3]For example, there are 194 different HS6 lines for what is defined as "fish expenditure" in the household survey, and the tariff rates for different HS6 lines for fish vary substantially depending on the type of fish and whether the fish was fresh, frozen, processed, or canned. Similarly for manufacturing items, for example, import tariff lines differ depending on whether a washing machine is fully automatic, has a built-in centrifugal drier, or whether it exceeds 10 kg of capacity, while it is a single consumption item in the household survey.

[4]For example, 'clothing and bedding' expenditure is matched to finished clothing items, as well as woven fabric and cotton yarn. These concordances are available upon request.

are converted to a 30-day expenditure period, assuming a linear distribution over time.[5]

The expenditure shares of broad categories across per capita expenditure quintiles are presented in Table 1 for rural and urban areas. For rural households, the total budget share of agricultural goods is 72% for the lowest quintile households and monotonically decreases to 52% for the highest quintile. The shares are lower for urban households across the distribution, with 58% for the lowest quintile and 40% for the highest quintile. This result is predicted by Engel's Law, which states that the share of food decreases with household per capita income. Similarly, the share of mining commodities is higher at the low end of the distribution and higher for the rural household as compared to urban households.[6] As discussed in Deaton (2000) and Eswaran and Kotwal (1994), the basic necessities, such as food and energy, have precedence over other commodities, but their expenditure does not increase proportionately with income, which leads to a negative relationship with income and their budget share. On the other hand, the expenditure gradient reverses for manufacturing products and nontradable services. On average, both rural and urban households allocate a higher share to these categories as their budget expands. The share of manufacturing products is 6% and 5% for the lowest quintile and monotonically increases to 11% and 8% for the highest quintile for rural and urban households, respectively. For nontradable services such as health and education, the gradient is much steeper. While the rural households in the lowest quintile only spend 13% of their budget to nontradable services, this share monotonically increases to 32% for the highest quintile. Urban households have a substantially higher budget share for nontradable services, with 29% at the lowest quintile and 49% at the highest quintile, potentially due to their higher income levels as well as easier access to these services.

To further investigate the changes in budget structure across the distribution, the local linear regression of expenditure shares of internationally tradable and nontradable items on per capita expenditure is provided in Figure 1. The figure presents consistent estimates for the expenditure shares based on the observations within a neighborhood of any given per capita expenditure level. The share of tradable commodities decreases with per capita expenditure as for low, middle, and middle-to-high parts of the distribution. However, it has a positive slope for high-income households in both rural and urban areas. Next, the same regression is run for broad tradable industry categories of agriculture, mining, and manufacturing. The results presented in Figure A.1 reveals that the nonmonotonic

[5]Households are asked the value and quantity of the consumption (i) within the last 30 days for the following commodity groups: cereals, pulses, milk and milk products, sugar and salt, rents, and taxes; (ii) within the last 7 days for the following commodity groups: edible oil, egg, fish and meat, vegetables, fruits, spices, beverages, and processed food. These are multiplied by $(30 \div 7)$; (iii) within the last 365 days for the following commodity groups: clothing, bedding, footwear, durable goods, education, and medical expenses. These are multiplied by $(30 \div 365)$. Only total expenditure (not the quantity) is recorded for internationally nontradable items such as education, health, rents, and taxes.

[6]The category is called "mining" for consistency with the employment categories, while in the household budget it represents the energy expenditure.

changes at the high end of the distribution is mainly due to the expenditure pattern of manufacturing products. Once the basic necessities such as food and energy are satisfied, the manufacturing expenditure share is very sensitive to increases in budget constraints, which has a steep and positive slope at the high end of the distribution where high price manufacturing items such as household durables and transportation equipment are important items in household budget.

The Figure 1 also shows that the budget share of internationally nontradable services also increases with income, but it plateaus at the high end of the distribution due to the increased importance of manufacturing products. This can be seen from Figure A.2 where the budget shares of all major nontradable items, such as medical services, education, and housing, increase discernibly in the middle and high-middle part of the distribution, but decreases with an even steeper slope at the high end of the distribution, with the exception of education expenditures in rural areas.

These stylized facts about the budget shares have important implications for the distributional effects of trade policy through the expenditure channel. The first mechanism is driven by Engel's Law as agricultural products are more important at the low end of the distribution. Thus, the effect of trade policy for these households is mostly determined by its effects through food prices. However, this simple interpretation is complicated by the fact that manufacturing products have the opposite gradient across the distribution. The second mechanism is therefore driven by the demand for non-essential manufactured products that are internationally tradable. Because trade policy varies across and within these categories, its distributional effects depend on relative level of protection of each product as well as its relative budget share across the distribution.

3.3 Employment Survey

The labor market information is obtained from the 66^{th} round of the NSS Employment and Unemployment Survey. This survey is also nationally representative and covers a wide range of labor market outcomes in rural and urban areas. Each individual reports the number of days worked, income earned, and the industry codes for up to five distinct labor market activities. This is an important advantage of this survey because poor individuals tend to work in a variety of industries in any given month (or even day) as documented by Banerjee and Duflo (2007). Another nontrivial advantage of this survey is that it covers informal employment as well as formal employment. Because it is based on information reported by individuals, casual work and income from this type of work are reported. This is important for India as informal employment constitutes about 75% of non-agricultural employment (World Bank, 2016).

Similar to the consumer survey, the industry categories reported by individuals are matched to the HS6 categories. The matching is more straightforward in this case because concordance tables between Indian Nationally Industry Classification, ISIC Rev3, and HS6 classifications are readily available. This matching is conducted at the activity level in order to reflect the different activities of individuals. The descriptive analysis presented in this section are based on the principal activities of individuals, while the welfare estimations in Section 5 cover all reported activities. Also, workers of all ages are included in the descriptive analysis and household welfare estimations in order to cover all wage income sources within households.

The share of employment across broad industry categories are presented in columns (3) and (4) of Table 2. Approximately 62% of rural workers and 28% of urban workers are employed in internationally-tradable industries including agriculture, manufacturing, and mining. Approximately 53% of rural workers are employed in the agricultural sector, whereas 0.7% is affiliated with mining, 9% is affiliated with manufacturing and 38% is affiliated with nontradable services such as health, education, and retail. In urban areas, despite the higher concentration in manufacturing at 18%, the share in agricultural sector is much lower at 9%, leading to an employment structure characterized by a high share in nontradable sectors at 72% of total employment.

More importantly, the structure of employment varies substantially across the distribution. Figure 2 shows the local linear regression of the employment share of tradable and nontradable sectors on per capita expenditure. Rural employment is concentrated in tradable sectors at the low end of the distribution, with a share higher than 90 percent among the poorest households due to high affiliation with the agricultural sector, as expected. The negative employment-expenditure gradient is maintained for households in the middle of the distribution, but it reverses at the high end of distribution where employment in tradable industries increases with per capita expenditure. This reversal in the at the high end of the distribution is due to the concentration of high-income landowners who are affiliated with the agricultural sector. On the other hand, the urban employment share in tradable sectors is much lower everywhere across the distribution. The highest levels of urban tradable employment are observed for low expenditure households, and monotonically decreases as we move right across the distribution.

Figure A.3 shows the employment shares for tradable categories of agriculture, mining, and manufacturing. In rural areas, while the employment share in the manufacturing sector increases with per capita income, the magnitude is still relatively low when compared to the agricultural sector, and mining employment is negligible. The share of the nontradable service sector, on the other hand, exhibit a positive slope at the low end of the distribution, and a negative slope at the high end of the distribution, while the overall trend is positive. Based on the structure of employment, we expect the trade restrictions to have a larger direct effect among poorer households relative to richer households, assuming away the indirect general equilibrium effects on nontradable sectors.[7] On the

[7]The effect of trade on these sectors is expected to be small, as the prices of largest service items,

other hand, urban employment is concentrated in the service sector at all per capita expenditure levels across the distribution. While agricultural employment is around 20% at the low end of the distribution, the average employment share is less than 10%. Manufacturing and mining employment is distributionally neutral in urban areas, and small in magnitude when compared to the employment in the service sector.

4 Trade Restrictiveness

In order to measure trade restrictiveness and its impact on households, the trade policy variables need to be aggregated up to the composite expenditure categories. The most common method of aggregating tariffs is by weighting them by imports. However, there are several issues with this aggregation method, as discussed by Nicita et al. (2014). First, the low import levels of a product may be due to its high tariff rates. Assigning a low weight for such a product underestimates the impact of a high tariff in the aggregate measure. Equivalently, this aggregation systematically gives higher weights to products with lower trade restrictions. Second, both cases will enter as quantitatively similar trade restrictiveness components in the aggregate index. Third, import demand elasticities vary substantially across products. A tariff may virtually eliminate imports for a product with high elasticity, thereby imposing a high welfare loss from trade protection. On the other hand, an equivalent tariff may have little impact on the imports of a low elasticity product, resulting in a lower welfare loss. The lower weight of the product with higher welfare loss and vice versa would induce a bias to any subsequent welfare analysis of trade restrictiveness (Anderson and Neary, 1994).

This paper constructs the trade restrictiveness indices for India for each of the composite commodities. The theoretical foundation for this index was first developed by Anderson and Neary (1994), and extended by Anderson and Neary (1996). It is based on the idea of finding a uniform tariff level that would lead to the same level of imports as the differentiated tariff structure. Feenstra (1995) showed that Anderson's index can be approximated by a weighted average of the squares of the tariffs if we assume away the general equilibrium feedbacks. The economy-wide version of this index was later estimated for all countries by Kee et al. (2009, 2013). The trade restrictiveness for each composite category c is given by:

$$TTRI_c = \left(\frac{\sum_{c \in i} m_i \epsilon_i \tau_i^2}{\sum_{c \in i} m_i \epsilon_i} \right)^{1/2} \tag{5}$$

Non-tariff policy measures, such as import licenses, has been an important protectionist tool for India. In order to account for non-tariff measures, this paper also incorporates ad-valorem equivalents of NTBs from Kee et al. (2009). This is a continuous measure

education and health, are highly regulated in India.

covering both domestic subsidies, and direct trade restrictions, such as quotas and import licenses. This data suggest that 27% of the tariff lines (HS6 categories) are subject to an NTB as well as a positive tariff rate. Assuming tariffs and NTBs are binding, tariffs and ad-valorem equivalent of NTBs can be aggregated into an overall trade protection imposed on product i is then given by:

$$T_i = \tau_i + NTB_i \tag{6}$$

where NTB_i is the ad-valorem equivalent of non-tariff trade barriers of HS6 product i.[8] The overall trade protection index is then given by:

$$OTRI_c = \left(\frac{\sum_{c \in i} m_i \epsilon_i T_i^2}{\sum_{c \in i} m_i \epsilon_i} \right)^{1/2} \tag{7}$$

The trade restrictiveness impacts household welfare through price changes. Assuming perfect-pass through on prices, the effect of complete elimination of trade restrictions on prices are given by:

$$\Delta lnp_c^{TTRI} = -\frac{TTRI_c}{(1 + TTRI_c)} \tag{8}$$

The Δlnp_c^{OTRI} is computed in the similar manner, where $OTRI$ is substituted for the $TTRI$ measure (Nicita et al., 2014).

A summary of the trade restrictiveness indices is presented in columns (1) and (2) of Table 3 for household expenditure categories. The results show that India's overall trade restrictiveness based on tariffs is 23%, and when the NTBs are included, this rate increases to 39%. This suggests that a uniform 39% tariff would lead to the same level of imports as the current protection structure. There is substantial heterogeneity across products. The highest level of protection is in the food category with 36% with respect to tariffs and 54% with respect to tariffs and NTBs. Decomposing this index into 'grains' and 'other food' categories show that overall trade protection is very high for grains at 75%, meaning that NTBs are used more often and aggressively for grain products. The highest index value in the data is for 'rice', with 295% $OTRI$.[9] For mining products, the trade restrictiveness index is 9% with respect to tariffs and 21% with respect to tariffs and NTBs. The level of trade restrictiveness is higher for the manufacturing sector is 13% with respect to tariffs and 29% with respect to tariffs and NTBs. There is substantial heterogeneity within

[8] The assumption of all binding trade instruments is consistent with the estimation method of ad-valorem equivalents, which takes the value of zero whenever it is not binding (Kee et al., 2009).

[9] The main HS6 category for the composite 'rice' product group is given by 'rice, semi-milled or wholly milled' (HS6 code: 100630). While the tariff rate for this category is 68%, the ad-valorem equivalent of NTBs is 227%, which leads to an outlier value of the trade restrictiveness index for India. Rice is a staple product for Indian households, with a higher expenditure share among poorer households. Therefore, the welfare cost associated with this composite good is expected to be important.

manufacturing category, as trade restrictiveness on household durables is twice as much as textile or nondurables.

The price changes associated with the elimination of these trade barriers are presented in columns (3) and (4). The highest price reduction can be seen in the food category, with a 23% reduction with respect to tariffs and a 29% reduction with respect to tariffs and NTBs. Overall, prices reduce by 15% if only tariffs are eliminated, and 23% if both tariffs and NTBs are eliminated. These estimates are likely to be biased upwards due to perfect price pass-through assumption, which is relaxed in next section as a robustness test.

Trade restrictiveness also affects individuals through their earnings depending on their industry affiliation. Next, the indices are computed across industries by aggregating HS6 level trade policy variables to the 4-digit International Standard Industrial Classification (ISIC Rev3) level using Equation 3. This yields $TTRI$ and $OTRI$ indices for each employment category reported by individuals in the employment survey. Table 2 shows the average trade restrictiveness across 1-digit ISIC Rev3 categories. The results show that the overall trade restrictiveness is computed as 56% for agricultural sector, 12% for mining sector and 28% for manufacturing sector. Note that the trade restrictiveness for industry categories are slightly different than that of expenditure categories. This is because the coverage of composite categories are not identical as some industry categories are not household consumption items. For example, 'mining' industries covers all activities including extraction and processing of oil and gas, whereas only the end products are represented in the household survey.

Figure 3 shows the correlation between trade restrictiveness based on TTRI and OTRI measures. For some products, NTBs are either not used or they are not binding. These products are along on the 45-degree line.[10] Both tariffs and NTBs are used for most industries as trade protection tools with varying degrees across sectors. It is possible that tariffs and NTBs are used either as complements or substitutes to each other. For example, they may be considered as substitutes if the level of NTBs tend to be low when tariffs are high, or complements if they both tend to be high for heavily protected sectors. In order to investigate this possibility, a new trade restrictiveness index based on NTB is constructed. Specifically, the measure NTRI is constructed by replacing T_i in Equation 7 with NTB_i. The results show that there is almost no correlation with TTRI and NTRI, with a correlation coefficient of 0.037, implying that these policy tools are not significant substitutes or complements to each other.

Next, trade restrictiveness by skill intensity is computed by splitting 2-digit ISIC Rev 3 categories into skilled labor intensive and unskilled labor intensive categories. The employment levels by skill-level are computed using the 61^{st} round of NSS Employment

[10] The number of such 4-digit industries is 28, including some mining and manufacturing industries. None of the agricultural industries have zero ad-valorem NTB measure.

and Unemployment Survey where a skill labor is an individual with at least secondary education. The industries with above-median ratio of skilled/unskilled employment are categorized by skill-labor-intensive industries. Contrary to the expectations, the results show that India protects its unskilled-labor-intensive sectors much more than skilled-labor-intensive sectors. With respect to tariffs, trade restrictiveness is 9% in unskilled-labor intensive industries, and 31% in skilled-labor-intensive industries. These indices increase to 27% and 55% when NTBs are included.

While this result is unexpected for a developing country, similar patterns of protection were also reported for other developing countries such as Colombia, Mexico and Morocco as noted by Goldberg and Pavcnik (2007), where trade protection was higher in unskilled labor intensive sectors, and tariff cuts during the trade liberalization therefore disproportionately affected unskilled-labor-intensive industries. This pattern was documented by (Hanson and Harrison, 1999) for Mexico, Morocco (Currie and Harrison, 1997), and Colombia (Attanasio et al., 2004). Given this initial protection structure, the increase in skill premium post-liberalization was therefore consistent with the Stolper-Samuelson theorem. Because protection is concentrated in the unskilled-labor-intensive sectors, trade liberalization reduced the relative returns to unskilled labor, thus increasing the skill premium. This highlights that the initial pattern of protection matters. Unlike the textbook models that compare autarky to free trade, the comparison must be done based on a movement form the initial protection structure to free trade. In this case, whether or not trade liberalization will reduce inequality in a developing country depends on the pro-poor bias of current trade policy.

In the current paper, the distributional effect through wage incomes are based on four sources of variation: the structure of industry affiliations of individuals across the distribution, the current protection levels of industries, the share of skilled labor across the distribution, and the relative importance of the income from each sector within households. The effects of trade policy on households are estimated based on these variations, and the distributional properties are investigated across the per capita expenditure distribution. Skill premium, on the other hand, only focuses on the gap between wages of skilled labor and unskilled labor at the individual level, and it is therefore a more restrictive method for distributional analysis. These differences highlight that Stolper-Samuelson effects are important, however, they explain only a part of the distributional effects though wage incomes.

5 Household Welfare and Trade Restrictiveness

5.1 Distributional Effects through Expenditure

The results for the first component of Equation 4 across the per capita expenditure quintiles are presented Panel A of Table 4. Following a total dismantlement of agricultural tariffs, rural households at the first quintile of per capita expenditure distribution experience a 13% welfare gain through the expenditure channel. The welfare gains decline monotonically across the per capita expenditure distribution until they reach 9% at the highest quintile. In urban areas, these estimates are very similar at 13% for lowest quintile and 7% at highest quintile due to their similar budget structures.[11] The negative welfare-expenditure gradient implies that the trade protection for agricultural products has a pro-rich bias through the expenditure channel, as the current protection structure has a disproportionate burden on poorer households, and therefore they benefit more once the protection is removed. With respect to the overall trade restrictiveness index, the welfare effect is 20% for the poorest quintile and 12% for the richest quintile in rural areas, and about one point lower in urban areas across the per capita expenditure spectrum. The difference between the welfare measures based on the two trade restrictiveness indices is also largest for the poorest quintile, implying that consumption items with relatively high NTBs are more important in a poorer households' budget.

Trade restrictiveness on mining products also had a pro-rich bias, although the welfare impact of removing these restrictions is smaller in magnitude. This is because both the current trade restrictiveness and the budget shares are lower for mining commodities. Removing all trade protection induces a 0.5% and 0.6% welfare gain for households at the poorest quintile in rural and urban areas, respectively. These estimates decreases to 0.3% for households at the highest quintile. The only expenditure category with a pro-poor trade protection structure is manufacturing products, as the poorer households experience relatively lower welfare gains upon removal of trade restrictions in this sector. These estimates are 0.2% for the poorest quintile in both rural and urban areas, and increases to 1.4% and 0.8% for the highest quintile in rural and urban areas, respectively.

The estimates in columns (7) and (8) show the results for all tradable products in the household budget. Overall, the burden of trade restrictions on the household budget with respect to tariffs is estimated to be 12% and 10% in rural and urban areas. The combined effect of tariffs and NTBs increases this effect to 18% and 15%. The results do not substantially differ across rural and urban areas due to their similar budget structure, which varies across income distribution, but the variation across rural or urban areas is much smaller. Both the magnitude and the distributional effect through the consumption

[11] The food expenditure patterns in rural areas varies greatly across regions as shown by (Atkin, 2013). However, they are quite similar across rural and urban areas within regions with respect to the variation studied in this paper.

channel is dominated by the effect on food commodities. More importantly, the results show that total welfare effect of trade protection through the expenditure channel is pro-rich.[12] As a percentage of their initial budget, poor households would benefit substantially more from the removal of current trade restrictions, or equivalently, poor households bear a higher burden of trade restrictions as a percentage of their budget.

5.2 Distributional Effects through Earnings

As discussed in Section 4, the results for the trade protection structure show that trade restrictiveness is higher in industries where employment, especially unskilled employment, is concentrated (Table 2). This observation, however, is not sufficient to conclude that trade policy impacts unskilled workers more than skilled workers. An important consideration is the responsiveness of earnings to changes in prices. On one hand, wages may be directly affected by price changes through the cost minimization of firms. This response may be limited if labor market regulations are strict, products markets are imperfectly competitive, or labor markets are imperfectly competitive, among other reasons. On the other hand, individuals may adjust their labor supply due to changes in employment opportunities or changes in the opportunity cost of leisure.

In order to incorporate the responsiveness of earnings, the following earnings equation is estimated.

$$lne_{ijdt} = \alpha_0 + \alpha_1 lnp_{dt} + \alpha_2 \mathbf{X'_{idt}} + \gamma_s + \beta_t + \delta_j + \nu_{ijdt} \tag{9}$$

where e_{idt} is the weekly earnings of individual i in industry j in district d at time t; lnp_{dt} is the price level, $\mathbf{X}'$ is a vector of individual characteristics, γ_s is state fixed effects, δ_j is 2-digit industry fixed effects, β_t is year fixed effects, and ν_{ijdt} is an $i.i.d.$ error term.

Because district level consumer price indices and producer price indices are not available, prices are computed from the corresponding rounds of the NSS Consumer Expenditure Survey where the quantity and value of consumption items are reported for each household. This yields the unit values of consumption items for each household, which are then aggregated up to the district level. One potential problem with aggregation is that a simple average across products and across households may lead to an overrepresentation of relatively unimportant items for which the employment shares are very low.

[12]For United States, Borusyak and Jaravel (2018) find the expenditure channel to close to neutral when the effects are compared across different education groups. Using very detailed data, their results indicate that while college graduates spend relatively more on nontradable goods, within tradables they spend more on imported goods (for example, electronics imported brands of consumers packaged goods) when compared to non-college graduates. The current paper relies on the household surveys as the barcode-level data is unfortunately not available for India. Another notable paper in the recent literature is Hottman and Monarch (2018). This paper constructs import price indices using transaction-level data, and estimates the consumer welfare impacts of U.S. imports using non-homothetic consumer preferences both within and across sectors, and show that lower-income household experienced most import price inflation between 1988 and 2014.

In order to circumvent this problem, the prices are aggregated using a weighted average where weights are the employment shares for each product. This model is estimated using two rounds of the NSS Employment and Unemployment Survey from the years of 2004-2005 (61^{st} round) and 2009-2010 (66^{th} round). The sample focuses on individuals who reported earnings and are employed in the agriculture, manufacturing or mining sectors. Because there is no restriction on the ages of workers in the household welfare analysis, all ages are included in the earnings regressions. The survey covers formal and informal employment, providing a comprehensive coverage of the labor force in India.

The prices in Equation 9 may be endogenous, as unobserved district-level shocks, such as technology shocks or weather shocks, may drive both prices and wages. There may also be spatially correlated shocks that affect both prices and wages. The price levels, therefore, instrumented with employment-weighted prices where weights are computed using the employment shares in all states, except the state in which the district is located. This instrument uses aggregate weights to obtain a measure of aggregate shocks that are independent of district-level shocks (Beaudry et al., 2012; Jacoby, 2016). As labor market outcomes and prices must be based on comparable product definitions, concordance tables are generated across two surveys and weighted average prices are computed based on this harmonized definition.[13]

Results presented in Table 5 show that prices have significant and positive effects on earnings, with the exception of rural workers with tertiary education. The first specification controls state fixed effects and industry fixed effects to account for time-invariant differences between states and industries, and year fixed effects to account for changes over time that are common to all individuals. State-specific changes in policies or industry-specific changes in productivity or cost structure may bias the elasticity estimates. In order to account for these variations, the interaction of state and year fixed effects are controlled in the second specification (columns 2 and 5), and industry-year fixed effects are controlled in the third specification (columns 3 and 6). The coefficient are largely robust across specifications. According to the preferred third specification, the elasticity of earnings with respect to prices is estimated to be 5% in rural areas and 18% in urban areas. The lower responsiveness in rural areas is consistent with the results documented by Kaur (2018) and Dreze and Mukherjee (1989) that rural wages in India tend to be rigid and do not adjust fully to the shocks in market conditions.[14]

Because the aim is to assess the distributional effects, the model is also estimated separately for three different skill categories: workers with primary education and be-

[13]These tables are available upon request.

[14]The implicit cooperation model of Osmani (1990) provides additional insights to determination in rural areas. Using a framework of repetitive non-cooperation game, he shows that a wage level above the competitive level can be sustained through implicit cooperation, and this explains both chronic unemployment and rigid wages among casual laborers.

low, middle/secondary education, and tertiary education.[15] The estimates are lower for individuals with low skill levels, while they increase along the skill profile, with the exception of individuals with tertiary education in rural areas. In rural areas, column (3) shows that earnings response is 3% for individuals with primary education or below, 11% for individuals with middle/secondary education, and insignificant for individuals with tertiary education. In urban areas, the corresponding earnings responses are 12%, 24%, and 23%, respectively. The higher responsiveness may potentially be due to the fact the share of formal employment is higher among individuals with more education.

In order to formally estimate the welfare implications, we need to evaluate the industry-level price changes resulting from the elimination of trade restrictiveness for each individual and assess the structure of these effects across the per capita expenditure distribution. The household welfare effect of trade policy through the earnings channel is given by the second component of Equation 4, and it is estimated based on the price changes and the price elasticity of earnings for each individual. The household-level effects are obtained by adding all activity level effects within households weighted by the importance of activity-level income, γ_{ih}. The mean welfare effects across the per capita expenditure quintiles are presented Panel B of Table 4. All estimates are negative, implying that elimination of trade protection would hurt households through the earnings channel. However, the magnitudes of the earnings effects are much lower when compared to the expenditure effects.

The lower magnitude of the earning effects is due to the distribution of workers within and across households as well as labor market mechanisms that prevent price changes to be fully reflected in earnings. The activity level effects are weighted with the importance of income source from each industry, therefore other income sources such as asset returns or income from nontradable sectors lower the welfare estimates. In addition, only individuals affiliated with tradable sectors experience the first-order effects of earnings channel, while tradable goods are present in the consumption baskets of all households, thus all households are affected from the expenditure channel. Finally, the earnings are not fully responsive to price changes, which prevents household fully benefit from protectionist measures.[16]

In terms of the distributional effects, the results presented in columns (7) and (8) suggest that welfare effects through the earnings channel are generally pro-rich, especially in urban areas. The effects are higher at the low end of the distribution compared to the high end of the distribution. In rural areas, the welfare loss from the elimination of trade

[15] The skill categories are as follows. Primary and below: not literate, literate without formal schooling, literate below primary, and primary education; middle/secondary: middle, secondary and higher secondary; tertiary: diploma/certificate course, graduate, postgraduate and above.

[16] The second-order general equilibrium effects through the earnings channel are not considered in this paper. These effects are expected to be small due to low labor mobility across sectors (Besley and Burgess, 2004).

restrictions is 2% for the lowest quintile and 1% for the highest quintile in both rural and urban areas. At the industry level, the distributional effects are much less prominent with the exception of urban agricultural workers, partly because industry-level split excludes nontradable workers while they are represented in the last two columns.

Overall, the distributional effects through earnings are driven by trade restrictiveness structure across industries, as well as employment and human capital structure across the per capita expenditure distribution, and the within-household distribution of income sources. Therefore, it is worth to note that the pro-poor effect through the earnings channel cannot be interpreted through one of these channels in isolation. While the results may partly be driven by a higher level of protection in industries that employ unskilled individuals, other potential mechanisms related to industry affiliations within and across households and household demographics play an important role. For example, an identical effect on individual wages would have different welfare implications for a household with a single wage earner, a household with multiple wage earners in different industries, or a household with highly diversified industry affiliations across activities. The welfare effects through the earnings channel reflects these variations, as the analyses are conducted for each activity of each individual and then aggregated up to the household level to obtained estimates comparable to expenditure effects.

5.3 Net Welfare Effects

The net effects through the consumption and earnings channels are presented in Table 6. In rural areas, the results show that households in the lowest quintile experience a 13% welfare gain through the elimination of tariffs, and a 19% welfare gain through the elimination of tariffs and NTBs. The welfare gains for households at the highest quintile are 9% for tariffs and 14% for all trade barriers, respectively. In urban areas, the magnitudes of the net welfare effects are 17% at the lowest quintile and 11% at the highest quintile. Because the poorest households gain relatively more from the elimination of trade protection, it follows that the current protection structure is more costly for poorer individuals.

This can also be seen from Figure 4, which presents the results of the local linear regressions for the elimination of both tariffs and NTBs. The expenditure effect exhibit a negative slope with higher gains experienced by poorer households in both rural and urban areas. The earnings effect in rural areas, on the other hand, is nonmonotonic with a negative slope at the low and middle part of the distribution and a positive slope at the high end of the distribution, and as a result, the net welfare effect also changes slope at the high end of the per capita expenditure spectrum. In urban areas, the distributional effect is monotonic for both channels, and similar to rural areas, it is dominated by the expenditure channel.

6 Effect of Trade Restrictiveness on Inequality

Suppose the initial welfare of the household h is represented by its per capita expenditure, W_h. In this section, the distributional properties of this welfare measure under current trade policy is compared to that of welfare under free trade. Given the estimated household welfare effects, dW_h in Equation 4, the welfare of the household under free trade is given by:

$$W_{h,post} = W_h + dW_h \tag{10}$$

The inequality based on initial welfare, W_h, welfare under zero tariffs, $W_{h,post}^{TTRI}$, and welfare under free trade $W_{h,post}^{OTRI}$ are then compared to assess the distributional properties of current trade protection structure. A removal pro-poor trade protection structure is expected to increase inequality, whereas a complete elimination of a regressive trade protection structure should lower inequality through its differential effects across the per capita expenditure spectrum.

The results are presented in Table 7. According to the current distribution of welfare (Panel A), inequality is higher in urban areas with respect to $p90/p10$ percentile ratio, Theil's Entropy Index, Gini Coefficient and Atkinson's Index. Moving from current trade policy to free trade, results suggest that welfare inequality is lower for all inequality measures considered in the paper. In rural areas, the $p90/p10$ percentile ratio decreases from 3.6 to 3.3 once tariffs are eliminated, and to 3.2 once all trade restrictions are eliminated. Theil's Entropy Index is reduced by 3.6 points and 6.0 points, Gini Coefficient is reduced by 2.8 points and 3.4 points, and Atkinson's Index is reduced by 3.6 points and 5.8 points in rural and urban areas, respectively, with statistically significant reductions for all measures.

In order to assess the contribution of each channel to overall inequality impacts, the index of pro-poor bias is estimated following Nicita et al. (2014). This measure is defined as the difference in the percentage change in the welfare of the average household in the top d_r deciles and the percentage change in welfare of the average household in the bottom d_p deciles. It is defined as:

$$P_d = E[dW_h|Q_h = d_r] - E[dW_h|Q_h = d_p] \tag{11}$$

where Q_h is the quintile to which household h belongs. This measure is computed by setting d_r and d_p at the top and bottom 40% of the distribution and checking for robustness using the top and bottom 20% of the distribution. The results are presented in Table 8 Panel A. The positive values in this table indicate that the elimination of trade barriers benefits rich households more than poor households, thus the current structure of protection is pro-poor. A negative value, on the other hand, indicates a pro-rich trade policy. The results show that India's trade policy is pro-poor through earnings, pro-rich through expenditure, and the overall bias of trade protection is pro-rich in both rural and urban areas. The direction of bias is robust to adding NTBs, and to considering the top and bottom 20% instead of the top and bottom 40%. More importantly, the distributional bias through the expenditure channel overcompensates the earning channel, therefore, the overall pro-poor bias of trade policy is driven mainly driven by its effect on household budget.

The changes in trade policy may not be directly transmitted to domestic prices (Atkin and Donaldson, 2015; Burstein and Gopinath, 2014). As a robustness test, imperfect price pass-through of tariffs are incorporated based on pass-through elasticities from (Ural Marchand, 2012).[17] The price effect of tariff liberalization is then given by

$$\frac{dp_c^{TTRI}}{p_c^{TTRI}} = -\gamma_s \frac{TTRI_c}{(1 + TTRI_c)} \text{ where } s = u, r. \tag{12}$$

The household-level welfare effects through earnings and expenditure channel are re-estimated under imperfect pass-through of prices. Next, inequality measures are obtained based on these welfare estimates in the same manner. The results are presented in Panel C of Table 7 show that a movement from current trade policy to free trade lowers all inequality measures. While the reduction is slightly smaller under the imperfect pass-through assumption, the main implications remain robust.

7 Conclusion

This paper investigates the pro-poor bias of the contemporary trade protection structure. The empirical method used in the paper allows us to characterize trade policies of countries as regressive or progressive with respect to two main channels, household expenditure, and household wage income, by studying the impact of removing all protectionist tools including tariffs and non-tariff barriers. A protection structure is characterized as pro-poor, or progressive if removal of current trade restrictions leads to higher welfare gains (or smaller welfare loss) for rich individuals as compared to poor individuals, as it implies that the richer households bear a disproportionate burden of the trade protection. On the other hand, a protection structure is deemed to be pro-rich, or regressive, if poor individuals experience higher welfare gains (or smaller welfare loss) from the elimination of trade barriers. As trade protection structure may have different distributional impacts through different channels, the overall welfare effect of trade policy thus depends on the distributional properties and relative magnitudes or expenditure and earnings effects.

The paper first constructs trade restrictiveness indices for India for household consumption and employment categories. The distributional properties of this protection

[17] The results form the specification presented in Table 2, column 8 of (Ural Marchand, 2012) used for this section. In the analysis not reported, the model was run with state-specific pass-through rates reported in Table 4, columns (1) and (2) of that paper and the results are robust to this change.

structure are then studied using two separate nationally representative survey data. The results suggest that Indian protection structure has opposing effects through the two channels. On one hand, the protection level is higher for products that have a high budget share for poor individuals. The price effect associated with higher levels of protection cause disproportionate welfare loss for the poorer households by increasing the cost of consumption. On the other hand, trade protection is biased towards industries in which poorer workers are concentrated, thus the protection structure is pro-poor in the sense that it disproportionately protects low per capita expenditure individuals. However, the results suggest that the regressive effect through the cost of consumption dominates the progressive effect through wage incomes. While Indian trade protection structure is successful in protecting poorer households through earnings channel, it places a disproportionate burden on the households on the low end of the distribution through the expenditure channel.

There are several caveats that need to be acknowledged. First, estimated pro-poor bias in this paper is based only on the first order effects as it uses a baseline budget structure and employment structure in latest available household surveys. The second order effects involving product substitution and employment structure are not incorporated. That said, these second-order effects tend to be small in magnitude. Another limitation of the paper is that it presents the pro-poor bias only through its impact on the household budget and earnings. While these are arguably two of the most important channels, there may be other effects through assets, government transfers, remittances, and farm profits. Also, the household survey does not report the quality of the products consumed by the households, or whether they purchase domestically produced or imported variety. These channels should be investigated in future work as more data become available.

The results on inequality and poverty suggest that a movement from the current protection structure to free trade would lower inequality and poverty in both rural and urban areas. This result suggests that current trade policy contributes to inequality rather than mitigate it, at least through the mechanisms studied in this paper. The political economy of trade policy tends to be biased towards the earnings channel. This is because the income effects are easily observed, and thus it is easier for policymakers to receive support for protectionist policies by highlighting the effects on wages and employment. The household impacts through the expenditure channel, however, are not as easily observed by the consumers, who would need to identify the trade-induced component of observed price changes, and evaluate this component on their budget structure for all of their expenditure items. This paper shows that the latter effect may be more important for household welfare in terms of its magnitude, and may also have the opposing distributional properties as the earnings channel.

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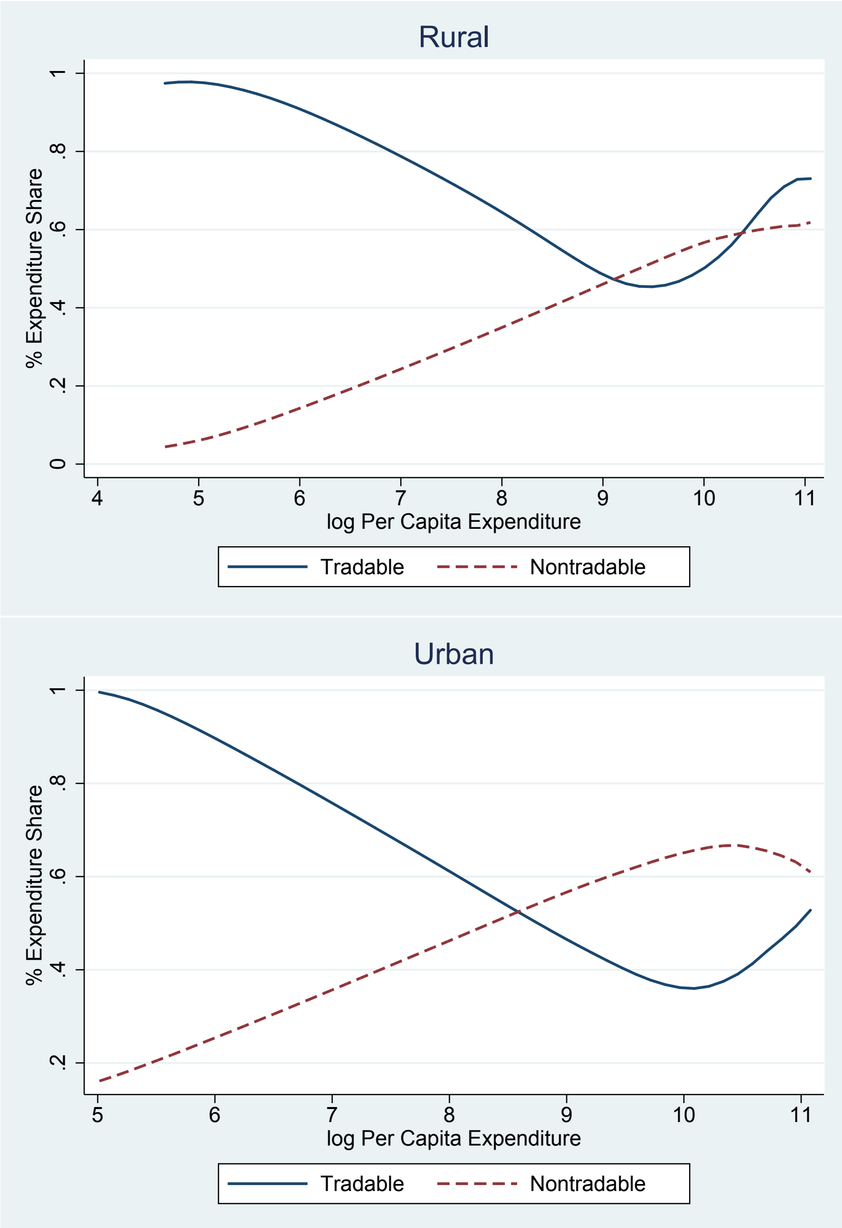
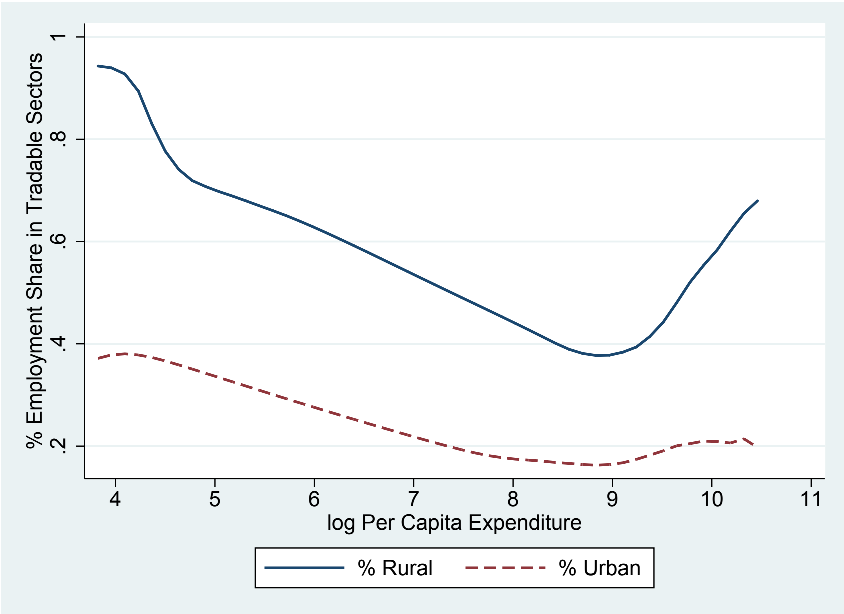
Figures

Figure 1: Expenditure Share of Internationally-Tradable Merchandise



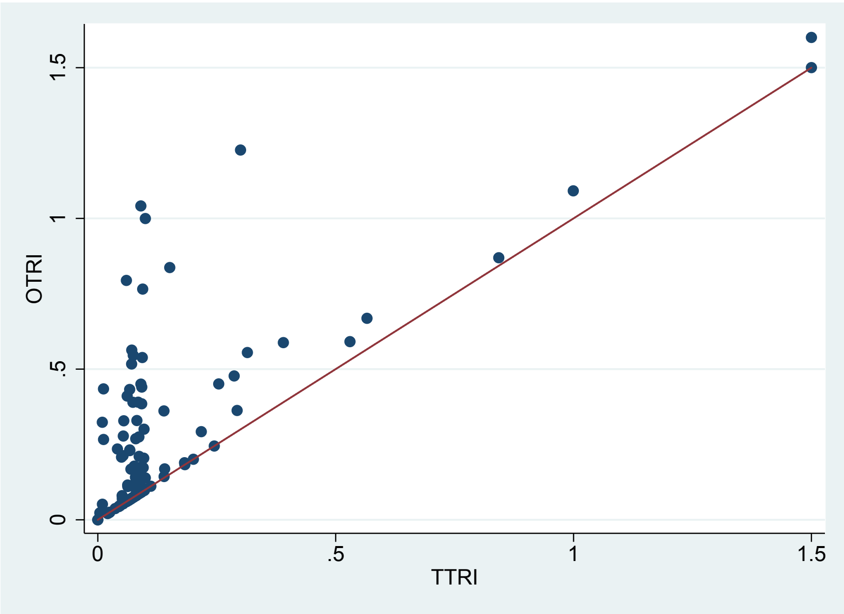
Notes: Tradable goods include food, energy and manufactured items. Nontradable goods include education, housing, medical services, and other services. Source: Government of India National Sample Organization. 2010. Employment and Unemployment Survey, 66^{th} Round.

Figure 2: Share of Workers in the Tradable Sectors



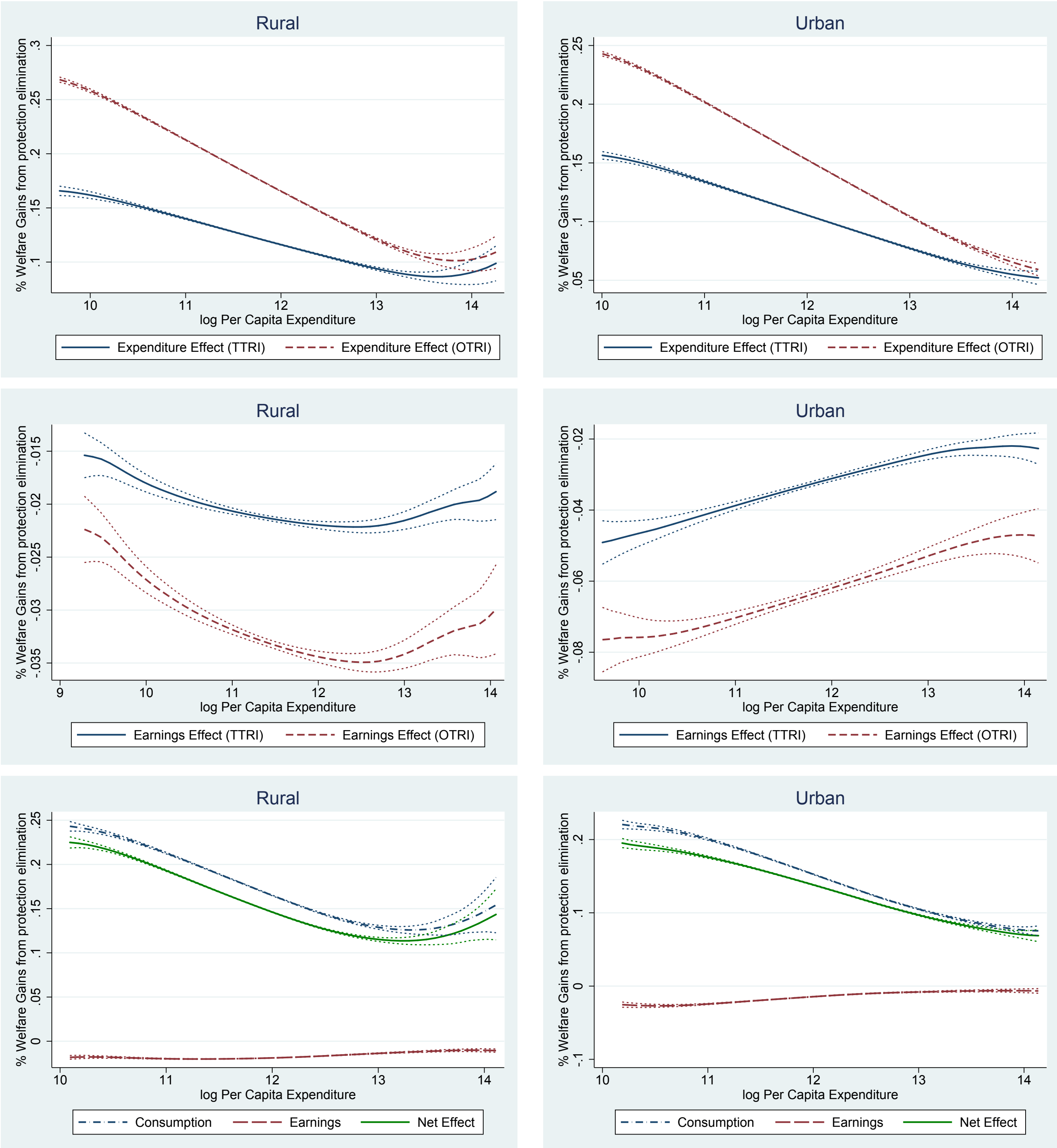
Notes: Tradable sectors include agriculture, manufacturing, and mining sectors. Source: Government of India National Sample Organization. 2010. Employment and Unemployment Survey, 66^{th} Round.

Figure 3: Correlation between Trade Restrictiveness based on Tariffs (TTRI) and All Trade Policy Tools (OTRI)



Notes: This figure presents results of Equations 5 and 7. Each scatter point represents a 4-digit ISIC 3 Rev Industry. The red line shows the 45 degree line.

Figure 4: Welfare Effects across the Per Capita Expenditure



Notes: The figure shows the local linear regression of welfare effects on per capita income. The first row presents expenditure effects, the second row represents earnings effects, and the last row represent net welfare effect across per capita expenditure distribution. A negative slopes indicates regressive distributional effect and a positive slope indicates progressive distributional effect of contemporary trade policy. Short-dash lines shows the 95% confidence intervals.

Tables

Table 1: Expenditure Shares Across Quntiles

	(1)	(2)	(3)	(4)	(5)
		Tradable Goods			
Quintile	Tradable Goods	Agriculture	Mining	Manufacturing	Nontradable Services
Rural					
1	86.77	71.76	8.95	6.10	13.23
2	82.63	68.74	7.53	6.39	17.37
3	79.44	65.80	6.78	6.87	20.56
4	75.63	61.89	5.95	7.81	24.37
5	67.85	52.17	4.80	10.88	32.15
Urban					
1	70.82	58.25	7.46	5.12	29.18
2	67.22	55.86	6.09	5.28	32.78
3	63.58	52.75	5.26	5.57	36.42
4	59.61	49.00	4.42	6.19	40.39
5	51.06	40.25	3.08	7.72	48.94

Notes: The household consumption items and ISICRev3 industry categories are merged to create composite categories of household consumption. Averages of expenditure shares across per capita expenditure quintile are presented.

Table 2: Trade Restrictiveness Indices and Composition of Workers

	(1)	(2)	(3)	(4)
	Trade Restrictiveness		Share of Employment	
	Tariffs	Tariffs and NTBs	Rural	Urban
Broad Industry Categories:				
Agriculture	31.34	56.34	52.67	9.44
	(6.57)	(16.59)		
Mining	11.67	11.67	0.69	0.85
	(8.76)	(8.76)		
Manufacturing	10.67	27.74	8.52	17.84
	(15.10)	(24.23)		
Nontradable			38.12	71.86
Industries by Skill Intensity:				
Skilled Intensive	9.40	27.26	11.85	61.23
	(14.98)	(24.39)		
Unskilled Intensive	30.54	54.59	88.15	38.77
	(8.46)	(19.10)		

Notes: Means and standard deviations of trade restrictiveness indices across industries are presented. The broad categories are indicated with bold letters, and sub-categories are indicated with italic letters. The distribution of employment across sectors are presented in column (3). All age groups are included in the estimates. The distribution of poor individuals across industries is presented in column (4). The poverty line is the international poverty line of $1.90 per person per day evaluated at the 2010 PPP of Rs 18.7 (World Development Indicators, 2017). Skilled-labor intensive industries are defined as 2-digit ISIC Rev 3 industries with over-median share of skilled workers. A skilled worker is defined as a worker with more than secondary education.

Table 3: Trade Restrictiveness Indices across Expenditure Items

	(1)	(2)	(3)	(4)
	Tariffs	Tariffs and NTBs	Δlnp^{TTRI}	Δlnp^{OTRI}
Expenditure Categories				
Agriculture	36.19	54.08	-22.58	-28.82
	(35.78)	(60.15)	(16.36)	(18.47)
Grains	29.18	75.44	-19.46	-30.44
	(28.14)	(110.17)	(17.37)	(25.23)
Other Food	32.89	43.52	-21.60	-26.93
	(30.00)	(32.82)	(14.93)	(15.98)
Mining	8.65	21.33	-7.52	-15.41
	(8.86)	(23.59)	(6.80)	(14.04)
Manufacturing	13.29	29.03	-9.70	-19.78
	(22.48)	(27.86)	(10.60)	(13.33)
Textile	7.97	20.12	-7.35	-16.43
	(2.51)	(9.03)	(2.18)	(6.38)
Nondurables	7.19	17.43	-6.64	-13.97
	(2.99)	(13.21)	(2.67)	(9.12)
Durables	15.84	33.72	-10.94	-21.99
	(26.64)	(31.58)	(12.48)	(14.65)
All	22.65	39.07	-15.00	-23.28
	(30.40)	(45.73)	(14.58)	(16.29)

Notes: Table presents means and standard deviations of trade restrictiveness indices, which are estimated across composite categories according to the Equations 5 and 7. The broad categories are indicated with bold letters, and sub-categories are indicated with italic letters. Δlnp^{TTRI} and Δlnp^{TTRI} are computed according to Equation 8.

Table 4: Welfare Effects through Expenditure and Earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Agriculture		Mining		Manufacturing		All Industries	
Quintile	Tariffs	Tariffs and NTBs	Tariffs	Tariffs and NTBs	Tariffs	Tariffs and NTBs	Tariffs	Tariffs and NTBs
				Panel A: Welfare Effects through Expenditure				
Rural								
1	13.32	20.28	0.37	0.46	0.22	0.40	13.92	21.15
2	12.43	18.41	0.31	0.41	0.27	0.46	13.01	19.28
3	11.58	16.75	0.28	0.39	0.37	0.57	12.23	17.71
4	10.52	14.91	0.23	0.36	0.56	0.78	11.31	16.05
5	8.67	11.82	0.17	0.30	1.38	1.65	10.22	13.77
All	11.73	17.19	0.29	0.40	0.45	0.65	12.47	18.24
Urban								
1	12.55	18.84	0.40	0.59	0.21	0.36	13.15	19.80
2	11.85	17.52	0.32	0.54	0.24	0.41	12.41	18.46
3	10.79	15.56	0.27	0.50	0.31	0.49	11.36	16.56
4	9.59	13.63	0.21	0.43	0.43	0.62	10.23	14.68
5	7.42	10.23	0.13	0.29	0.83	1.06	8.38	11.58
All	0.02	14.04	0.23	0.43	0.50	0.70	10.50	15.17
				Panel B: Welfare Effects through Earnings				
Rural								
1	-2.27	-3.40	-1.13	-1.44	-0.88	-1.68	-1.26	-1.93
2	-2.45	-3.70	-0.92	-1.10	-1.00	-1.96	-1.35	-2.10
3	-2.45	-3.71	-0.94	-1.07	-1.05	-2.11	-1.33	-2.07
4	-2.44	-3.69	-1.01	-1.24	-0.98	-2.03	-1.22	-1.90
5	-2.26	-3.45	-0.91	-1.00	-0.85	-1.87	-0.97	-1.52
All	-2.37	-3.59	-0.98	-1.17	-0.95	-1.93	-1.22	-1.90
Urban								
1	-6.12	-9.26	-2.13	-2.55	-2.27	-5.33	-1.32	-2.39
2	-5.93	-9.07	-2.61	-2.61	-1.95	-5.12	-1.10	-2.10
3	-5.88	-9.05	-3.03	-3.30	-1.90	-5.11	-0.83	-1.65
4	-5.41	-8.43	-2.86	-2.87	-1.89	-4.87	-0.61	-1.25
5	-4.28	-6.60	-2.00	-2.15	-2.08	-4.95	-0.44	-0.93
All	-5.52	-8.48	-2.53	-2.69	-2.02	-5.08	-0.86	-1.66

Notes: The reduction in cost is based on the first component of Equation 4. The estimated mean within each quintile and product category is presented. The standard errors of the mean estimations are omitted for brevity.

Table 5: Effect of consumer prices on earnings

	Rural			Urban		
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: ln(earnings)						
<u>*All Workers*</u>						
ln(*p*)	0.068***	0.054***	0.053***	0.133***	0.188***	0.182***
	(0.010)	(0.013)	(0.013)	(0.016)	(0.020)	(0.020)
N	37,406	37,406	37,406	13,834	13,834	13,834
R^2	0.471	0.477	0.478	0.578	0.573	0.577
First Stage F Statistics	2539.22	1492.45	1501.51	1644.58	949.57	963.93
<u>*Primary and Below*</u>						
ln(*p*)	0.042***	0.026*	0.026*	0.117***	0.127***	0.121***
	(0.011)	(0.014)	(0.014)	(0.019)	(0.025)	(0.025)
N	27,387	27,387	27,387	6,444	6,444	6,444
R^2	0.449	0.456	0.458	0.471	0.478	0.483
First Stage F Statistics	1907.72	1187.40	1193.42	845.09	500.31	497.06
<u>*Middle/Secondary*</u>						
ln(*p*)	0.128***	0.115***	0.112***	0.146***	0.245***	0.240***
	(0.022)	(0.031)	(0.030)	(0.023)	(0.032)	(0.032)
N	8,898	8,898	8,898	5,459	5,459	5,459
R^2	0.405	0.415	0.419	0.477	0.457	0.466
First Stage F Statistics	915.20	482.07	487.02	774.62	390.35	397.16
<u>*Tertiary*</u>						
ln(*p*)	-0.013	-0.007	-0.029	0.135***	0.217***	0.231***
	(0.070)	(0.090)	(0.090)	(0.052)	(0.065)	(0.067)
N	1,121	1,121	1,121	1,931	1,931	1,931
R^2	0.416	0.455	0.469	0.453	0.451	0.462
First Stage F Statistics	119.20	78.23	75.65	218.99	188.13	177.24
State FE	Yes	No	No	Yes	No	No
Year FE	Yes	No	No	Yes	No	No
2-digit Industry FE	Yes	Yes	No	Yes	Yes	No
State*Year FE	No	Yes	Yes	No	Yes	Yes
Industry*Year	No	No	Yes	No	No	Yes

Notes: All regressions include age, age-squared, a dummy for male workers, a dummy for married workers, a dummy for rural households, and education indicators. In columns (4)-(6), the $ln(p)$ variable is instrumented with employment-weighted prices within districts where the weights are employment shares except the state in which the district is located. Employment weighs are from the 2004-2005 (61^{st} round) of the NSS Employment and Unemployment Survey. Education categories are defined as primary or below (not literate, literate without formal schooling, literate below primary, and primary), secondary (middle, secondary, and higher secondary), and tertiary (diploma/certificate course, graduate, postgraduate and above). Standard errors are clustered within districts.

Table 6: Welfare Effect of Elimination of Trade Protection

Quintile	Tariffs	Tariffs and NTBs	Tariffs	Tariffs and NTBs
	Rural		Urban	
1	12.66	19.23	11.81	17.37
	(0.04)	(0.08)	(0.06)	(0.11)
2	11.65	17.17	11.33	16.39
	(0.03)	(0.06)	(0.05)	(0.09)
3	10.89	15.62	10.56	14.93
	(0.03)	(0.06)	(0.05)	(0.07)
4	10.06	14.09	9.67	13.50
	(0.04)	(0.06)	(0.04)	(0.07)
5	9.22	14.09	8.01	10.77
	(0.10)	(0.06)	(0.06)	(0.10)
All	10.90	15.64	10.28	14.60
	(0.05)	(0.08)	(0.05)	(0.08)

Notes: The change in welfare following the elimination of trade protection is estimated according to Equation 4. The mean and the standard error of the mean is presented for each per capita expenditure quintile.

Table 7: Changes in Inequality Induced by Elimination of Trade Protection

	Rural				Urban			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	p90/p10	Theil's Entrophy Index	Gini Coeffi- cient	Atkinson (2)	p90/p10	Theil's Entrophy Index	Gini Coeffi- cient	Atkinson (2)
				Panel A: Pre-Liberalization				
W_h	3.596	0.183	0.308	0.245	5.520	0.267	0.381	0.363
		(0.004)	(0.002)	(0.002)		(0.008)	(0.002)	(0.003)
				Panel B: Post-Liberalization: Perfect Pass-Through				
$W_{h,post}^{TTRI}$	3.294	0.153	0.286	0.216	4.850	0.214	0.353	0.314
		(0.003)	(0.002)	(0.002)		(0.005)	(0.003)	(0.004)
$W_{h,post}^{OTRI}$	3.212	0.147	0.280	0.209	4.711	0.207	0.347	0.305
		(0.003)	(0.002)	(0.002)		(0.004)	(0.003)	(0.004)
				Panel C: Post-Liberalization: Imperfect Pass-Through				
$W_{h,post}^{TTRI}$	3.337	0.156	0.288	0.219	4.901	0.217	0.355	0.318
		(0.003)	(0.002)	(0.002)		(0.005)	(0.003)	(0.004)
$W_{h,post}^{OTRI}$	3.294	0.152	0.285	0.215	4.799	0.212	0.351	0.311
		(0.003)	(0.002)	(0.002)		(0.004)	(0.003)	(0.004)

Notes: Initial welfare is the per capita expenditure of the household (W). Post-TTRI is computed as $W(1 + \Delta W_{TTRI})$, and post-OTRI is computed as $W(1 + \Delta W_{OTRI})$, where both values incorporate the effects through wages and consumption.

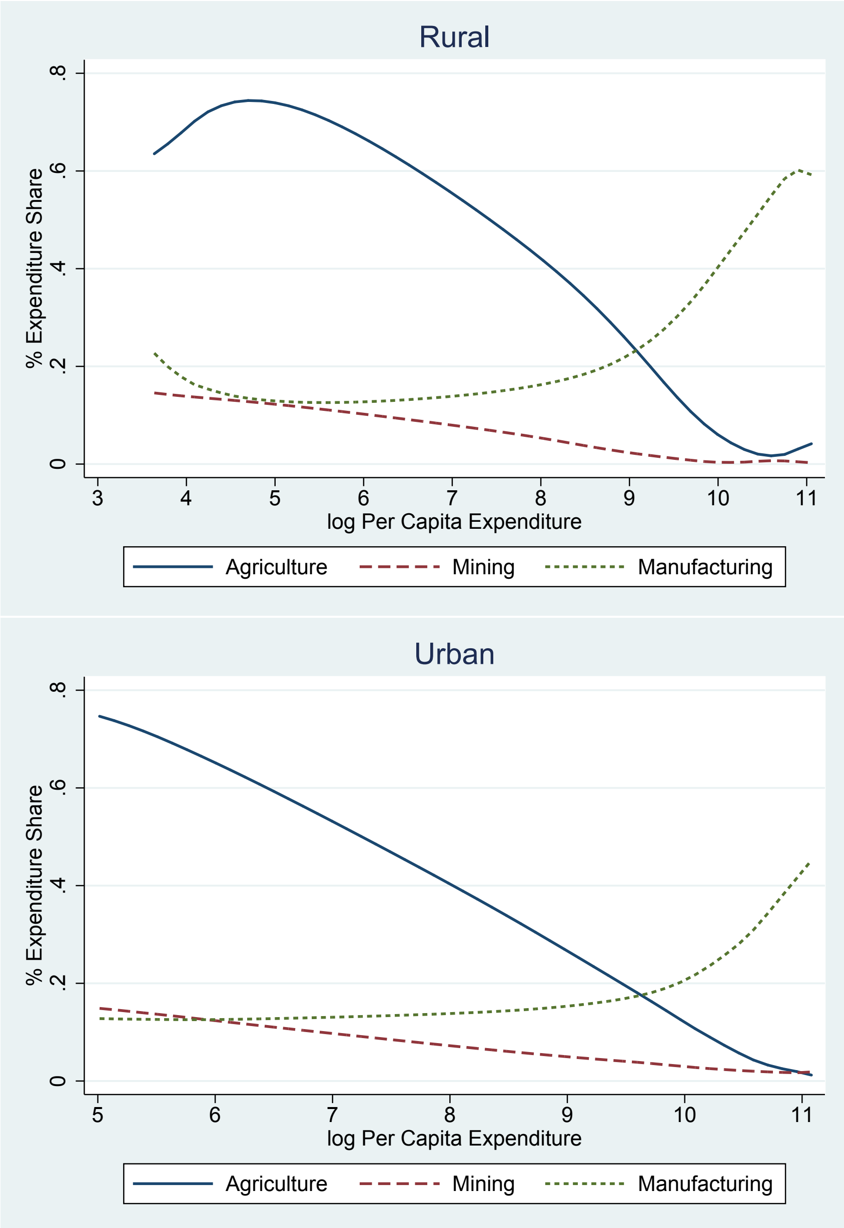
Table 8: Index of Pro-poor Bias in Trade Policy

	Rural			Urban		
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Expenditure	Earnings	Overall	Expenditure	Earnings
			Panel A: Perfect Pass-Through			
Tariffs						
Top 40%-bottom 40%	-2.52	-2.73	0.21	-2.73	-3.41	0.69
Top 20%-bottom 20%	-3.45	-3.73	0.29	-3.80	-4.69	0.89
Tariffs and NTBs						
Top 40%-bottom 40%	-5.11	-5.41	0.30	-4.74	-5.90	1.16
Top 20%-bottom 20%	-7.14	-7.54	0.40	-6.60	-8.07	1.47
			Panel B: Imperfect Pass-Through			
Tariffs						
Top 40%-bottom 40%	-1.24	-1.34	0.10	-1.80	-2.26	0.45
Top 20%-bottom 20%	-1.69	-1.83	0.14	-2.51	-3.10	0.59
Tariffs and NTBs						
Top 40%-bottom 40%	-2.51	-2.66	0.15	-3.13	-3.90	0.76
Top 20%-bottom 20%	-3.51	-3.70	0.20	-4.36	-5.33	0.97

Notes: This table presents the pro-poor bias index of trade policy based on Equation 11. Positive value indicates that the existing trade policy is pro-poor. The standard errors of the mean estimation omitted for brevity.

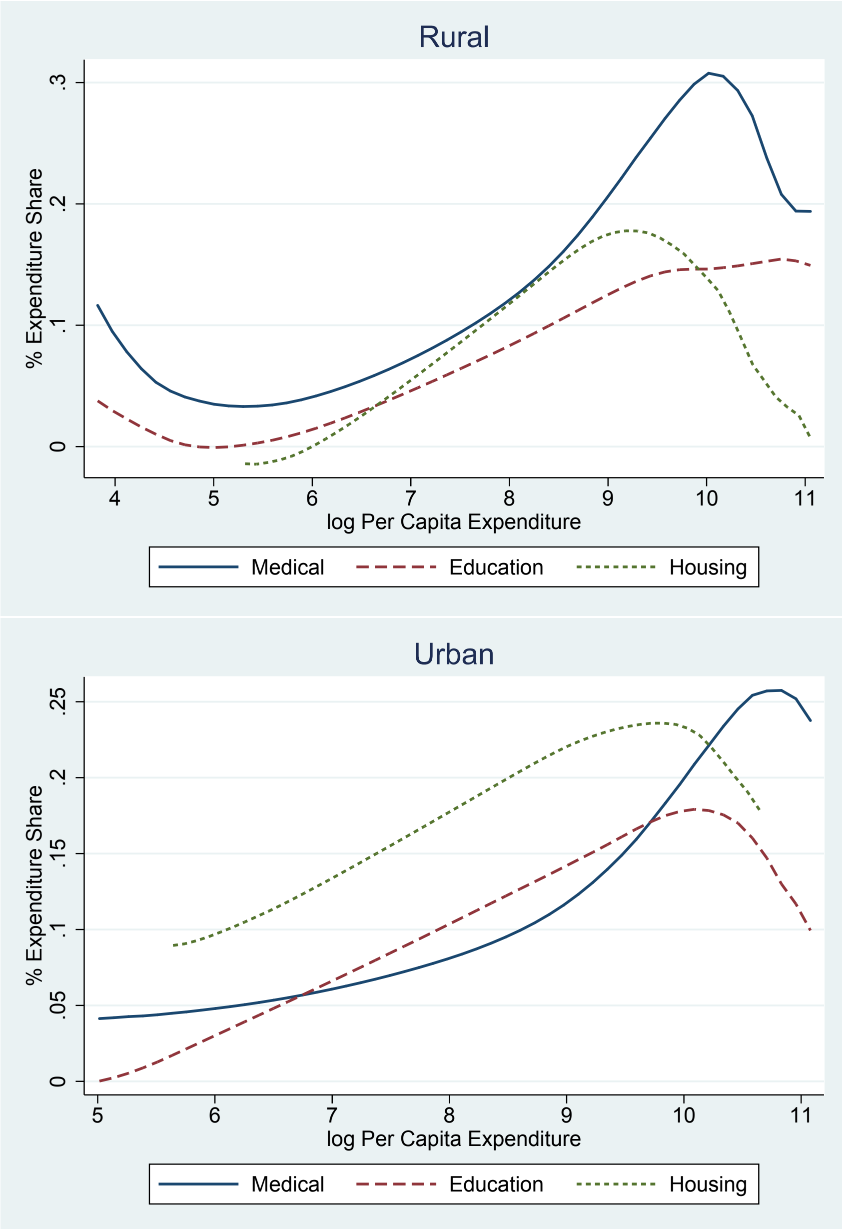
A Appendix

Figure A.1: Brake-up of Tradable Budget Shares



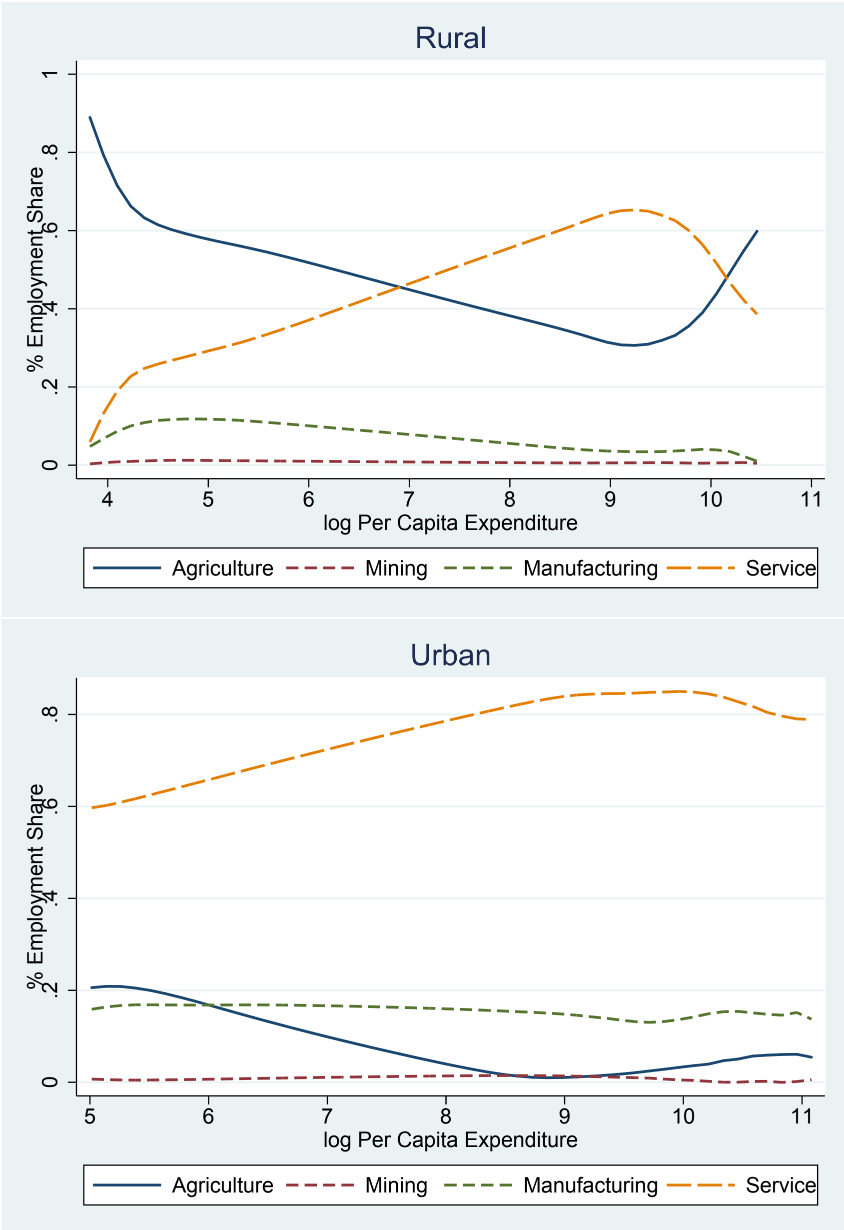
Notes: Government of India National Sample Organization. 2010. Employment and Unemployment Survey, 66^{th} Round.

Figure A.2: Brake-up of Nontradable Budget Shares



Notes: Government of India National Sample Organization. 2010. Employment and Unemployment Survey, 66^{th}Round.

Figure A.3: Break-up of Workers in Tradable and Nontradable Sectors



Notes: Tradable sectors include agriculture, manufacturing, and mining sectors. Source: Government of India National Sample Organization. 2010. Employment and Unemployment Survey, 66^{th} Round.