Does trade liberalization promote regional disparities? Evidence from a multiregional CGE model of India

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Abstract

Over last few decades, there has been a growing interest among researchers in understanding the link between trade liberalization and regional disparities within the context of an individual country. In this study, we develop the first ever single-country multiregional Computable General Equilibrium (CGE) model for the Indian economy to investigate this linkage. Overall our results suggest that, in the short-run, trade liberalization has a beneficial impact on the rich and fast growing middle income states and a marginal or negative impact on the poor states.

Keywords: – trade liberalisation, economic growth, regional disparities, computable general equilibrium model, South Asia, India

1. INTRODUCTION

Over the last few decades there has been a growing interest among researchers and policy makers in understanding the regional economic impact of globalization, particularly, trade liberalization. Diverse schools of thought exist among researchers on the link between trade liberalization and regional disparities. According to Shankar and Shah (2003), regional inequalities pose an important development challenge in countries with large geographic areas. Moreover, with the expansion of globalization, regional disparities are exacerbated as the competitiveness of a region is largely determined by its skill base rather than its resources. As such skilled workers are placed in position where they gain at the expense of unskilled workers who are typically concentrated in poor regions. This argument has been supported by other researchers who concluded that trade openness tends to promote regional inequality (see Daumal, 2010; Milanovic, 2005). In contrast, Williamson (1965) postulated that regional disparities are likely to worsen during early stages of development and tend to decrease overtime. However, empirical evidence on the nexus between trade liberalization and regional inequality has been ambiguous and some researchers argue that the positive or negative impact of trade liberalization on regional inequality is largely determined by each country's specific geography (Brülhart, 2010).

Recent focus on poverty alleviation under the United Nations Millennium Development Goals has led to a renewed interest in understanding the link between trade reforms and regional disparities, particularly, within emerging and developing countries. In this paper, we examine India, an emerging economy in South Asia, to understand the link between trade reforms and regional disparities. India makes a fascinating case study to understand this linkage as it has the largest concentration of poor people in the world despite being one of the world's fastest growing economies (Topalova, 2008).

After decades of pursing an inward looking development strategy, India embarked on the path of trade reforms in 1991 in conjunction with other macroeconomic reforms. The reforms resulted in accelerating Indian economic growth with growth rates jumping from 3-4 per cent during the pre-reform period up to 8-9 per cent in the 2000s. Interestingly, in recent years, policy makers globally, including those from within India, are becoming more concerned with the distributional impacts of trade reforms - particularly the "inclusive growth path". For example, the main theme of the Approach Paper to the Eleventh Five-Year Plan (2007-12) in India was 'faster and more inclusive growth'.

To the best of our knowledge, the existing empirical studies on the trade and regional disparities within the Indian context have adopted a partial equilibrium analytical framework (for example see Cashin & Sahay 1996; Dasgupta, *et al.*, 2000; Nagaraj *et al.*,1998; Rao, *et al.*, 1999; Subrahmanyam 1999; Bhattacharya & Sakhtivel 2004, Ghosh 2010; Das, *et al.*, 2010). Many researchers have, however, highlighted the drawbacks of using a partial equilibrium framework to analyze the impact of policy or external shocks that are likely to have economy-wide implications and operate within multiple channels in the economy (see Chen & Ravallion, 2004; Coxhead, 2003). Therefore, in this paper we develop the first ever multiregional Computable General Equilibrium (CGE) model for India in order to analyze the above linkage within a general equilibrium framework.

The main objective of our study is to identify and quantify the regional impact of trade liberalization within a general equilibrium framework. In addition to the standard neoclassical assumptions, our model incorporates economies of scale as well as imperfect competition. Further, simulations are carried out to analyze the economy-wide and regional impact of across the board tariff reductions as well as differential tariff cuts across industries.

2. TRADE LIBERALIZATION IN INDIA : STYLISED FACTS

After decades of pursuing an inward looking development strategy, wherein import substitution constituted a major element of both trade and industrial policies and production for the domestic market was shielded behind high tariff walls and high effective protection, India embarked on the path of trade reforms in 1991. This was undertaken in conjunction with other macroeconomic reforms. Although initially this change was taken with the objective of resolving balance of payments crisis, it was also aimed at the long-term broad objectives of accelerating economic growth and eliminating poverty. The trade liberalization measures included devaluation of exchange rate and moving to a unified market determined exchange rate system in 1993; reductions in the list of prohibited exports and imports; lowering of nominal tariffs; withdrawal of quantitative restrictions on imports and phasing out the system of import licensing; changes in export incentives and a switch from direct subsidies to indirect export promotion measures.

A key aspect of India's trade reforms in the 1990s was the reduction of import duties. Prior to reforms, import duties were one of the highest in the world with some commodities even above 200 per cent (Kotwal, *et al.*, 2011). The peak tariff rate has since come down from its high level in 1991-92 to 25 per cent in 2003-04. The average tariff rate has also declined over the 1990s. Table 1 displays cross-country average tariff barriers since the nineties and includes a clear depiction of the drastic fall in tariff barriers in India from the high levels of 1990. Table 2 presents the average import duty rates of different sectors in India. As time has progressed, it can be observed that average tariff rates have declined significantly in mining, intermediate goods and capital goods sectors. In contrast, the agricultural sector maintains relatively high protection compared to other tradable sectors over this period.

Table 1 here

Table 2 here

Among the most common non-tariff barriers are the restrictions or prohibitions on imports maintained through import licensing requirements. Prior to the reforms, quantitative restrictions on the importation of a wide range of products were most commonly used as non-tariff barriers. During the period 1980-85, 98 per cent of the manufactured imports of intermediate inputs and 95 per cent of the capital goods were subject to non-tariff barriers. This was almost 100 per cent in the case of consumer goods (Kotwal *et al.*, 2011). In the initial phase of reforms in 1991-92, about 3000 tariff lines covering raw materials, intermediates and capital goods were freed from licensing restrictions. By 1996-2000, only 28 per cent of manufactured imports in intermediate inputs category and 8 per cent of the capital goods were subject to non-tariff barriers.

Within the country, trade is concentrated among high income and more developed states. Data on the state of origin of exports reveals domination of Maharashtra and Gujarat. Among the 15 major states, it is these two states which accounted for 51 per cent of the country's total exports followed by Tamil Nadu and Karnataka during the period 2008-10 (see Figure 1).

Figure 1 here

3. REGIONAL DISPARITIES

Regional disparities have increased significantly in the post-reform period in India and, as such, a large number of studies have examined whether the states have diverged or converged with each other.[1] This is a question which has bothered policy makers and academia for the past two decades. Bhattacharya and Sakhtivel (2004) built a common state income series for the period

1980-81 to 1999-2000 by applying 1993-94 base year backwards up to 1980-81. The results of their study revealed that regional disparity has indeed increased since the reforms of the nineties. The authors concluded that states with faster growth rates in the 1980s continued to grow even faster in the post-reform period, thus widening the gap between lagging and fast growing states with no evidence of convergence. They also found a negative relationship between population growth rates and states' income growth rates. Thus, states with high population growth rates have experienced lower income growth rates since the reforms evidenced by issues such as high unemployment, migration and other social conflicts. Standard measures of inequality such as Gini coefficient, Theil's index, Kakwani index and Atkinson's index have also revealed increases in inequality across the states; especially since the reforms in 1991 (Gaur 2010).

Recent studies on convergence have however, noted mixed results depending on the period of study and the number of states (covering non-special category and special category states) chosen.[2] Some studies find evidence of conditional convergence in regional incomes with faster convergence taking place during the post-reform period 1992-2006 (Agarwalla and Pangotra 2011). Among the factors leading to convergence are variations in human capital; production structures; and physical and social infrastructure (Ghosh 2010).

Increased divergence however, is reflected in the widening of the gap between rural and urban areas in both income and non-income indicators. This has taken place even within the fast growing states where the less developed areas have lagged further behind (Kanbur 2010). Per capita consumption has also converged at the urban level, but diverged at the rural level. Nonetheless, inequality and poverty have converged across both rural and urban areas (Das, *et al.* 2010).

In discussing lagging regions, it should be noted they are apparent not only within fast growing states but also in the border areas surrounding other states. Kanbur (2010) suggested that instead of abandoning the regional polices aimed at redistribution of resources, including strategic

investments to lessen poverty, these policies should be strengthened even further as otherwise the presence of fissiparous tendencies as a result of regional inequalities, could pose a real danger to the country.

Amongst the sectors, rich states with high per capita incomes experienced low rates of growth in the agricultural sector (Birthal, *et al.* 2011). The authors further argued that investment in physical infrastructure and human capital is not enough for convergence, and it is the labor market linkages between the agriculture and non-agriculture sectors which hold the most promise for reducing the proportion of people employed in the agricultural sector. The regional concentration of industries has also increased since the reforms and less developed states have failed to catch up with more developed ones even in this respect (Saikia 2011).

Inequalities have increased not only inter-state, but intra-state as well. High within state inequality exists in the lagging states and even in the developed states such as Maharashtra, Gujarat, Haryana and Karnataka. The coefficient of variation in per capita GDP within the states has actually increased in less developed states such as Bihar. Growing within-state inequality is also reflected in the widening of the gap between per capita GDP of the richest district and the poorest district. In terms of the convergence debate, studies have noted increased divergence in growth performance across districts indicating increased within-state inequality. This is particularly evident in Bihar where growth has been concentrated in few districts. For instance, the difference in the ratio of per capita GDP between Patna (highest income growing district) to Sheohar district (lowest income increasing) rose from 6.68 in 1999-2000 to 8.65 in 2006-07 (Planning Commission 2013).

In considering what has been the impact of trade openness on regional inequality and if trade liberalization will effectively lead to increases in regional disparities, the economic theory (Heckscher-Ohlin model) stipulates that countries will specialize and trade in goods in which they are relatively well endowed. As such, labor abundant countries will trade in relatively labor

intensive products in exchange for capital intensive goods. In line with this there is a presumed homogeneity of factors of production, perfect competition in commodity and factor markets, and immobility of factors between countries, amongst other considerations. These assumptions have however been challenged by many studies as trade liberalization and regional disparities have increased simultaneously in many countries.

Changing trade composition and trade openness can arguably be seen to as important factors in escalating regional disparities and regional inequalities (Daumal 2010; Rodriguez-Pose & Gill 2006; Barua and Chakraborty 2010). The changing composition of trade, with the lessening importance of the primary sector, aggravates intra-regional disparities. Conversely, the regional disparities lessen with the increase in agricultural exports (Rodriguez-Pose and Gill 2006).

The effect of trade openness on regional inequality however, has not been uniform across countries. Whilst it led to a decline in regional inequality in Brazil for example, it had the opposite effect in India (Daumal 2010). In contrast, foreign direct investment led to increase in inequalities in both countries. In the Indian case this was affirmed by Barua and Chakraborty (2010) and Barua and Sawhney (2010) who found that trade openness was a major factor leading to differential response of the regions and that lagging states faced poor performance on the trade front as an outcome of structural problems.

Topalova (2007) found that the incidence of poverty increased by 2 per cent in the rural districts in India with industries exposed to trade reforms. Some of the major reasons for this increase in poverty were lack of geographical and inter-sectoral mobility. The study also established that different regions in India experienced different effects of trade liberalization and the regions exposed to foreign competition suffered in terms of poverty reduction. Increased trade openness also led to the widening of the wage gap between men and women employed in the manufacturing industries (Menon and Rodgers 2009).

Regional disparities are also reflected in marked variations in infrastructure across the states. In the current study, we computed a composite infrastructure index for India at the sub-national level covering three dimensions; physical infrastructure, social infrastructure and financial infrastructure. The dimension of physical infrastructure consists of three variables: electricity available (Gwh); length of roads (in km) and teledensity per thousand population. Teledensity shows the number of telephone connections for every 100 individuals within an area.

The second dimension of our infrastructure index consisted of three indicators: access to safe drinking water (tube wells, tap and hand pump); percentage of schools having girls' toilet facilities; and infant mortality rate. An ideal indicator of health infrastructure would be the number of hospital beds per thousand population or number of doctors per thousand population. Consistent data for all the states was however, not available to us on these indicators. We therefore opted for infant mortality rate. Infant mortality rate reflects the number of infants who die before reaching 12 months of age per thousand live births.

Our final dimension of the index is financial infrastructure. Availability of financial infrastructure in various states accessible to an entire population irrespective of geographical location, gender, and population groups (rural and urban) is a priority agenda for the policy makers in many developing countries. Access to bank branches, in our study, is measured by average population per bank branch, thus the higher the population covered per bank branch the lower the access to banking sector (and visa-versa). Our second indicator of financial infrastructure reflects availability of credit in various states as a ratio of the deposits mobilized by the states. The methodology we follow in the construction of this index is similar to that followed by UNDP in the construction of its Human Development Index. The results are shown in Table 3.

Table 3 here

Based on the composite infrastructure index constructed by us, some states rank much higher in terms of availability of infrastructure in all dimensions. The regional disparities in infrastructure

can be observed as the coefficient of variation (36.3 per cent). Tamil Nadu ranks highest in the composite index which includes physical, social and financial infrastructure followed by the northern state, Punjab. Low income backward states rank far below in the infrastructure index.

Notwithstanding these economic reforms, regional disparities (except in education which are gradually narrowing), continue to be high and the policy target of achieving inclusive growth is yet to be realized (Thorat & Dubey 2012). The review of the available literature on the impact of economic reforms on regional disparities also indicates that the empirical support for economic reforms and regional disparities nexus is inconclusive within the Indian context. Furthermore, all available empirical studies in this area have utilized the partial equilibrium framework and general equilibrium impacts are not investigated.

4.   MULTIREGIONAL COMPUTABLE GENERAL EQUILIBRIUM (CGE) MODEL FOR INDIA

In this study, we develop a comparative static multiregional CGE model for India in a "top down" mode which encompasses 17 regions[3]. To our knowledge, this is the first such multiregional CGE model developed for India. The Global Trade and Analysis Project (GTAP)[4] GTAP version 7 Indian database (base year 2004) is used as the core CGE database which is supplemented by other regional data from sources such as *Annual Survey of Industries* (Government of India, 2011a); *Time Series Data on Annual Survey of Industries* (Government of India, 2011b); *Estimates of State Domestic Prod*uct (CSO, 2012); and various industry outputs and employment data from the Ministry of Statistics and Programme Implementation (MOSPI) website. The projections of the national output and employment are disaggregated into 17 regions. The model contains 57 commodities produced by 57 industries.

The theoretical structure of the core model closely follows the ORANI model (Dixon *et al.*, 1982) with neoclassical assumptions. Since the seminal paper by Harris (1984) which highlighted

the importance of economies of scale and imperfect competition in modelling trade liberalisation within a general equilibrium framework, researchers have been debating the validity of standard neoclassical assumptions in modelling economies in the context of trade liberalisation. Therefore, in this model we have attempted to incorporate economies of scale and imperfect competition following the CGE model of Abayasiri-Silva and Horridge (1996). Hence, this Indian CGE model can undertake simulations using the standard neo-classical model assumptions of constant returns to scale technology and perfect competition as well as the new technology assumptions and new pricing rules. Few other studies have attempted to incorporate imperfect competition and scale economies within CGE models (see for example Harris, 1984; Cory and Horridge, 1985; Horridge, 1987; Devarajan and Rodrik, 1988; Melo and Roland-Holst, 1991; Francois and Roland-Holst, 1997; and Swaminathan and Hertel, 1997).

In the monopolistic competitive market structure, it is assumed that users differentiate among products of different firms. Hence, firms are not price takers as in the perfect competitive markets. The model contains two alternative pricing rules to model the monopolistic competition. These are, optimal markup rule or Lerner pricing rule (L_P) and the Harris's (1984) pricing rule (H_P) (for detailed description of these pricing rules see Abayasiri-Silva and Horridge, 1996; 1999). Lerner pricing rule assumes that markup has an inverse relationship with the perceived elasticity of demand for firms' products. The Lerner pricing rule is given as $L_P = (P-M_C)/P = 1/E_p$, where L_P is Lerner price index, E_p is the elasticity of demand for the product, M_C is the marginal cost of a given product and P is price. The mark-up factor is equal to $P = [1/(1-L_P)]M_C$ and under the perfect competition $L_p = 0$, as $P = M_C$.

Harris pricing rule is based on a mixed pricing rule presented in Harris (1984). It is a combination of Lerner pricing rule and the import parity pricing rule (Eastman-Stykolt's, 1966). In percentage form it can be given as $hp = \partial p_m + (1-\partial)lp$, where hp is Harris price, P_m is import

price, lp is Lerner price index (in percentage form) and ∂ is a parameter (0< value <1). In this simulation experiment we set ∂=0.5.

In the standard neoclassical model with perfect competition and constant returns to scale technology, zero pure profit condition is maintained as there are no entry barriers to new firms. However, in this monopolistic competitive model with increasing returns to scale technology we assume that in the short-run, number of firms is fixed. Hence, existing firms enjoy a super normal profit in the short-run.

Regional disaggregation of the model is based on the ORANI Regional Equation System (ORES) (Dixon *et al.*, 1982). ORES is based on a technique developed by Leontief *et al.* (1965) in order to disaggregate the results of a national input-output model into regions. This method has been widely adopted by many researchers in disaggregating national CGE model results into regions in a "top down" fashion (for some applications see Haddad *et al.*, 2002; Giesecke, 2004; Dixon *et al.*, 2007; Giesecke, 2008).

The shares of regional industry output, employment, household consumption and exports have been used to generate regional results from the national results. In the "top down" regional disaggregation approach, we assume that each industry uses the same technology in each region. Furthermore, in this approach, the regional industries are divided into 2 groups, i.e., national industries and local industries. National industries include industries producing tradable goods which are freely traded among regions and the regional output of such an industry is assumed to follow the corresponding national industry. In contrast, local industries produce commodities or services which are scarcely traded across regions. Hence, the outputs of these industries are assumed to follow local demand for those commodities. This, in turn, captures local multiplier effects within the region (Horridge, 2003). Although the "top down" approach has some limitations such as, inability to capture impact of regional policy shocks (see Dixon, *et al.*, 1982), it does offer a number of advantages including a limited data requirement and the ability to

capture regional consequences of a national shock in terms of regional industry structure and regional multiplier effects (Giesecke, 2004). According to Dixon, *et al.* (2007: P. 53),

"Tops-down approaches are most suitable for analysis of national policy changes (such as the removal of tariffs and quotas) that could be expected to have little effect on the relative costs of sourcing commodities from different regions".

Given the policy shocks implemented in this paper are national policy changes (in this case a tariff cut), the "top down" approach would be a useful method to capture regional macroeconomic effects as it takes into account the impacts coming from national industries as well as local industries along with the regional multiplier effects. This approach is further justified due to a lack of reliable regional input-output tables for the 17 regions specified in this model. Furthermore, within the developing country context there have been few attempts to capture regional impacts of trade reforms using the "top down" approach (see for example, Souza Ferreira Filho and Horridge, 2006;Butt and Bandara, 2008; 2009; and Gunawardena, 2012). A detailed description of this ORES based regional disaggregation method is given in Dixon *et al.* (1982) and Horridge (2003).

5. REGIONAL IMPACT OF TRADE LIBERALIZATION: SIMULATION RESULTS

In this study, we conducted a set of simulation experiments to understand the short-run impact[5] of trade liberalization on the regional growth of India. Accordingly, we reduced the existing import tariffs for all tradable commodities by 50 per cent. In addition to this main simulation experiment, another simulation was carried out by implementing tariff cuts at different levels

across industries to closely reflect India's actual efforts toward trade reforms. The tariff cuts were calculated based on historical trends presented in Table 2.

The experiments were carried out within a short-run macro environment (or closure). In the short-run closure[6], all sectoral capital is exogenised and as we assume a slack labor market, the total employment is endogenised. Furthermore, sectoral rates of return and real private consumption are also considered endogenous. In these simulations the nominal exchange rate, which is exogenous, is considered as the numeraire. The CGE model was solved using the GEMPACK software suite (Harrison & Pearson, 1998).

As a sensitivity analysis, we conducted the above simulations using monopolistic competitive market structure with increasing return to scale. In these simulations Harris pricing (H_P) rule was used in addition to marginal cost pricing. Furthermore, we assumed only the manufacturing sector was operating within a monopolistic competitive market with increasing return to scale technology. Agricultural and service sectors were assumed to follow perfectly competitive market structure with constant return to scale technology.

a) Macroeconomic and Industry Effects

The percentage change results of important macro variables over the base year values for the simulation experiment with 50 percent tariff cut using the standard model (with perfectly competitive market structure with constant returns to technology) are summarized in Table 4.

The results of the simulation exercise suggest that trade liberalization bodes well for the national economy wherein real GDP increases by 1.2 percent and the aggregate employment increases by 1.73 per cent from the basecase.

The same simulation under the monopolistic competitive and increasing returns to scale model, shows that GDP increases by 2.82 per cent and the aggregate employment increases by 4.56 per cent from the basecase (see Table 4).

Both simulations, that being the standard model and the monopolistic competitive manufacturing sector with increasing returns to scale, yield a positive increase in real GDP and aggregate employment. This suggests that trade liberalization stimulates growth as found in many empirical studies in the literature. However, it can be seen that the effects are more pronounced in the monopolistic competitive and increasing returns to scale model compared to that of the standard model. These results are consistent with the outcome of Harris (1984) for the Canadian economy. Under the monopolistic competitive market structure, the manufacturing industries enjoy a super normal profit in the short-run. Similarly, under increasing returns to scale technology assumption, firm's unit cost falls as output increases. Thus, in the event of a reduction in tariffs, the export industries that would benefit by cheap imported inputs will increase their existing supernormal profit margins and expand their production compared to manufacturing industries operating under a perfectly competitive market structure. This is evident from comparing the manufacturing industry output and employment results presented in Table 5 for the standard model and the monopolistic competitive model.

Table 4 here

Table 5 here

Under the standard model, the Industry level value added results suggest that the manufacturing industries such as meat products, wearing apparel, textile, leather products and manufacturing

nec. have been positively affected in the short-run (see Table 5). Furthermore, service industries such as business services and sea transport have also been stimulated. In contrast, agricultural industries such as vegetable oils and fats, sugarcane, sugar beet, oil seeds, wool, silk-worm cocoons, vegetables, fruit, nuts and crops nec., in addition to manufacturing industries such as, beverages and tobacco products, sugar and paper products, and publishing have shown a contraction in the short-run. It is evident that export industries which face elastic demand are the main winners under this policy shock and the import substitution industries tend to suffer from cheaper imports. Furthermore, these results are consistent with the proposition that previously heavily protected industries suffer when trade is liberalized.

Under the monopolistic competitive model (see Table 5) industries, particularly the manufacturing industries, perform well compared to those under the standard model. As described previously the export industries expand their production taking advantage of cheaper imported inputs as well as the increasing returns to scale technology. The other industries also enjoy some gains from the reduction in the cost of imported inputs as well as the increase in derived demand for intermediated goods from the expanding industries.

The percentage change results of important macro variables over the base year values for the simulation experiment with differential tariff cuts across industries using the standard model and the monopolistic competitive model are summarized in Table 4.

These results show a similar pattern to the previous simulation outcome thus indicating that results under the monopolistic competitive model are more pronounced than that of the standard model. By considering these results and India's industry structure, including the price setting mechanism along with the recent trends in economic performances, it can be assumed that a monopolistic competitive model would show a better fit in describing the short run impact of tariff reforms in India,

b) Regional Effects

When we consider short-run impact of trade liberalization on gross domestic product at the state level under the 50 percent tariff cut simulation using the standard model (see Table 6), it is evident that poor states such as Orissa, Uttar Pradesh, Assam and Rajasthan show a marginal growth, while Bihar and Madhya Pradesh portray a negative growth. In contrast, middle income states such as Karnataka and Kerala demonstrate higher economic growth compared to other middle income states. Of the richer states, Tamil Nadu shows the highest growth and Gujarat and Maharashtra, which comprise a sizable proportion of export industries, also shown a higher growth. Punjab and Haryana show a moderate growth.

It is evident that Tamil Nadu, a high income state, benefited substantially by trade liberalization given that manufacturing industries such as textiles, wearing apparel and leather products, which were stimulated by the trade shocks (output expanded by 2.4, 9.5 and 3.7 percent respectively), are largely located in this state. The middle income state of Karnataka, also benefited by the expansion of manufacturing industries such as wearing apparel and manufacturing nec. In addition, service industries that have a direct link to manufacturing operations such as trade, business services and financial services also tend to contribute to higher growth in the above two states.

Appendix Table 1A presents the industry contribution to percentage change of Gross State Domestic Product (GSDP) under standard model assumptions. According to the table it can be observed that textiles, wearing apparel and trade contribute mostly to the higher growth in Tamil Nadu. Industries such as manufacturing nec, trade and business services mainly contributed to the growth in Karnataka while manufacturing industries such as food products nec and service industries such as trade had a higher contribution to growth in Kerala. Delhi shows the highest growth among all states due to the outcome of service industries such as financial services nec, trade, business services nec, transport nec, construction and electricity.

Furthermore, Gujarat and Maharashtra are benefited by the expansion of manufacturing industries such as manufacturing nec., textile, wearing apparel, chemical, rubber, plastic products, food products nec. and machinery and equipment in conjunction with services industries such as public administration, trade, transport nec., financial services nec. and business services nec.

Simulation results indicate that, in general, poor states benefited least by the trade liberalization in the short-run. Among the poor states, Bihar and Madhya Pradesh were affected most significantly. It is evident that agriculture related industries which were enjoying higher protection such as vegetable oils and fats, oil seeds, vegetables, fruit, and nuts played the most notable contribution in the negative growth in above states. Service industries such as trade, construction, and financial services nec. were also to detract from growth in these states.

Table 6 here

Under the monopolistic competitive model, the short-run impact of trade liberalization on economic growth at the state level seems better compared to that of the standard model (see Table 6 and Figure 2). However, Bihar portrays negative growth while Assam, Orissa and Uttar Pradesh experience marginal growth relative to other states. Appendix Table 2A presents industry contribution to percentage change in Gross State Domestic Product (GSDP) under monopolistic competitive model assumptions. According to Appendix Table 2A agricultural industries contribute positively to growth in the above states, while service industries detract from growth.

Tamil Nadu, Gujarat, Karnataka and Maharashtra demonstrate the highest regional growth compared to all the other states. It is evident that manufacturing industries and service industries contribute substantially to growth in the above states. As described previously, the manufacturing industries expand their production taking advantage of cheaper imported inputs as well as increasing returns to scale technology.

As depicted in Table 6, under the differential tariff cut scenario, percentage change in regional GDP under the standard and monopolistic competitive models show a very close pattern to that of the previous simulation. The few exceptions that are shown in the results are largely due to the differential tariff cuts implemented across industries.

Overall, our results suggest that in the short-run, trade liberalization has a beneficial impact on the rich and fast growing middle income states and a marginal or negative impact on the poorer states. For this reason it can be expected that in the short-run, trade liberalization would tend to widen the gap between the rich and the poor states in India. These results are consistent with previous investigations on India by Birthal, *et al.* (2011); Gaur (2010); and Barua and Chakraborty (2010). Furthermore, as highlighted by several researchers (see Daumal 2010; Rodriguez-Pose & Gill 2006; Barua and Chakraborty 2010) the changing trade composition has been one of the main contributing factors in aggravating regional disparities. Our model results further substantiate the above findings, particularly in the scenario that mimics the imperfect competition, where among the tradable industries; manufacturing industries have expanded well above the agricultural industries. This in turn has led to an increase in growth in regions where manufacturing industries are predominantly located. Further justification for this argument is demonstrated by the finding of Saikia (2011) who highlights the fact that since the reforms, less developed states have failed to catch up with more developed ones in terms of regional concentration of industries.

It is also evident that under monopolistic competitive market structure with increasing returns to scale technology in the manufacturing sector, the national economy and regional economies are stimulated significantly compared to the results of the standard model.

Figure 2 here

6. CONCLUDING REMARKS AND POLICY IMPLICATIONS

In this study we attempted to identify and quantify the regional impact of trade liberalization within a general equilibrium framework using a multiregional CGE model for India. Two tariff reform scenarios were simulated under perfect competition drawing on the constant returns to scale technology assumption and the monopolistic competitive market structure with increasing return to scale technology assumption.

Overall results imply that in the short-run, trade liberalization will have a positive impact on the rich and fast growing middle income states and a marginal or negative impact on the poor states. As such, trade liberalization is likely to widen the gap between the rich and the poor states in India in the short-run. Further, it is evident that under monopolistic competitive market structure with increasing returns to scale technology in the manufacturing sector, the national economy and the regional economies are stimulated significantly compared to the results of the standard model.

Based on the above general equilibrium analysis, it is evident that to create a more 'inclusive' growth, trade reforms should be complemented by other policy measures that promote regional equality. It is evident from industry results that manufacturing industries tend to expand relative to other tradeable industries as a result of tariff reforms. Similarly, based on the projections of gross state domestic product, it is evident that regions with a higher concentration of manufacturing industries show a significant growth over other states. This suggests that trade reforms should accompany a range of complimentary policies to promote the distribution of manufacturing industries among all states with a particular focus on those, lagging behind. Implementing policies such as providing tax concession to manufacturing

industries to locate their businesses in less developed states, promoting agro-based manufacturing industries within backward states which have a sizable agricultural sector, increasing government investments and lastly, promoting public-private participation in infrastructure development in less developed states in conjunction with other policy measures that encourage foreign direct investment, would help to expand and diversify the manufacturing base within India.

As agriculture is still the central sector in most of the backward states and forms the main livelihood of rural population in these regions, promoting export oriented agriculture and agro-based manufacturing industries, are important in terms of stimulating the regional economies as well as the distribution of income. Therefore, investing in agricultural infrastructure such as irrigation facilities, post-harvest storage and other technologies and marketing facilities is vital for reaping the full benefits of trade liberalization.

In addition, long terms policy measures such as increased spending on education in less developed states to increase the quality and quantity of human capital and implementing measures that increase productivity in less developed states, would help to reduce the gap between the rich and poor states. Furthermore, policies that would promote capital and labor mobility will also help to reduce regional inequality in India. Understanding the regional impact of trade reforms will also help in designing better targeted and robust poverty reduction programs within vulnerable states in India.

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Table 1: Cross-Country Tariff barriers

Countries	Years	Tariff rate, applied, simple mean (%)			Tariff rate, applied, weighted mean (%)		
		All products	Primary	Manufactured	All products	Primary	Manufactured
Argentina	1992	14.18	14.81	8.06	12.66	13.73	5.83
	2010	11.44	11.87	7.52	6.22	7.04	1.62
Bangladesh	1989	105.36	109.33	78.85	88.43	112.12	53.54
	2008	13.89	13.58	16.33	13	14.04	8.79
Brazil	1990	33.5	34.91	23.27	18.95	28.7	6.47
	2010	13.44	14.01	8.1	7.64	9.83	1.47
China	1992	39.71	40.75	34.67	32.17	36.41	13.96
	2010	8.02	7.97	8.29	4.29	6.04	1.82
India	1990	81.56	83	71.56	54	76.28	27.13
	2009	11.5	10.25	20.13	8.22	8.31	7.54
Indonesia	1990	16.83	16.88	16.48	13.32	15.82	5.26
	2010	4.79	5.03	3.21	2.49	2.93	1.57
Korea	1990	12.98	12.87	13.8	9.54	11.51	6.19
	2010	10.33	7.35	26.31	8.71	5.06	12.74
Malaysia	1988	14.07	14.67	10.28	9.38	10.91	4.62
	2009	6.75	6.07	10.14	3.95	3.66	5.04
Mexico	1991	14.29	14.45	12.98	11.91	13.03	8.25
	2010	7.82	7.51	10.65	6.07	4.66	11.54
Pakistan	1995	50.09	51.38	40.9	43.47	49.54	36.17
	2009	14.78	14.84	14.46	9.53	12.28	6.46
Thailand	1991	37.8	38.78	29.57	31.36	32.83	25.67
	2009	11.22	10.47	15.86	4.92	6.14	2.91

Source: Compiled from World Bank Indicators Online (2012).

Table 2: Average Import Duty Rates of Different Sectors in India (weighted averages)

Sectors/Commodities	1991-92	1996-97	2001-02	2006-07	2009-10
Agriculture	68.3	14.8	21.6	63.5	20.5
Mining	95.5	20.5	14.6	5.5	8.7
Consumer goods	114.1	36.1	45.1	29	12.5
Intermediate Goods	65.6	33.6	31	12.3	6.8
Capital Goods	94.8	28.5	23.1	8.4	5.6
All Commodities Average	**77.2**	**31.4**	**25.9**	**11**	**7**

Source: Planning Commission (2013).

Table 3: Infrastructure Index of States

States	Composite Infrastructure Index (Normalised) (2011)	Ranking of states in infrastructure index
Andhra Pradesh	0.876	3
Gujarat	0.696	7
Haryana	0.655	8
Karnataka	0.787	4
Kerala	0.741	6
Maharashtra	0.778	5
Punjab	0.92	2
Tamil Nadu	1	1
Assam	0.014	14
Bihar	0	15
Madhya Pradesh	0.223	12
Orissa	0.205	13
Rajasthan	0.632	9
Uttar Pradesh	0.426	10
West Bengal	0.415	11
Coefficient of Variation (%)	36.3	-

Table 4: Projections of percentage change in macro variables under 50% tariff cut scenario and the variable tariff cut scenario

Macro Variable	Projections under 50% tariff cut simulation		Projections under varible tariff cut simulation	
	S	**M**	**S**	**M**
Employment	1.73	4.56	0.57	3.94
Real Imports	7.36	8.35	5.13	6.67
Real Exports	12.67	19.03	7.85	15.18
Real Household Consumption	0.70	1.93	0.39	1.90
Real GDP	1.20	2.82	0.51	2.41
Consumer Price Index	-2.55	-1.17	-2.04	-0.91

% change from the basecase

S - Under Standard Assumptions

M - Under increasing returns to scale and monopolistic competitive model assumptions

Table 5: Projections of percentage change in industry variables under 50% tariff cut scenario

Industry	Projections under 50% tariff cut simulation			
	S		M	
	Industry output	Industry employment	Industry output	Industry employment
Paddy rice	0.40	1.07	0.98	2.65
Wheat	0.42	1.11	0.90	2.44
Cereal grains nec	0.40	1.07	0.76	2.06
Vegetables, fruit, nuts	-0.20	-0.52	0.30	0.79
Oil seeds	-0.55	-1.43	1.28	3.51
Sugar cane, sugar beet	-0.39	-1.00	0.75	2.02
Plant-based fibers	1.14	3.12	2.98	8.67
Crops nec	-0.08	-0.21	0.37	0.99
Cattle,sheep,goats,horses	0.10	0.25	0.84	2.26
Animal products nec	0.52	1.40	1.23	3.37
Raw milk	0.59	1.59	1.50	4.14
Wool, silk-worm cocoons	-0.21	-0.54	-0.23	-0.60
Forestry	0.40	0.87	0.89	1.97
Fishing	0.34	1.21	0.86	3.13
Coal	-0.81	-3.30	-0.72	-2.94
Oil	-0.14	-0.55	-0.23	-0.91
Gas	0.74	3.16	1.33	5.92
Minerals nec	0.32	0.98	0.25	0.76
Meat: cattle,sheep,goats,horse	2.07	5.34	1.08	2.76
Meat products nec	15.60	26.76	53.51	99.08
Vegetable oils and fats	-8.73	-21.64	4.95	13.38
Dairy products	0.57	1.23	2.58	5.64
Processed rice	0.60	0.78	1.60	2.07
Sugar	-2.17	-5.05	0.79	1.86
Food products nec	0.86	1.84	3.74	8.09
Beverages and tobacco products	-1.85	-4.75	1.52	3.97
Textiles	2.43	3.23	7.09	9.44
Wearing apparel	9.50	12.68	18.31	24.67

Table 6: Projections of percentage change in Gross State Domestic Product (GSDP) under 50% tariff cut scenario and the variable tariff cut scenario

Region	Projections under 50% tariff cut		Projections under varible tariff cut	
	S	M	S	M
Delhi	3.43	1.82	2.69	1.56
Punjab	0.68	2.08	0.30	1.90
Haryana	0.95	2.68	0.54	2.34
Rajasthan	0.15	1.69	-0.30	1.56
Uttar Pradesh	0.16	1.10	-0.12	1.06
Madhya Pradesh	-0.25	1.46	-0.54	1.57
Bihar	-0.19	-0.04	-0.32	0.03
West Bengal	0.57	1.42	0.09	1.24
Assam	0.20	0.59	-0.07	0.60
Orissa	0.48	1.08	0.02	0.99
Gujarat	1.03	3.19	0.13	2.62
Maharashtra	1.01	2.98	0.38	2.47
Andhra Pradesh	0.70	1.59	0.11	1.32
Karnataka	1.29	3.04	0.56	2.57
Kerala	1.11	1.75	0.61	1.71
Tamil Nadu	1.36	3.51	0.72	3.12
Rest of India	0.70	1.73	0.23	1.38

% change from the basecase

S - Under Standard Assumptions

M - Under increasing returns to scale and monopolistic competitive model assumptions
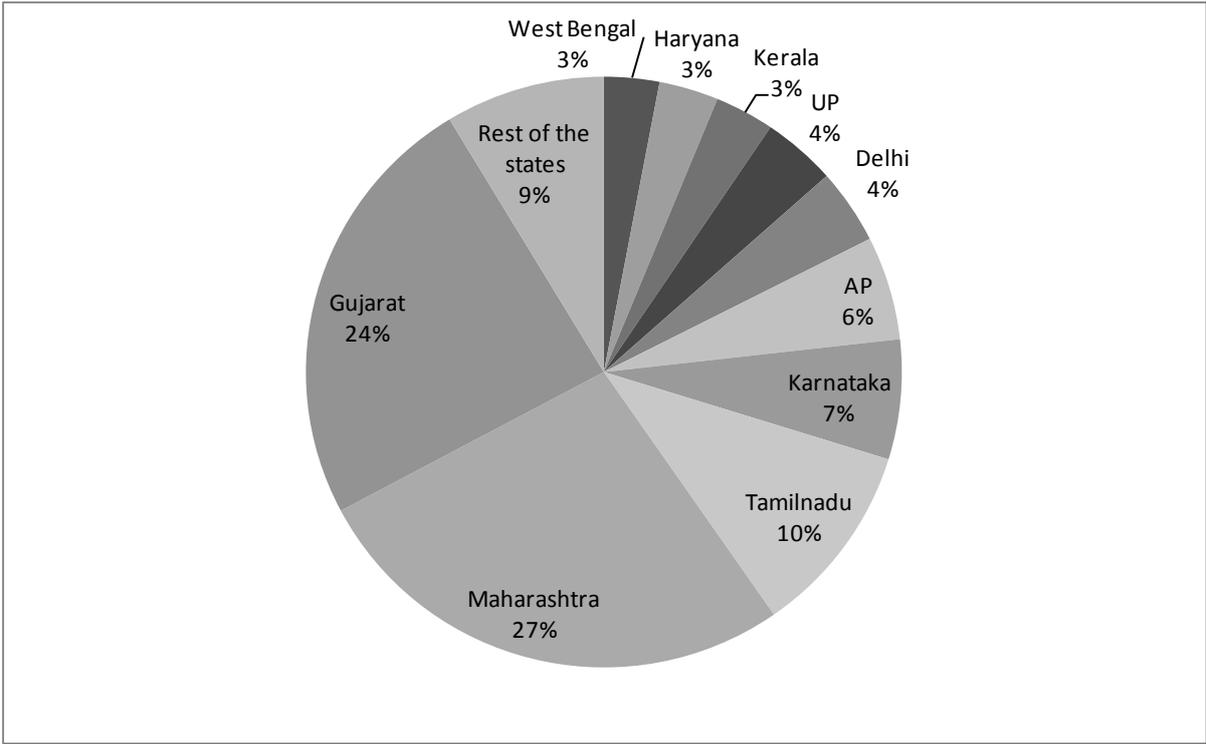
Source: Computed by the Authors based on data from Economic Survey, Government of India.

Figure 1: Percentage Contribution of States' to Total Exports (Average 2008-10)

Figure 2. Comparison of Gross State Domestic Product under the standard model and the monopolistic competitive model (50% tariff cut simulation)

Table A1: Industry contribution to percentage change of Gross State Domestic Product under standard model assumptions (50% tariff cut simulation)

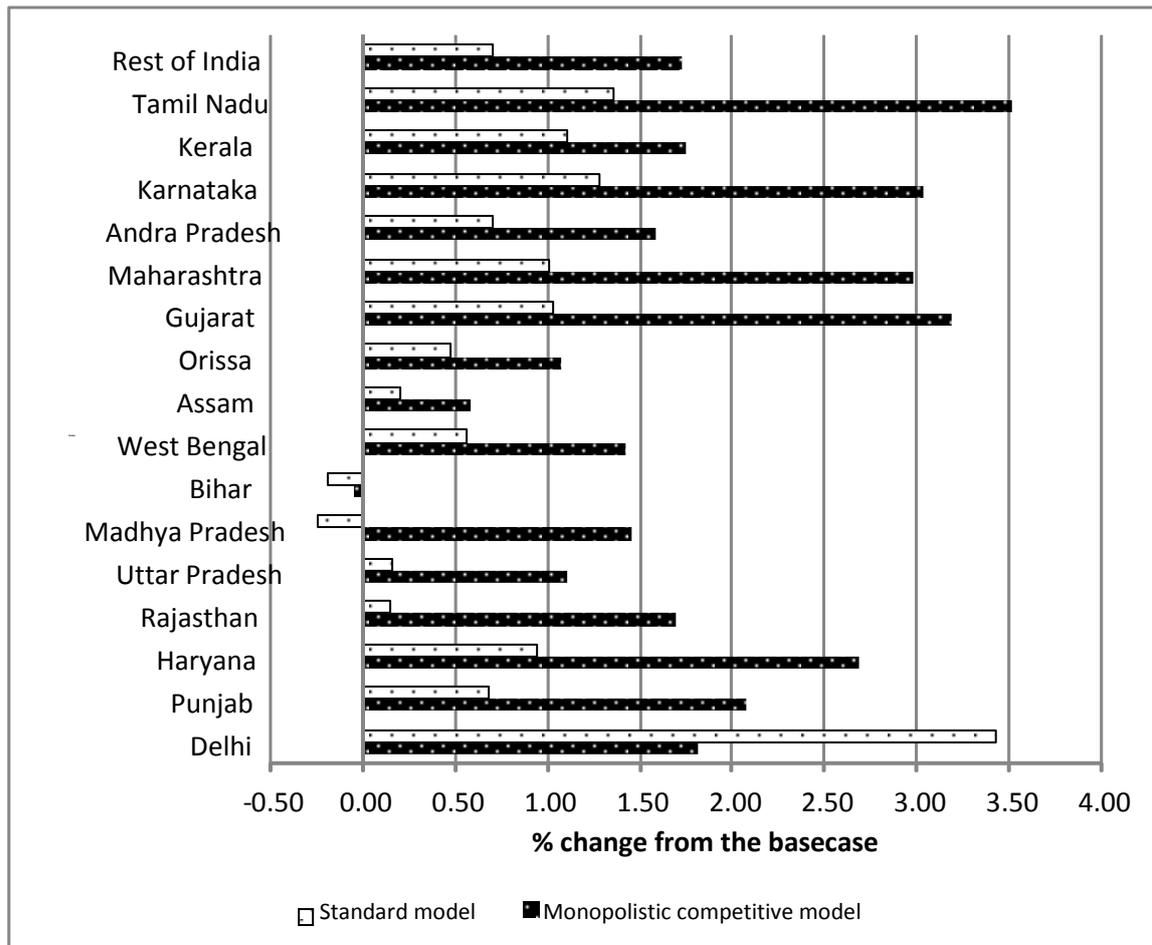| Industry	Delhi	Punjab	Haryana	Rajasthan	Uttarprades	Madhyaprades	Bihar	Westbengal	Assam	Orissa	Gujarat	Maharashtra	Andraprades	Karnataka	Kerala	Tamilnado	Rest of India
Paddy rice	0.00006	0.02401	0.00806	0.00051	0.01164	0.00303	0.01276	0.01988	0.02069	0.02006	0.00140	0.00221	0.01521	0.00593	0.00142	0.00634	0.00032
Wheat	0.00000	0.04110	0.02945	0.01801	0.03317	0.01646	0.01470	0.00114	0.00036	0.00003	0.00317	0.00159	0.00002	0.00047	0.00000	0.00000	0.00018
Cereal grains nec	0.00000	0.00115	0.00278	0.01391	0.00275	0.00417	0.00448	0.00042	0.00008	0.00050	0.00185	0.00481	0.00515	0.00920	0.00000	0.00187	0.00029
Vegetables, fruit, nuts	-0.00118	-0.00488	-0.00487	-0.00122	-0.01209	-0.00528	-0.02987	-0.01671	-0.01168	-0.01767	-0.00603	-0.00853	-0.00917	-0.00898	-0.00561	-0.00826	-0.00543
Oil seeds	0.00000	-0.00116	-0.01475	-0.07423	-0.00785	-0.10206	-0.00267	-0.00502	-0.00530	-0.00352	-0.02844	-0.02074	-0.01806	-0.01347	-0.00003	-0.00841	-0.00112
Sugar cane, sugar beet	0.00000	-0.00222	-0.00254	-0.00017	-0.02319	-0.00137	-0.00301	-0.00044	-0.00132	-0.00040	-0.00344	-0.01155	-0.00397	-0.00811	-0.00015	-0.00828	-0.00005
Plant-based fibers	0.00000	0.02069	0.01755	0.00622	0.00000	0.00750	0.01410	0.04105	0.01549	0.00305	0.02968	0.01737	0.01905	0.00576	0.00002	0.00091	0.00001
Crops nec	0.00000	-0.00638	-0.00384	-0.00409	-0.00506	-0.00398	-0.00378	-0.00218	-0.00249	-0.00234	-0.00077	-0.00123	-0.00278	-0.00209	-0.00016	-0.00090	-0.00066
Cattle,sheep,goats,horses	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Animal products nec	0.00001	0.00370	0.01041	0.00187	0.00157	0.00253	0.00531	0.01705	0.02713	0.00941	0.00217	0.00901	0.02335	0.01070	0.00603	0.02355	0.00545
Raw milk	0.00019	0.00482	0.00308	0.00461	0.00446	0.00340	0.00388	0.00122	0.00098	0.00110	0.00201	0.00154	0.00267	0.00171	0.00139	0.00155	0.00094
Wool, silk-worm cocoons	0.00000	-0.00012	-0.00033	-0.00320	-0.00018	-0.00010	-0.00009	-0.00010	0.00000	0.00000	-0.00036	-0.00018	-0.00065	-0.00140	0.00000	0.00000	-0.00069
Forestry	0.00017	0.00251	0.00144	0.00873	0.00560	0.00747	0.00571	0.00279	0.00753	0.00650	0.00395	0.00822	0.00414	0.00668	0.00492	0.00179	0.00566
Fishing	0.00001	0.00073	0.00057	0.00030	0.00142	0.00066	0.00368	0.01235	0.00530	0.00376	0.00202	0.00135	0.01035	0.00150	0.00459	0.00287	0.00205
Coal	0.00000	0.00000	0.00000	0.00000	-0.00018	-0.00770	-0.00008	-0.00612	0.00000	-0.03189	0.00000	-0.00155	-0.00392	0.00000	0.00000	0.00000	-0.01276
Oil	0.00000	0.00000	0.00000	0.00000	-0.00007	-0.00290	-0.00003	-0.00231	0.00000	-0.01203	0.00000	-0.00058	-0.00148	0.00000	0.00000	0.00000	-0.00481
Gas	0.00000	0.00000	0.00000	0.00000	0.00021	0.00884	0.00009	0.00704	0.00000	0.03666	0.00000	0.00178	0.00450	0.00000	0.00000	0.00000	0.01466
Minerals nec	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.02544	0.00141	0.00119	0.00000	0.00000	0.00000	0.00103
Meat: cattle,sheep,goats,horse	0.00140	0.00016	0.00265	0.00002	0.00306	0.00065	0.00778	0.00959	0.00234	0.00232	0.00030	0.00329	0.00862	0.00253	0.00215	0.00219	0.00245
Meat products nec	0.00002	0.00000	0.00003	0.00000	0.00004	0.00001	0.00009	0.00011	0.00003	0.00003	0.00000	0.00004	0.00010	0.00003	0.00003	0.00003	0.00003
Vegetable oils and fats	0.00000	-0.00140	-0.01787	-0.08995	-0.00951	-0.12365	-0.00323	-0.00609	-0.00642	-0.00426	-0.03447	-0.02514	-0.02189	-0.01632	-0.00003	-0.01020	-0.00136
Dairy products	0.00060	0.01536	0.00981	0.01469	0.01421	0.01083	0.01239	0.00389	0.00312	0.00352	0.00641	0.00490	0.00853	0.00544	0.00444	0.00494	0.00301
Processed rice	0.00009	0.03756	0.01261	0.00079	0.01820	0.00475	0.01996	0.03109	0.03237	0.03138	0.00218	0.00345	0.02379	0.00928	0.00222	0.00992	0.00050
Sugar	0.00000	-0.00208	-0.00238	-0.00016	-0.02175	-0.00128	-0.00282	-0.00042	-0.00124	-0.00037	-0.00323	-0.01084	-0.00373	-0.00761	-0.00014	-0.00777	-0.00005
Food products nec	0.01526	0.03320	0.02484	0.01622	0.02658	0.04847	0.00281	0.01373	0.02911	0.00776	0.04538	0.03645	0.03711	0.02760	0.13339	0.02547	-0.01969
Beverages and tobacco products	-0.00170	-0.01565	-0.00567	-0.00520	-0.01326	-0.00401	-0.00924	-0.00512	-0.00994	-0.00262	-0.00308	-0.00883	-0.01890	-0.02118	-0.00298	-0.00632	-0.00317
Textiles	0.00515	0.11532	0.03750	0.07801	0.01859	0.04285	0.00048	0.02602	0.00203	0.00128	0.09908	0.06908	0.02409	0.01209	0.01055	0.13662	0.04602
Wearing apparel	0.10322	0.06955	0.14669	0.01210	0.02623	0.00506	0.00000	0.00910	0.00017	0.00000	0.00963	0.03405	0.00514	0.10886	0.00529	0.14646	0.00496

Continued

Industry	Delhi	Punjab	Haryana	Rajasthan	Uttarprades	Madhyaprades	Bihar	Westbengal	Assam	Orissa	Gujarat	Maharashtra	Andraprades	Karnataka	Kerala	Tamilnado	Rest of India
Leather products	0.01336	0.00638	0.02065	0.00371	0.02523	0.00573	0.00080	0.02072	0.00000	0.00000	0.00033	0.00365	0.00139	0.00271	0.00462	0.04021	0.00432
Wood products	0.00004	0.00214	0.01446	0.00857	0.00220	0.00094	0.00093	0.01304	0.00515	0.00181	0.00886	0.00335	0.00281	0.00404	0.01503	0.00533	0.00407
Paper products, publishing	-0.00035	-0.00211	-0.00098	-0.00075	-0.00125	-0.00062	-0.00008	-0.00031	-0.00159	-0.00151	-0.00245	-0.00143	-0.00156	-0.00159	-0.00076	-0.00189	-0.00124
Petroleum, coal products	0.00001	0.00000	0.00003	0.00023	0.00486	0.00023	0.01008	0.00460	0.01989	0.00078	0.02119	0.01406	0.00044	0.00998	0.01062	0.00666	0.00376
Chemical,rubber,plastic prods	0.00486	0.01519	0.01676	0.02648	0.01906	0.01158	0.00018	0.02953	0.01042	0.03959	0.12145	0.06540	0.02914	0.01826	0.01529	0.01719	0.02661
Mineral products nec	0.00010	0.00443	0.00347	0.02892	0.00352	0.01626	0.00136	0.00399	0.00333	0.00934	0.01375	0.00774	0.01708	0.00895	0.00241	0.01067	0.00671
Ferrous metals	0.00112	0.01178	0.00851	0.00675	0.00550	0.00493	0.00111	0.01627	0.00177	0.03507	0.01459	0.01856	0.00877	0.01242	0.00486	0.00572	0.02436
Metals nec	0.00040	0.00422	0.00305	0.00242	0.00197	0.00177	0.00040	0.00584	0.00063	0.01258	0.00523	0.00666	0.00315	0.00445	0.00174	0.00205	0.00874
Metal products	0.00509	0.01727	0.01620	0.00977	0.00977	0.00470	0.00036	0.00640	0.00047	0.00309	0.03176	0.03909	0.01255	0.00932	0.00074	0.03056	0.00876
Motor vehicles and parts	0.00019	0.00106	0.01534	0.00069	0.00172	0.00105	0.00000	0.00005	0.00001	0.00000	0.00052	0.00559	0.00023	0.00264	0.00001	0.00858	0.00102
Transport equipment nec	0.00056	0.01576	0.04995	0.00083	0.00147	0.00065	0.00005	0.00424	0.00000	0.00000	0.00512	0.01518	0.00202	0.00594	0.00390	0.00593	0.00274
Electronic equipment	0.00502	0.00213	0.00302	0.02067	0.02691	0.00164	0.00000	0.00312	0.00003	0.00000	0.00565	0.02162	0.00837	0.01453	0.00494	0.01682	0.02322
Machinery and equipment nec	0.00182	0.00977	0.02257	0.00288	0.00803	0.00575	0.00031	0.00308	0.00016	0.00039	0.01765	0.04322	0.00461	0.02601	0.00146	0.02170	0.01927
Manufactures nec	0.01223	0.01420	0.02450	0.03430	0.03094	0.00094	0.00034	0.00469	0.00000	0.00000	0.17486	0.31916	0.01747	0.27137	0.00431	0.09013	0.02227
Electricity	0.15283	0.01644	0.02394	0.00974	0.00669	-0.00934	-0.00642	0.02551	0.00780	0.02546	0.03455	0.01113	0.02878	0.05613	0.05334	0.05084	0.06341
Gas manufacture, distribution	0.00060	0.00004	0.00010	-0.00003	-0.00004	-0.00010	-0.00007	0.00004	0.00000	0.00003	0.00014	0.00003	0.00003	0.00019	0.00016	0.00020	0.00016
Water	0.00585	0.00076	0.00094	0.00011	-0.00004	-0.00041	-0.00031	0.00099	0.00008	0.00106	0.00178	0.00030	0.00278	0.00182	0.00203	0.00202	0.00175
Construction	0.17549	0.00098	0.01331	-0.02995	-0.02014	-0.03485	-0.04538	-0.00193	-0.01608	-0.00129	0.01379	0.00934	0.00637	0.03106	0.03279	0.03026	0.00514
Trade	0.65671	0.05461	0.15233	-0.01002	-0.00892	-0.07389	-0.10263	0.06377	0.00730	0.04338	0.15321	0.03363	0.05841	0.16713	0.19555	0.22725	0.19930
Transport nec	0.20384	0.03668	0.04945	0.01259	0.00822	-0.01392	-0.01020	0.03507	0.01452	0.02851	0.05427	0.01344	0.04171	0.07739	0.06657	0.08477	0.09108
Sea transport	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.07179	0.00000	0.10962	0.04601	0.01750	0.07650	0.04852	0.08558	0.06417	0.00000
Air transport	0.07270	-0.00003	0.00000	-0.00074	-0.00040	-0.00156	-0.00054	0.00028	-0.00126	-0.00029	0.00028	0.00621	0.00078	0.00533	0.00055	0.00370	-0.00004
Communication	0.04109	0.00493	0.00499	0.00241	0.00215	-0.00222	-0.00224	0.00812	0.00142	0.00356	0.01347	0.00032	0.01097	0.01282	0.02740	0.01858	0.03590
Financial services nec	0.81871	0.03811	0.03079	-0.00029	-0.00574	-0.02912	-0.03421	0.02328	-0.00237	0.02769	0.02948	0.04492	0.02161	0.07005	0.07886	0.05389	0.00993
Insurance	0.10418	0.00869	0.00548	0.00262	0.00104	-0.00147	-0.00238	0.00648	0.00820	0.00811	0.00524	0.00787	0.00465	0.01176	0.01327	0.00951	0.00258
Business services nec	0.50027	0.05183	0.15937	0.07271	0.01897	0.05643	0.03031	0.04354	0.06164	0.07478	0.02324	0.04368	0.09808	0.14969	0.19886	0.09433	0.01689
Recreation and other services	0.07564	0.01002	0.00654	0.00199	-0.00061	-0.00764	-0.00616	0.01278	0.00546	0.00649	0.01104	0.07387	0.00937	0.01785	0.02135	0.01890	0.02221
PubAdmin/Defence/Health/Educat	0.14976	0.01769	0.01487	-0.00561	-0.01109	-0.02302	-0.01793	0.01677	0.00126	0.00764	0.02316	0.05998	0.11989	0.04675	0.04288	0.04531	0.03218
Dwellings	0.25788	0.00110	0.02944	-0.04458	-0.04664	-0.07642	-0.05906	-0.00660	-0.03386	-0.01102	0.04649	0.00778	0.00719	0.06629	0.04505	0.07053	0.02484

Table A2: Industry contribution to percentage change of Gross State Domestic Product under increasing returns to scale and monopolistic competitive model assumptions (50% tariff cut simulation)

Industry	Delhi	Punjab	Haryana	Rajasthan	Uttarprades	Madhyaprades	Bihar	Westbengal	Assam	Orissa	Gujarat	Maharashtra	Andraprades	Karnataka	Kerala	Tamilnado	Rest of India
Paddy rice	0.00015	0.05860	0.01963	0.00123	0.02844	0.00734	0.03133	0.04853	0.05075	0.04906	0.00338	0.00536	0.03713	0.01445	0.00349	0.01544	0.00078
Wheat	0.00000	0.08841	0.06321	0.03855	0.07145	0.03506	0.03181	0.00244	0.00078	0.00005	0.00676	0.00340	0.00005	0.00102	0.00000	0.00000	0.00039
Cereal grains nec	0.00000	0.00217	0.00523	0.02608	0.00519	0.00778	0.00850	0.00079	0.00015	0.00093	0.00347	0.00902	0.00971	0.01730	0.00001	0.00352	0.00054
Vegetables, fruit, nuts	0.00179	0.00729	0.00726	0.00182	0.01808	0.00782	0.04491	0.02499	0.01754	0.02645	0.00896	0.01270	0.01371	0.01340	0.00843	0.01232	0.00814
Oil seeds	0.00000	0.00278	0.03545	0.17818	0.01895	0.24405	0.00648	0.01211	0.01284	0.00849	0.06804	0.04973	0.04354	0.03238	0.00007	0.02021	0.00271
Sugar cane, sugar beet	0.00000	0.00438	0.00501	0.00034	0.04589	0.00267	0.00597	0.00087	0.00263	0.00078	0.00676	0.02274	0.00786	0.01602	0.00029	0.01634	0.00010
Plant-based fibers	0.00000	0.05652	0.04784	0.01690	0.00001	0.02029	0.03873	0.11221	0.04253	0.00833	0.08058	0.04723	0.05204	0.01569	0.00004	0.00246	0.00002
Crops nec	0.00000	0.03024	0.01818	0.01927	0.02398	0.01862	0.01799	0.01033	0.01184	0.01109	0.00364	0.00578	0.01316	0.00991	0.00075	0.00427	0.00311
Cattle,sheep,goats,horses	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000	0.00000	0.00000	0.00000
Animal products nec	0.00002	0.00876	0.02463	0.00440	0.00372	0.00594	0.01266	0.04044	0.06465	0.02234	0.00511	0.02125	0.05536	0.02533	0.01438	0.05567	0.01295
Raw milk	0.00049	0.01228	0.00782	0.01169	0.01139	0.00858	0.00997	0.00311	0.00251	0.00282	0.00510	0.00390	0.00682	0.00435	0.00357	0.00394	0.00241
Wool, silk-worm cocoons	0.00000	-0.00013	-0.00036	-0.00344	-0.00019	-0.00011	-0.00009	-0.00011	0.00000	0.00000	-0.00038	-0.00020	-0.00071	-0.00150	0.00000	0.00000	-0.00075
Forestry	0.00039	0.00561	0.00320	0.01941	0.01253	0.01655	0.01285	0.00624	0.01691	0.01455	0.00878	0.01829	0.00927	0.01491	0.01108	0.00399	0.01270
Fishing	0.00003	0.00185	0.00144	0.00075	0.00361	0.00165	0.00942	0.03142	0.01355	0.00958	0.00510	0.00340	0.02633	0.00381	0.01175	0.00727	0.00522
Coal	0.00000	0.00000	0.00000	0.00000	-0.00016	-0.00668	-0.00007	-0.00536	0.00000	-0.02796	0.00000	-0.00135	-0.00343	0.00000	0.00000	0.00000	-0.01120
Oil	0.00000	0.00000	0.00000	0.00000	-0.00011	-0.00465	-0.00005	-0.00373	0.00000	-0.01948	0.00000	-0.00094	-0.00239	0.00000	0.00000	0.00000	-0.00780
Gas	0.00000	0.00000	0.00000	0.00000	0.00038	0.01626	0.00017	0.01305	0.00001	0.06803	0.00000	0.00329	0.00834	0.00000	0.00000	0.00000	0.02725
Minerals nec	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.01922	0.00107	0.00090	0.00000	0.00000	0.00000	0.00079
Meat: cattle,sheep,goats,horse	0.00072	0.00008	0.00135	0.00001	0.00156	0.00033	0.00398	0.00489	0.00120	0.00118	0.00015	0.00167	0.00439	0.00129	0.00110	0.00111	0.00125
Meat products nec	0.00006	0.00001	0.00011	0.00000	0.00013	0.00003	0.00033	0.00040	0.00010	0.00010	0.00001	0.00014	0.00036	0.00011	0.00009	0.00009	0.00010
Vegetable oils and fats	0.00000	0.00084	0.01075	0.05405	0.00576	0.07401	0.00197	0.00367	0.00390	0.00258	0.02061	0.01508	0.01321	0.00982	0.00002	0.00613	0.00082
Dairy products	0.00277	0.06941	0.04421	0.06608	0.06433	0.04850	0.05632	0.01756	0.01418	0.01594	0.02879	0.02202	0.03853	0.02455	0.02018	0.02226	0.01362
Processed rice	0.00025	0.09803	0.03284	0.00206	0.04757	0.01227	0.05239	0.08118	0.08488	0.08206	0.00566	0.00897	0.06210	0.02417	0.00584	0.02583	0.00131
Sugar	0.00000	0.00075	0.00086	0.00006	0.00788	0.00046	0.00103	0.00015	0.00045	0.00013	0.00116	0.00391	0.00135	0.00275	0.00005	0.00281	0.00002
Food products nec	0.06723	0.14370	0.10726	0.06983	0.11522	0.20791	0.01224	0.05944	0.12666	0.03364	0.19519	0.15704	0.16070	0.11924	0.58226	0.10993	-0.08544
Beverages and tobacco products	0.00143	0.01288	0.00466	0.00426	0.01093	0.00327	0.00765	0.00421	0.00822	0.00216	0.00252	0.00724	0.01556	0.01740	0.00247	0.00519	0.00261
Textiles	0.01505	0.33189	0.10763	0.22332	0.05353	0.12211	0.00137	0.07486	0.00587	0.00370	0.28329	0.19783	0.06928	0.03471	0.03055	0.39224	0.13278
Wearing apparel	0.20080	0.13291	0.27976	0.02300	0.05018	0.00957	0.00000	0.01738	0.00033	0.00000	0.01827	0.06475	0.00982	0.20764	0.01017	0.27920	0.00951

Industry	Delhi	Punjab	Haryana	Rajasthan	Uttarprades	Madhyaprades	Bihar	Westbengal	Assam	Orissa	Gujarat	Maharashtra	Andraprades	Karnataka	Kerala	Tamilnado	Rest of India
Leather products	0.03268	0.01532	0.04950	0.00886	0.06072	0.01364	0.00193	0.04982	0.00000	0.00000	0.00080	0.00872	0.00333	0.00651	0.01117	0.09638	0.01041
Wood products	0.00010	0.00493	0.03314	0.01959	0.00507	0.00215	0.00216	0.02997	0.01189	0.00416	0.02021	0.00767	0.00645	0.00927	0.03475	0.01220	0.00938
Paper products, publishing	0.00159	0.00941	0.00437	0.00335	0.00560	0.00276	0.00038	0.00137	0.00713	0.00676	0.01089	0.00634	0.00697	0.00708	0.00342	0.00841	0.00555
Petroleum, coal products	0.00002	0.00001	0.00006	0.00038	0.00832	0.00038	0.01736	0.00788	0.03422	0.00134	0.03602	0.02395	0.00075	0.01705	0.01830	0.01137	0.00645
Chemical,rubber,plastic prods	0.01382	0.04244	0.04671	0.07360	0.05333	0.03204	0.00051	0.08255	0.02927	0.11083	0.33731	0.18189	0.08142	0.05092	0.04301	0.04788	0.07457
Mineral products nec	0.00016	0.00724	0.00565	0.04700	0.00575	0.02631	0.00224	0.00652	0.00546	0.01530	0.02232	0.01258	0.02791	0.01459	0.00396	0.01738	0.01100
Ferrous metals	0.00465	0.04815	0.03471	0.02745	0.02253	0.01998	0.00457	0.06656	0.00727	0.14377	0.05929	0.07552	0.03587	0.05069	0.02001	0.02331	0.09996
Metals nec	0.00147	0.01519	0.01095	0.00866	0.00711	0.00630	0.00144	0.02099	0.00229	0.04533	0.01869	0.02381	0.01131	0.01598	0.00631	0.00735	0.03152
Metal products	0.01168	0.03891	0.03641	0.02190	0.02205	0.01049	0.00082	0.01443	0.00107	0.00698	0.07110	0.08766	0.02828	0.02095	0.00167	0.06868	0.01980
Motor vehicles and parts	0.00275	0.01473	0.21286	0.00955	0.02397	0.01440	0.00000	0.00075	0.00009	0.00003	0.00714	0.07730	0.00314	0.03662	0.00007	0.11901	0.01417
Transport equipment nec	0.00147	0.04047	0.12806	0.00211	0.00377	0.00165	0.00013	0.01088	0.00000	0.00000	0.01308	0.03882	0.00520	0.01522	0.01008	0.01519	0.00707
Electronic equipment	0.00318	0.00133	0.00188	0.01282	0.01679	0.00101	0.00000	0.00194	0.00002	0.00000	0.00350	0.01341	0.00522	0.00904	0.00310	0.01045	0.01451
Machinery and equipment nec	0.00566	0.02986	0.06882	0.00876	0.02456	0.01739	0.00095	0.00941	0.00050	0.00120	0.05357	0.13146	0.01409	0.07933	0.00450	0.06613	0.05906
Manufactures nec	0.02646	0.03017	0.05193	0.07251	0.06584	0.00198	0.00072	0.00996	0.00000	0.00000	0.36935	0.67587	0.03713	0.57615	0.00923	0.19104	0.04745
Electricity	0.08918	0.05365	0.07431	0.06732	0.03685	0.04893	-0.00694	0.07317	0.02118	0.07669	0.10662	0.03249	0.08786	0.13908	0.08117	0.13747	0.18170
Gas manufacture, distribution	0.00029	0.00015	0.00030	0.00015	0.00002	0.00011	-0.00011	0.00010	-0.00001	0.00004	0.00043	0.00009	0.00013	0.00042	0.00022	0.00050	0.00037
Water	0.00311	0.00266	0.00441	0.00177	0.00081	0.00117	-0.00035	0.00186	0.00037	0.00168	0.00479	0.00100	0.00441	0.00423	0.00246	0.00556	0.00488
Construction	-0.00593	0.01479	0.04234	0.00030	-0.02457	-0.00762	-0.09293	-0.00804	-0.03831	-0.01112	0.04939	0.03520	-0.00150	0.06266	-0.01304	0.07624	0.00748
Trade	0.38105	0.18013	0.45525	0.19400	0.07562	0.14222	-0.14848	0.16356	0.02780	0.09923	0.50361	0.10830	0.19764	0.40360	0.29219	0.59671	0.51266
Transport nec	0.11751	0.10442	0.13048	0.09242	0.04927	0.07073	-0.01275	0.07892	0.02684	0.06300	0.15508	0.03955	0.09266	0.16976	0.09273	0.20621	0.20095
Sea transport	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.05889	0.00000	0.07865	0.06052	0.03318	0.05801	0.05619	0.06417	0.07789	0.00000
Air transport	0.04311	0.00026	0.00000	0.00129	0.00020	0.00131	-0.00035	0.00383	0.00063	0.00045	0.00350	0.01981	0.00379	0.01432	0.00216	0.01318	0.00027
Communication	0.01879	0.01362	0.01393	0.01324	0.00825	0.00722	-0.00133	0.01267	0.00126	0.00714	0.03337	0.00090	0.01377	0.02769	0.01122	0.03917	0.02157
Financial services nec	0.36899	0.14909	0.12587	0.08265	0.02148	0.06327	-0.03436	0.06802	0.01609	0.06616	0.10154	0.16110	0.05661	0.18174	0.10338	0.16696	0.03872
Insurance	-0.01105	0.01753	0.01815	0.01078	0.00486	0.00778	-0.00768	0.00866	-0.01347	0.00667	0.01480	0.02256	0.00700	0.02311	0.00743	0.02318	0.00668
Business services nec	0.23010	0.04517	0.11466	0.06290	0.02041	0.05456	0.01067	0.03365	0.03399	0.04527	0.03342	0.05340	0.05314	0.11414	0.10803	0.09121	0.02118
Recreation and other services	0.03835	0.02986	0.02027	0.02740	0.01229	0.02024	-0.01115	0.02417	0.00457	0.00982	0.03043	0.19299	0.02036	0.03988	0.02547	0.04812	0.04700
PubAdmin/Defence/Health/Educat	0.07866	0.05086	0.04337	0.04425	0.02334	0.03514	-0.01935	0.03904	0.00764	0.01736	0.07295	0.16371	0.06143	0.10493	0.05844	0.11208	0.07447
Dwellings	0.05775	0.02833	0.09860	0.00875	-0.05459	-0.00598	-0.11856	-0.01914	-0.08244	-0.04002	0.17136	0.02984	0.00149	0.14411	0.02296	0.18235	0.05783

[1] We have reviewed some of the recent studies on the subject.

[2] Special category states are referred to as such because they are small in terms of population and are ethnically, culturally, socially and economically different to the rest of the country. These are 11 in number and are Arunachal Pradesh, Assam, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, and Uttarakhand. The typical features of a special category state, i.e., hilly terrain, sparsely populated habitation and high transport costs, lead to increased costs for delivering public services. With the relatively lower level of economic activity in most special category states, their tax base is limited vis-à-vis non-special category states. These states, to a large extent, depend on transfers from the center (comprising grants and tax devolutions) for their resource needs.

[3] Delhi, Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Assam, Orissa, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Rest of India.

[4] See Hertel (1997) for details of the GTAP model and the database.

[5] In the short run, all sectoral capital is exogenised and as we assume slack labor market, the total employment is endogenised. In contrast, in the long run, we assume full employment, thus the aggregate employment is exogenised and allows real wages to be determined within the model. Similarly, we allow sectoral capital to be mobile thus allowing sectoral rate of return to be exogenised. However, in this simulation we focus only the short run impacts of the policy reforms.

[6] The following variables are assumed to be exogenous: agricultural land, all technological change, real wages, real investment, real government demand, demand for inventories by commodity, all sales tax rates and commodity specific shifters, foreign prices of imports and exports, number of households and their consumption preferences and real unit cost of 'other cost tickets'(Production subsidies etc.)