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Does Openness Affect Regional Inequality? A Case Study for India

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Abstract

This paper examines the impact of economic liberalization on interregional inequality in India. It has been observed in many studies that interregional inequality in India has been steadily increasing over time. This paper is a further confirmation of this result. We have tried to locate the cause of rising interregional inequality within the production structure of the economy and observed that it is positively and systematically related to the cross-regional inequalities in agriculture and manufacturing. This systematic relationship has further been examined from a structuralist viewpoint to unravel the factors determining manufacturing production across regions where we have found that trade openness is the key factor determining the manufacturing share in income across the regions. Our further enquiry into manufacturing and trade patterns has shown that the Herfindahl index of concentration has been increasing over time on both counts. This result, along with the findings of the structuralist model about disproportionate growth of manufacturing across regions, provides an explanation of the cause of rising interregional inequality in India.

1. Introduction

Lobbying groups in both developed as well as developing countries often raise dissenting but at times even impassionate voices over adverse implications of the WTO-induced reforms and trade liberalization on income distribution within an economy. Both theoretical as well as empirical literature on the subject is dense and ever growing. The present paper makes an attempt to examine the effects of globalization on income distribution in India where the focus of attention being given on interregional, rather than interpersonal income distribution.[1]

Interregional distribution of the standard of living is extremely important for any federal economy since rising interregional disparities affect political stability, particularly in democracies like India. It has been observed in India that the forces of regionalism often seem to originate in actual or perceived inequalities in the regional income, which may at times even take very ugly forms affecting law and order and thereby the smooth functioning of government. So, in view of such negative influences of regional imbalances on an economy, it appears worthwhile to examine if trade liberalization has accentuated regional disparities in India or not, given the widely held view that India's policy of economic liberalization has aggravated regional inequalities in India.

We organize the paper as follows. In section 2 we have made an attempt to provide some theoretical conjectures about how openness may affect regional inequality. Section 3 gives the linear and nonlinear trends in regional inequality and an analysis of the causality of inequalities. In section 4, we examine how inequalities are evolved in

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the process of growth by using the Chenery and Syrquin (1977) model of structural transformation. In section 5 we try to show that while international trade significantly determines interregional growth in manufacturing, it is also a cause of disproportionate growth in manufactures across regions in a labor-abundant country. In section 6 we draw the broad conclusions of the paper.

2. Trade and Regional Inequality: Some Theoretical Conjectures

Interregional income inequality seems to have increased much faster in many countries with the opening-up of these economies to freer international trade (Zhang and Fan, 2002; Gajwani et al., 2007; Marjit et al., 2007). What makes this issue interesting is the fact that we find precious little literature in the standard trade theory about the effects of trade on interregional income inequality. In what follows, we shall try to provide a simplified model by assuming that there are two regions in a country.

Suppose the country which in our case being India is assumed to have two regions, viz. the periphery, which is relatively unskilled labor and land abundant, and the metropolis, which is relatively skilled labor and capital abundant. Labor, both skilled and unskilled, is immobile between the regions but capital is perfectly mobile within the country. The periphery produces agriculture which is relatively land intensive and also produces one type of manufactured goods, which may be called consumer goods, the production of which involves unskilled labor intensively. In contrast, the metropolis produces machinery which is capital intensive, and the service good which is relatively skilled labor intensive. The machinery produced in the metropolis is used as an intermediate good in the production of consumer goods in the periphery. The trade between the metropolis and the periphery will be determined by relative production advantage.

Suppose that the country is now exposed to trade with the rest of the world. Assume that both agriculture and services are internationally nontraded goods for this country. Thus, India being a small country takes the world price as given. In the given situation, if the world relative price of machinery is cheaper than the consumer goods prices, our country specializes in the consumer goods which it will export to the world and import machinery from the rest of the world. Since the periphery has abundant cheap unskilled labor, capital therefore will move from the metropolis to the periphery, and as a consequence the machinery sector will decline in the metropolis. On the other hand, the consumer goods sector in the periphery will expand without having much impact on agriculture. The reason for this is that land is used exclusively in the agricultural sector. However, as the unskilled labor is drawn from agriculture to the consumer goods sector, agriculture becomes more mechanized as its capital intensity will rise. In the metropolis, as the machinery sector declines, it will release both capital and skilled labor but since skilled labor is assumed to be immobile, it will be absorbed in the service sector. The metropolis may experience an increase in the service sector since the expansion of the periphery may create more demand for the services. We therefore expect that the periphery will experience a relatively higher increase in the share of manufacturing in their GDP than the metropolis. A rise in the share of manufacturing tends to increase the per capita income following the Chenery et al. (1988) hypothesis, and a disproportionate increase in the share of manufactures between the periphery and the metropolis may eventually lead to a higher percentage increase in per capita income in the periphery compared to the metropolis. Under such a scenario, we expect that interregional inequality in income may decline with the opening-up of the economy to world trade. This process of economic transformation being unfolded by

trade liberalization is expected to reduce both interregional income disparities and skilled–unskilled wage disparities.

Of course, there is an alternative plausible situation where unskilled labor is more mobile than the capital because the periphery may lack the basic infrastructure for the expansion of manufactures such as roads and bridges, electricity, water supply, port facilities, financial intermediaries and banking, and over and above an efficient administrative and delivery system. As a consequence, the metropolis shall witness increased concentration in manufactures instead of the dispersal of manufacturing to the periphery and this process will result in increased interregional inequality. Thus, our neoclassical variant of the trade theory provides the possibility of either an increase or decrease in interregional income inequality.

In contrast to the above variant of the neoclassical trade model, in an interesting study Elizondo and Krugman (1992) have tried to relate regional disparities in a federal economy with the trade policy regime of the country. What follows from their analysis is that in an open economy there may not be any conflict between economic growth and regional distribution of income and, in fact, the openness of an economy is the instrument to achieve both economic growth and a geographical dispersion of economic activities.

The issue that concerns us here is whether the above conjectures about trade and regional inequality are in conformity with the actual developments that India had witnessed ever since India had liberalized its economy due to the WTO-induced reforms. We thus put forward the following testable hypothesis based on the above conjectures that interregional inequalities, given the degree of federal intervention, tend to increase as an economy moves from a liberalized trade regime to a restrictive trade regime, and vice versa. Thus, regional inequality may decline as a result of trade liberalization. In what follows, we attempt to test this hypothesis in the context of the Indian economy.

3. Trends in Regional Inequality in India

There has been a proliferation of studies showing rising rather unabatedly interregional inequality in India.[2] Of late, economists try to claim that the WTO-led trade liberalization policies undertaken in India since the mid-1990s are chiefly responsible for a sharp increase in interregional inequality in income (Zhang and Fan, 2002; Gajwani et al., 2007; Marjit et al., 2007). For instance, Gajwani et al. (2007) argued that openness has led to a change in regional comparative advantage, "from the quality of land to the level of human capital as India integrates with the international market." On the other hand, Zhang and Fan (2002) observed that, "regions adjacent to more developed economies, or with better infrastructure such as ports and airports, enjoy a far better location advantage for trade and development than landlocked regions." The above explanations no doubt are interesting but seem to be quite ad hoc in nature. The causality between openness and inequality has to be addressed in a systematic way so as to derive an empirically verifiable hypothesis. We shall make an attempt in this paper to provide such a causal relationship between them. We argue that the patterns of distribution of the manufacturing across the regions provide the key to the cause of rising or falling interregional inequality.

Having set the tone of the paper, let us have a look at the levels and trends in interregional[3] inequality in India for income as well as for various other components of income such as agriculture, manufactures, services, primary, and infrastructure etc. We

use the Theil measure of inequality to calculate the levels of interregional inequality in India for the period 1981 to 2000.

The Theil Measure

The Theil or entropy measure of inequality,[4] often called "entropy," E_x, is defined as follows:

$$E_x = \sum x_i \log(x_i / p_i),$$

where x is an indicator such as per capita NSDP, agriculture, manufacturing, services, infrastructure etc., and i stands for a region, p_i is region i's share in total population, and x_i is region i's share in various economic activities like NSDP, Agriculture, Manufacturing etc. We estimate E_x using interregional data on net State domestic products as provided by the CSO (see the Appendix).

The Entropy and their Trends

Table 1 gives the Theil entropy measure for all 26 States over the period from 1980–81 to 1999–2000. Income in our analysis is measured by the Net State Domestic Product (NSDP) for each of the States and Union Territories of India. We further disaggregate the NSDP data into agriculture (which also includes forestry and logging and fishing), primary products (mining and quarrying), manufacturing, infrastructure (which includes construction, electricity, gas and water supply and transport, storage and communication) and services (which includes trade, hotels and restaurants, banking and insurance, real States, ownership of dwellings and ownership services, and public administration and other services). We further subdivided the manufacturing into registered and unregistered to derive more insights about the manufacturing sector and accordingly we have estimated the entropy measure of registered manufacturing and unregistered manufacturing. Finally, we combined both agriculture and primary into one single category and estimated its entropy measure. The values shown in Table 1 indicate that inequality has increased in almost all counts.

The estimates of the Theil inequality measures have been further analyzed in Table 2. The annual average rate of growth of inequality has been the highest in infrastructure (10.88%) followed by agriculture (8.46%) and income (4.69%) and all these estimates are very highly significant. The manufacturing inequality levels are always above the income inequality levels and both are increasing. But the registered manufacturing inequality in fact has been decreasing over time. It can be noted from Table 1 that most of the sectors have shown increases in their indices after 1994, though the biggest increase can be seen only in the infrastructure sector.[5]

The increase of inequality in manufacturing is also found to be positive and significant. However, the breakup of manufacturing into registered and unregistered[6] shows divergent trends. The conflicting trends of inequalities in registered and unregistered manufacturing perhaps implies the existence of different labor market conditions in two types of manufacturing, namely unionization of the labor force in the former and the lack of it in the latter. Also, the public sector enterprises and planned investment, which are a part of registered manufacturing, are guided by some regional considerations in the allocation of resources, while the unregistered industries are purely market-driven. Moreover, rising rents and labor costs in the metropolis may also be responsible for the de-agglomeration of industries from the urban regions to the less

Table 1. Entropy Estimates at Constant Prices (26 States and Union Territories), 1980–81 = 100

Year	*Income*	*Manuf.*	*Services*	*Agri. and prim.*	*Reg. manuf.*	*Unreg. manuf.*	*Agri.*	*Prim.*	*Infra.*
1981	2.10	9.49	4.24	1.52	32.8	13.25	3.9	18.2	9.26
1982	2.09	8.29	4.17	1.68	26.7	13.33	4.6	18.7	9.48
1983	2.21	7.85	4.36	1.96	25.4	12.05	5.3	18.1	10.01
1984	2.05	7.92	4.21	1.64	25.5	12.81	4.3	17.3	9.93
1985	2.10	7.54	4.01	1.50	22.6	13.99	4.0	18.2	10.24
1986	2.34	8.42	4.47	1.79	25.8	14.04	4.6	17.3	9.87
1987	2.31	9.04	4.34	1.77	28.6	14.20	4.7	16.5	9.52
1988	2.46	7.62	4.18	2.14	21.9	14.39	5.8	16.8	9.65
1989	2.36	7.45	4.12	1.94	21.0	14.60	5.3	15.5	9.71
1990	2.78	7.72	4.28	2.06	21.6	15.11	5.6	17.3	10.26
1991	2.65	8.23	4.22	1.94	24.3	14.33	5.4	16.0	9.74
1992	2.29	8.10	4.99	2.19	23.1	15.72	6.3	13.9	10.09
1993	2.52	9.75	5.27	2.37	27.4	18.41	6.6	16.0	10.50
1994	3.69	10.20	5.76	2.38	27.8	20.40	6.6	16.0	10.90
1995	4.38	9.97	4.77	2.08	25.5	21.98	5.9	16.7	30.36
1996	4.98	10.40	5.24	2.34	26.7	23.16	6.7	17.0	35.87
1997	5.15	11.10	5.12	2.27	28.6	23.67	6.4	15.3	39.09
1998	5.19	9.99	5.38	2.38	25.7	21.90	6.8	15.1	39.11
1999	5.38	10.40	5.70	2.12	27.0	24.23	6.2	12.2	37.46
2000	4.50	10.60	5.93	2.47	25.7	27.25	7.3	12.0	55.47

Table 2. Inequality Trends

		t-Value
Income (1981–2000)	4.69	5.46***
Agriculture (1981–2000)	8.46	18.60***
Primary activities (1981–2000)	–0.25	–5.76***
Registered manufacturing (1981–2000)	–0.95	–0.55
Unregistered manufacturing (1981–2000)	1.66	4.49***
Manufacturing (1981–2000)	1.27	3.77***
Services (1981–2000)	0.93	2.20**
Infrastructure (1981–2000)	10.88	7.84***
Agriculture and primary activities (1981–2000)	–1.00	–0.53

Note:
*** Significant at 1% level of confidence; ** significant at 5% level of confidence.

Table 3. Nonlinearity Trends in the Theil Index of Inequality for the State Domestic Product and its Components (26 States and Union Territories)

Inequality index	*Time period*	*Constant*	*T*	T^2	T^3	R^2
Income	1981–2000	0.0325	–0.0067	0.0009	–2.51e–05	0.71
		(3.86)***	(–2.16)**	(2.83)***	(–2.83)***	
Agriculture	1981–2000	4.26006	–0.0052	–0.0208	–0.0007	0.81
		(8.21)***	(–0.03)	(0.91)	(–1.00)	
Primary sector	1981–2000	20.0788	–1.024	0.1010	–0.0035	0.70
		(18.08)***	(–2.29)**	(2.07)**	(–2.26)**	
Manufacturing	1981–2000	0.1029	–0.0103	0.0012	–3.28e–05	0.77
		(16.73)***	(–4.56)***	(5.16)***	(–5.09)***	
Registered manufacturing	1981–2000	34.2374	–3.4174	0.3241	–0.0087	0.42
		(14.80)***	(–3.67)***	(3.19)***	(–2.73)***	
Unregistered manufacturing	1981–2000	13.13	–0.1962	0.0444	—	0.93
		(14.93)***	(–1.02)	(4.97)***		
Services	1981–2000	0.0494	–0.0044	0.0006	–1.82e–05	0.61
		(10.99)***	(–2.63)**	(3.52)***	(–3.86)***	
Agriculture and primary sector	1981–2000	0.0200	–0.0023	0.0004	–1.36e–05	0.51
		(5.07)***	(–1.51)	(2.37)**	(–2.87)***	
Infrastructure	1981–2000	0.0693	0.0214	–0.0041	0.0002	0.94
		(1.06)	(0.89)	(–1.71)	(3.22)***	

Notes: Figures in parentheses are *t*-values.
*** Significant at 1% level; ** significant at 5% level; * significant at 10% level.

urban regions. Similarly, inequality in the service sector has also gone up but at a much slower rate than manufacturing and agriculture. The linear trend results, particularly in case of manufacturing, convince us that some measure of nonlinearity may exist in the behavior of inequality over time. In Table 3 we give the results of the estimation of nonlinear trends in the relationships between inequality and time.

In order to examine whether the post-reform period shows a different trend in inequality from that of the pre-reform period, we applied a time dummy in the regression to separate the two periods. We assume that the year 1995 divides the period into

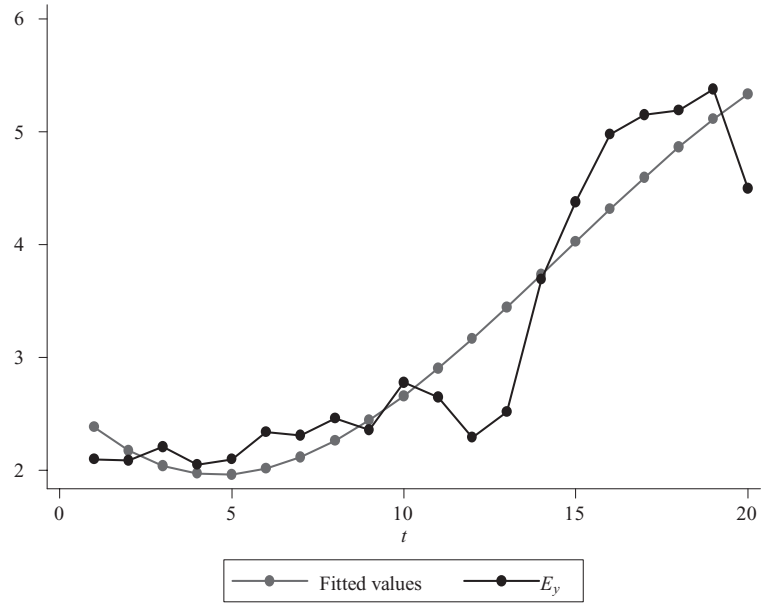

Figure 1. Fitted and Actual Income Inequality

two, namely, pre-reform (1981–94) and post-reform (1995–2000). Interestingly, we noticed that the time dummy for income is positive and significant, implying that the post-reform period has witnessed a higher rate of increase in income inequality.[7] In case of manufacturing, we observe a positive time dummy, though not very significant, but agriculture has shown a very significant positive time dummy. In short, we can conclude that inequality has increased during the post-reform period. The linear trend results with the time dummy convince us that some measure of nonlinearity may exist in the behavior of inequality over time.

It is clear from Table 3 that, except for agriculture, nonlinearity in the remaining cases is found to be significant in the sense that the coefficients of the higher degrees of time are all significant. In agriculture we observe that a steady linear rising trend in inequality over time, but the nonlinearity analysis shows that perhaps inequality in agriculture has declined during the later period. In a way, this is also true for unregistered manufacturing, although we observe that nonlinearity up to the second degree is significant. For the other cases, a significant polynomial relationship up to third degree can be seen for income, manufacturing combined, registered and unregistered manufacturing, services, agriculture, primary, agriculture–primary combined, and infrastructure. The sharp fall in inequality in the primary sector perhaps dominates the polynomial relationship for the agriculture–primary sector combined. The above results of nonlinearity make it clear that the relationship between the growth of inequality and time shows cyclical behavior. Figure 1 shows that while there was some tendency for income inequality to fall during 1980–85, it had started rising since then almost at an exponential rate, particularly after 1995 when India became a signatory of the WTO.

It must, however, be remembered that since the measure of inequality is a mere statistical construct, it does not by itself provide any explanation of the causes of an increasing trend of interregional income disparity in India. As a preliminary investigation into the relationship between income inequality and the inequalities in its various

Table 4. Regression Results of Income Inequality

E_y =	Constant	+	E_m	+	E_p	+	E_a	+	E_s
	–2.795		0.7545		–0.0836		0.550		–0.528
	(–0.91)		(3.64)		(–0.74)		(2.19)		(–0.83)
			$R^2 = 0.7898$		$N = 2$				

components, we have performed a regression analysis where we have regressed income inequality on the inequalities in its components.[8] The results are reported in Table 4.

The regression results clearly show that only manufacturing and agriculture inequalities positively affect income inequality. The primary and service sector inequalities have a dampening impact on income inequality, though the coefficients for both these variables are not significant. In the next section we develop a structural model of economic transformation to examine how both manufacturing and agriculture determine income across regions and, as a consequence, income inequality.

4. Structural Change and Rising Regional Inequality

To examine if there is any systematic relationship between income inequality and manufacturing inequality, we shall be using the cross-country analysis of structural evolution of an economy as proposed by Chenery and Syrquin (1977).[9] The well-known Chenery–Syrquin model provides the basic structuralist view on economic growth. It states that the manufacturing sector is the key sector that provides momentum for economic growth and thus determines the level of income. That is, as the per capita income rises, the share of manufacturing in GDP also rises and *pari passu* the share of agriculture and primary goods falls.[10] Thus, we argue that if in the process of economic growth there are concentrations of manufacturing activities in a few regions, then it would lead to divergences in the regional growth rates which eventually would be reflected in rising interregional income inequality in the country.

The regression equation for estimation with cross-regional data is given in equation (1):

$$x = \alpha + \beta_1 \ln Y + \beta_2 (\ln Y)^2 + \gamma_1 \ln N + \gamma_2 (\ln N)^2 + \varepsilon F, \tag{1}$$

where x is the share of manufacturing in GDP, Y is per capita income or GDP per capita, N is population size, and F is the trade balance. Though this equation was used to analyze the cross-country patterns of structural changes, we have used the framework to examine the patterns of evolution of the regions with the help of cross-regional data for the Indian economy for the period 1981–2000. In our study, we first ignore the trade variable and consider a closed-economy framework. However, we relax this assumption later and introduce international trade in the regression equation. With the pooled sample, we estimate the model through fixed effect or random effect techniques and, by taking the Hausman test to find the desirability of the equation, we have reported our results.

The regression equation is purported to explain that manufacturing output share depends on per capita income as well as the size of the population. While the per capita income variable captures the income effect of demand and the operation of Engel's law, the population size variable represents the extent of demand, which affects the size of production and economies of scale. We expect that the coefficients of these variables will take positive values, implying that as income rises the demand for manufactures

Table 5. Structural Change Equations (closed-economy model)

	Coefficients	*Std. error*	*z*	*P* > |*z*|
ln *Y*	–0.5150	0.1313	–3.92***	0.000
(ln *Y*)^2	0.0354	0.0083	4.26***	0.000
ln *N*	0.0455	0.0818	0.56	0.578
(ln *N*)^2	–0.0016	0.0026	–0.62	0.537
Constant	1.6940	0.8880	1.93*	0.054

Note:
*** Significant at 1% level of confidence; * significant at 10% level of confidence.

will rise following Engel's law and therefore it leads to a rise in the share of manufactures in GDP. Similarly, as the size of the population increases, the scale of production also rises with concomitant effects on reduction of the cost of production. The latter effect also will have an upward thrust on the share of manufactures. Our estimated equation gives the results, as presented in Table 5.

In Table 5 we notice that the manufacturing share variable, while significantly negatively related to per capita income, is also positively and significantly related to the square of per capita income. On the other hand, the population variable is not at all significant. In order to find the relationship between manufacturing share and per capita income we need to calculate the elasticity of manufacturing share with respect to per capita income, which we expect to be positive. The estimated equation for elasticity can be written as:

$$(Y/x)(dx/dY) = [\beta_1 + 2\beta_2 \ln Y]/x.$$

Putting the values of β_1 and β_2 into the above equation, the elasticity is coming significantly positive. This implies that the graph (Figure 2) depicting the relationship between manufacturing share and per capita income has to be a positively sloped curve. Thus the relation between per capita income and estimated manufacturing share, as shown in Figure 2, is quite consistent with the standard cross-country results.

Now let us consider this result in the context of increasing inter-State income inequality in India. It can be interpreted as an indication of the disproportionate growth in manufacturing production across the States of Indian union. We have also observed that whenever income inequality rises, manufacturing inequality also tends to rise. Similarly, the relationship between agricultural share and per capita income is depicted by the estimated negatively sloped curve.[11] This result is again consistent with the standard cross-country results. That is, as income rises the share of agriculture in income tends to decline.

5. Trade Liberalization and Regional Income Inequality

We now turn to the effects of openness on manufacturing orientation across the regions of India. In the literature, "openness" is defined in a number of ways: for instance, exports as a percentage of GDP has been used as an indicator of increased openness or outward orientation in World Bank studies. We shall consider below three indices of openness; namely, Trade(exports + imports)/NSDP, Exports/NSDP, and Manufacturing Trade/NSDP ratios. We represent these ratios over time in Figure 3. Since all three ratios show similar trends, their inclusion in the regression equation as independent

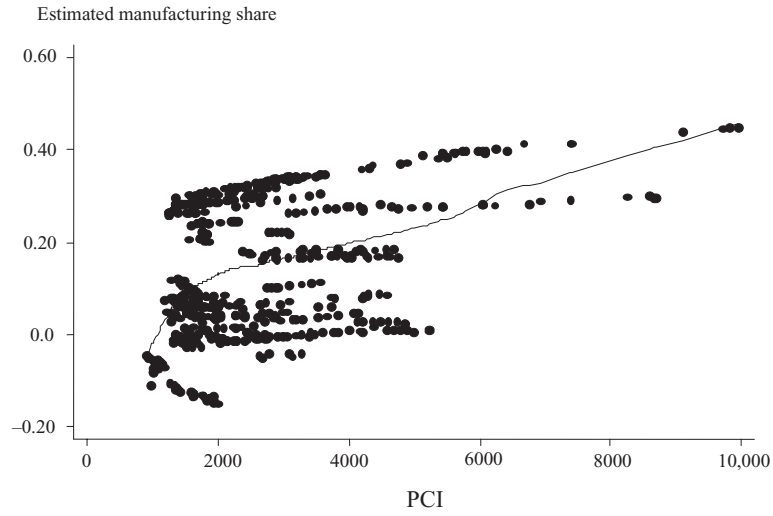

Figure 2. Estimated Manufacturing Share and Per Capita Income

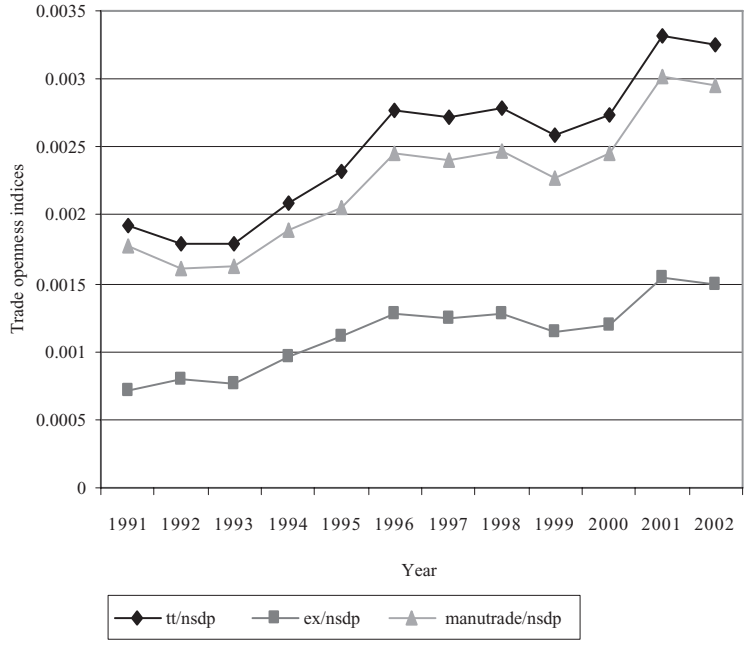

Figure 3. Trade Openness Indices of India, 1991–2002

variable is unlikely to show different results as far as the sign of the coefficient is concerned. Hence, in our subsequent analysis we shall consider only the Trade/NSDP ratio as the variable representing the openness of an economy.

How can trade liberalization affect regional inequality? We propose here that for this we need to consider the impact of trade openness in determining the inter-State manufacturing growth paths, since manufacturing share determines income growth. While international trade has often been cited as a cause of increasing income inequal-

ity between classes (Stolper–Samuelson) and between countries (the terms-of-trade effect), much less attention has been paid on the effects of trade across the regions within a country (Silva and Leichenko, 2004). This is mainly because the standard general-equilibrium trade models are essentially spaceless in the sense that the entire country is conceived of as a single market point characterized by single product price and single factor price prevailing everywhere.

How do we expect trade to affect manufacturing? The liberalization drive in the developing countries is based on the presumption that trade liberalization will allow resources to be shifted away from agriculture and primary to the manufacturing enterprises, since the developing countries have comparative advantage in relatively unskilled labor-intensive industries. If it does indeed happen, then we expect that the share of manufacturing in NSDP will also rise for each State, and accordingly each State should experience a rise in its per capita income as argued above in our analysis of structural change and economic growth. However, trade may increase or decrease income inequality depending on whether the impact on manufacturing specialization is unevenly or evenly spread out across the States. We now provide two testable hypotheses, not necessarily mutually exclusive.

The first hypothesis, following Elizondo and Krugman (1992), can be stated as follows:

Hypothesis 1. *The manufacturing concentration across States declines over time as the economy is opening up to trade resulting in a breakdown of the hegemony of the metropolis in manufacturing production. The result is a decline in manufacturing concentration.*

We assume that relatively backward regions with very low manufacturing orientation have relatively lower labor prices, capital being perfectly mobile across the States. We assume further that labor is more expensive in the metropolis and that labor is imperfectly mobile across the States. We can justify labor immobility on the ground of existence of marked differences in rural–urban wage rates in India. On the other hand, capital market is much more integrated partly because of governmental intervention and partly because of the centralized monetary system in the economy. Similarly, over the years the transport connectivity between the metropolis and the periphery has improved remarkably, thanks to the multi-lane high-speed roads that have been constructed in recent years. Moreover, with the growth of educational institutions across the States and with the rise in distant educational facilities and internet communication etc., the peripheral States are no more in any disadvantage as compared to developed regions in terms of the location of production. Thus, we should expect a dispersal of industrial spectrum across the States, which will result in an even distribution of industrial activities. Opportunities to international trade would then lead to a decline in the capital-intensive industries from the metropolis and the rise of the labor-intensive enterprises in the periphery. The metropolis will specialize in providing services in which cheap capital and skilled labor are more important and which are also relatively abundant in the metropolis. As a result, the periphery will specialize more and more in commodity production. The increased demands for unskilled labor may lead to a fall in the skilled–unskilled wage disparities. Since the share of unskilled labor in total labor force is much higher than the skilled one, the overall impact of manufacturing growth on per capita income is bound to have positive effect. Thus, we may expect that trade liberalization will lead to higher growth and reduced income inequality.

The second hypothesis following our discussion on trade and regional inequality can be stated as follows:

HYPOTHESIS 2. *As the economy is opening up to trade, the share of manufacturing in NSDP tends to rise.*

Thus, Hypothesis 1 in conjunction with Hypothesis 2 may imply that with the opening-up of trade we should expect a decline in regional income inequality. However, the falsification of Hypothesis 1 would therefore indicate that liberalization may have led to more concentration of manufacturing activities in the metropolis having the undesirable impact on regional income inequality.

In order to test the first hypothesis we have calculated the Herfindhal index of concentration in manufacturing activities across the States. The index shows that the concentration level[12] has increased, falsifying our null hypothesis.

Let us now consider testing of the second hypotheses for which we require data on foreign trade for the Indian States, which unfortunately we do not have. What, in fact, we have is the aggregate trade data for exports and imports for the country. Therefore, in our study we have used a methodology to estimate the export–import data for each State of India. (See the Appendix for details on the procedure to estimate the State-wise export and import data.) We then introduce another variable, openness, in equation (2) to capture the trade effect. The openness variable is defined as total trade, i.e. export plus import, as a percentage of the NSDP for each State.

Thus, we re-estimate equation (1) by incorporating the total trade variable[13] (*tt*). The results of the estimated equation are presented in Table 6. We can clearly see from the results given in Table 6 that the total trade as a percentage of NSDP is positively and significantly affecting the manufacturing output proportion. Further, as the economy is opening up to the force of trade, while the share of manufacturing showed a tendency to decline at the lower end of per capita income as can be seen in Figure 4, the manufacturing share increases rather exponentially as the per capita income rises. What does this mean? This means that trade leads to an expansion of the share of manufacturing in income but perhaps more so for the metropolis if opening up the economy strengthens rather than weakens the existing manufacturing clusters in the metropolis. The increase in the concentration of manufacturing as discussed above lends support to the view that perhaps trade contributed to a disproportionate growth of manufactures across the States. In fact, we have also calculated to find whether there is also concentration of foreign trade across the States. Not surprisingly, indeed we observed that trade concentration has also increased during the post-reform period (see Table 10). Hence, we can summarize the Indian experience of trade liberalization as follows: as India is opening up to international trade, there has been more concentration of

Table 6. Results of the Chenery–Syrquin Model with Total Trade /NSDP (*tt/nsdp*) *as the Openness Variable*

Variable	*Coefficient*	*Standard error*	*z*	*P* > mod. *z*
ln *N*	–0.1149	0.1173	–0.98	0.327
$(\ln N)^2$	0.0037	0.0037	1.01	0.312
ln *Y*	–0.5928	0.1992	–2.98***	0.003
$(\ln Y)^2$	0.0398	0.0125	3.18***	0.001
tt/*nsdp*	6.8517	2.2359	3.06***	0.002
Constant	3.1991	1.2601	2.54***	0.011

Note:
*** Significant at 1% level of confidence.

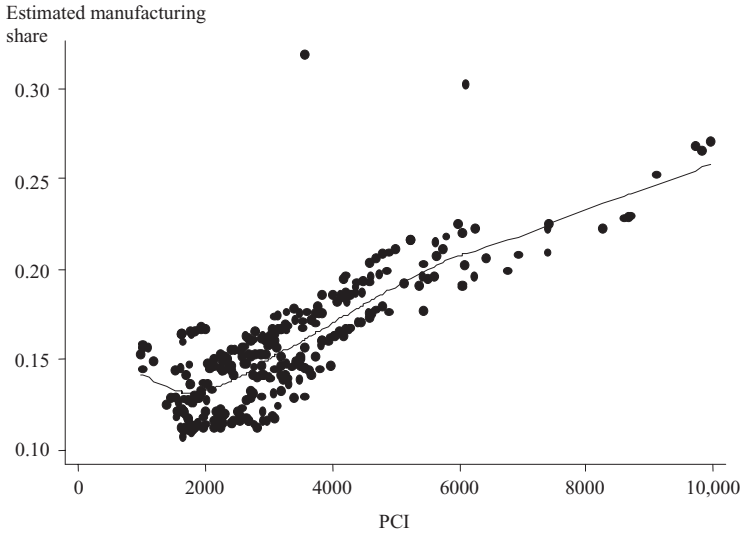

Figure 4. Estimated Manufacturing Share and Per Capita Income with Total Trade

Table 7. Estimates of Inequality Measure on Trade/NSDP Ratio

Inequality index	*Constant*	*TRNSDP*	*TRNSDP*^{2}	*TRNSDP*^{3}	R^2
Income (E_y)	3.16	–0.33	0.03	–0.0006	0.96
	(6.53)***	(–2.82)***	(4.23)***	(–4.41)***	
Manufacturing (E_m)	10.17	–0.58	0.05	–0.0009	0.79
	(8.74)***	(–2.08)**	(2.56)**	(–2.60)**	
Agriculture (E_a)	1.76	–0.67	–0.03	0.0005	0.81
	(2.05)**	(3.29)***	(–2.48)**	(2.13)**	

Notes: *TRNSDP* = Trade/NSDP ratio; *TRNSDP*^{2} and *TRNSDP*^{3} are a higher order of the Trade/NSDP ratio.
*** Significant at 1% level of confidence; ** significant at 5% level of confidence.

manufacturing in the metropolis. Given India's comparative advantage in manufactures, the concentration of manufacturing in the metropolis also implies that trade is more concentrated in the metropolis too. The net effect of these is a disproportionate rise in income between the metropolis and the rural sector and a consequent rise in the observed interregional income inequalities.

Trade openness thus had played a significant role in the determination of manufacturing output. These results are consistent with our expectation. However, contrary to our expectation, we have observed that there had been a disproportionate expansion of the manufacturing activities in the metropolis resulting in an increase in manufacturing concentration. The net result was that trade leads to growth in overall income but at a cost of rising interregional inequality. We further confirm it by introducing the Trade/NSDP ratio on the entropy estimates to find how it affects income inequality.

The three regression equations given in Table 7 give the estimates of income, manufacturing, and agricultural inequalities, respectively, being regressed on the trade openness variable. The graphs of the three nonlinear equations are given in Figures 5, 6, and 7. We can see from Figure 5 that the income inequality, though, increases with

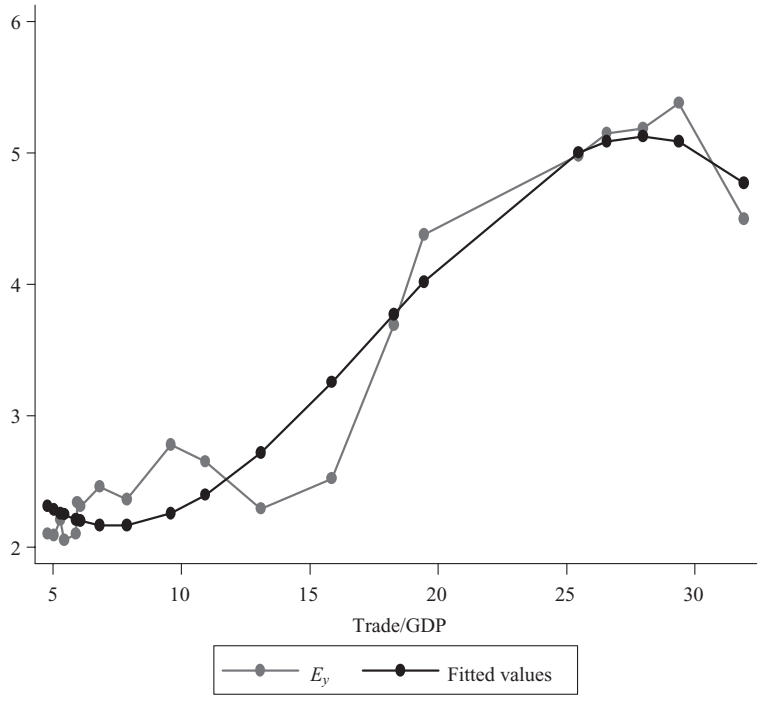

Figure 5. Actual and Fitted Income Inequality against Trade/NSDP Ratio

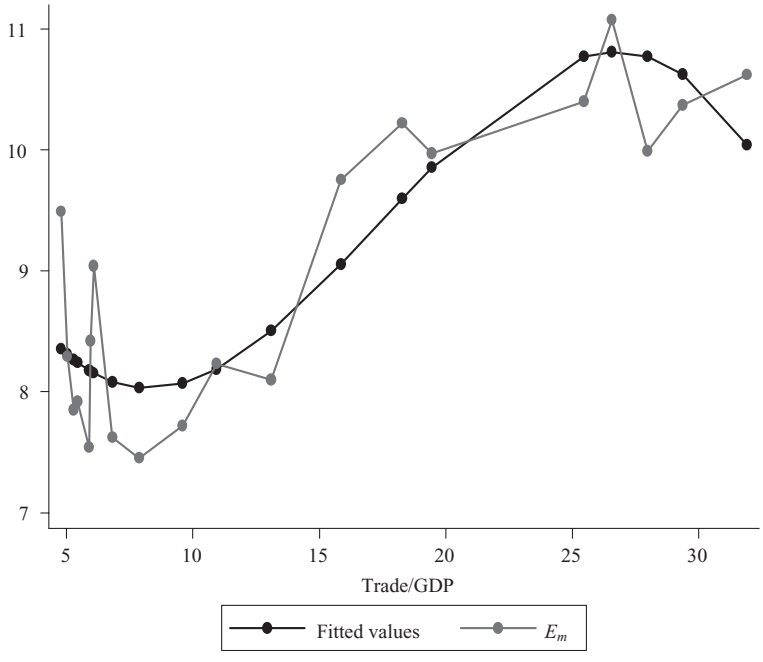

Figure 6. Actual and Fitted Manufacturing Inequality against Trade/NSDP Ratio

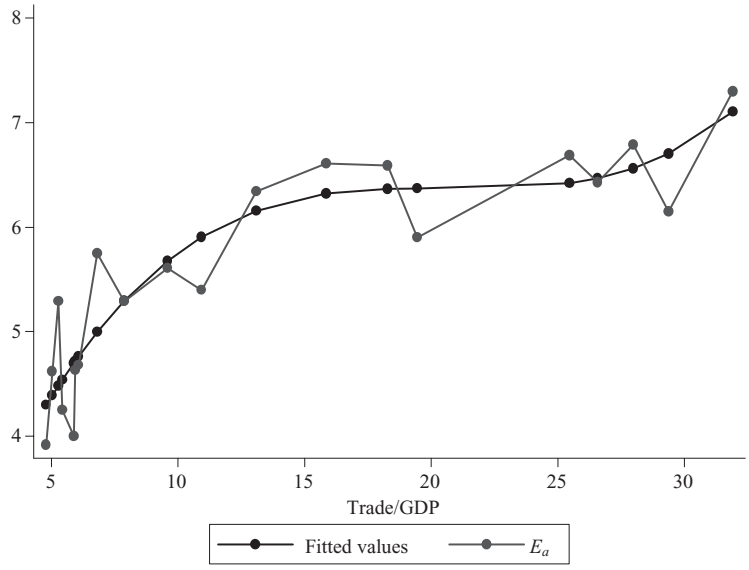

Figure 7. Actual and Fitted Agricultural Inequality against Trade/NSDP Ratio

increased openness; nevertheless, there shows a tendency for it to decline with a further rise in the Trade/NSDP ratio. The case for manufacturing, as shown in Figure 6, is also identical, although we can see in Figure 7 that the agricultural inequality increases with a further opening-up of the economy. This is not difficult to explain. First, as we argued in Hypothesis 1 above, the manufacturing inequality seems to have declined with a further opening-up of trade (see Table 7). This implies that the less developed regions have experienced a certain amount of growth in manufacturing, leading to a rise in their income. In consequence, we thus observe a tendency for income inequality to fall. On the other hand, with the opening-up of the economy India has been able to export certain agricultural goods but the impetus of this was felt mainly by the regions which have very well-developed agriculture such as Punjab, Western UP, Maharashtra, and Tamil Nadu. It is a well-known fact that the "green revolution" in India has been regionally quite biased. Therefore, the rising agricultural inequality may have some impact on rising income inequality but the decline in manufacturing inequality as observed above may have a far more significant effect on pulling down the income inequality by outweighing the pressure from agricultural inequality.

The results demonstrate that trade openness has an inverted-U relationship with both the income and manufacturing inequalitie, but an opposite one with agricultural, i.e. a U-type relationship. We have also tried to estimate the inequality equation on the Trade/NSDP ratio in logarithmic form; the results are reported in Table 8.

Table 8 gives the logarithmic estimates of income, manufacturing, and agricultural inequalities. The advantage of the logarithmic estimate is that the coefficient of the independent variable can be interpreted as an estimate of elasticity. However, the elasticity estimates are positive in all cases, but the values of the coefficient of the Trade/NSDP ratio in all cases is less than 1, so we can interpret that as "Trade/NSDP" ratio increases, inequality increases but at a decreasing rate.

Table 9 reports the estimation of the Trade/NSDP ratio on various inequalities with the openness dummy, and confirms that openness is positively related to both manufacturing and income inequality and negatively with agriculture, though the result is not

Table 8. Elasticity Estimates of Inequality Measure on Trade/GDP Ratio

Inequality index	*Constant*	Log(*Trade/GDP*)	R^2
Log income (E_y)	–0.010	0.491	0.86
	(–0.86)	(10.68)***	
Log manufacturing (E_m)	1.818	0.153	0.62
	(25.63)***	(5.42)***	
Log agriculture (E_a)	1.130	0.239	0.77
	(14.67)***	(7.79)***	

Note:
*** Significant at 1% level of significance.

Table 9. Elasticity Estimates with Openness Dummy

	Constant	Log(*Trade/GDP*)	*Openness*
Log(E_y(Income inequality))	0.322	0.269	0.391
	(2.73)***	(4.78)***	(4.75)***
Log(E_m(Manufacturing inequality))	1.927	0.095	0.101
	(18.38)***	(1.91)*	(1.39)
Log(E_a(Agriculture inequality))	0.945	0.337	–0.172
	(9.07)***	(6.80)***	(–2.37)**

Note:
*** Significant at 1% level of confidence; ** significant at 5% level of confidence; * significant at 10% level of confidence.

Table 10. Trade Concentration in India

Year	*Herfindhal index (total trade, 10 States)*
1991	0.8380
1992	0.8280
1993	0.8372
1994	0.8422
1995	0.8406
1996	0.8532
1997	0.8632
1998	0.8507
1999	0.8414
2000	0.8418
2001	0.8586

significant in the case of manufacturing. Table 10 provides further confirmation to our result of trade openness on increasing income and manufacturing inequality, and shows that the trade concentration has been increasing since 1991.

Thus it may be concluded that as far as the impact of openness on interregional income inequality is concerned, openness does show an increasing interregional income inequality in India, though at a somewhat decreasing rate. This essentially neoclassical result is

exactly the opposite of the Elizondo–Krugman (1992) hypothesis. However, our analysis of the elasticity of inequality to openness may be taken as an indication that, in the long run perhaps, the rise in interregional inequality may eventually taper off.

6. Conclusion

We may draw the following conclusions from our above analyses. First, regional inequality in India has been increasing in all components of income except for the primary sector where we observe a persistent decline in interregional inequality in India. Second, regressing income inequality on the inequalities in various components of income, we find that only manufacturing and agricultural inequalities significantly and positively affect income inequality. Third, our structural change analysis shows that the share of manufacturing has been steadily increasing across all States and the share of agriculture has been declining. Finally, our regression results of the impact of increased openness on average income inequality shows that while openness had initially led to a rise in both income and manufacturing inequalities, there was clear evidence of a decreasing tendency of inequality as openness had increased. On the other hand, in the case of agriculture, the inequality indices show a tendency to rise further. This result has negative implications for the impact of globalization on income inequality insofar as income inequality is positively and significantly affected by agricultural inequality. Our presumption, however, is that in the long run manufacturing is bound to dominate the fate of interregional income inequality subject to a caveat that central government plays a proactive role in providing a level playing field for all the regions in terms of the basic infrastructure. Any further increase in infrastructural inequality across the regions may lead to an agglomeration of manufacturing activities in those regions which are well endowed with better infrastructure. In no time then, we will lose the initial momentum of the interregional income equalization impact of trade and the country again will fall into the otherwise inescapable trap of rising interregional inequality.

Appendix

NSDP Data

The National Accounts Statistics (NAS) brought out by the Central Statistical Organization (CSO) is the main source of data for various regional economic activities in India. The regional income data are, however, compiled by the statistical departments of various regions (i.e. the States). But, the data for economic activities are available at two different base year prices: (1) 1980–81 prices and (2) 1993–94 prices. The CSO gives us both the current as well as constant price data. As mentioned above, there are two constant price series—one for 1980–81 prices and the other for 1993–94 prices. Since we did not obtain the constant price series for the entire period of our analysis at 1980–81 prices, we have therefore converted the data from 1993–94 onwards till 1999–2000 (the end period of our analysis) available at 1993–94 prices to 1980–81 prices using the price indices correction analysis, and used these data for our calculations. The outputs of economic activities for all the regions are given in Rs. Lakhs.

Estimation of State-Wise Trade Data Series

The trade data that we have used for our analysis have been sourced from India Trades Database Centre for Monitoring the Indian Economy (CMIE) and Directorate

General of Commercial Intelligence & Statistics (DGCIS). We have used the trade data based on the HS Code classification from 01 to 99. On the basis of availability of data, we have restricted our analysis from the period of 1990–91 till 1999–2000. The trade values are also given in Rs. Lakhs.

Methodology

We considered the entire trade series for India based on the HS Code classification ranging from 01 to 99 into two broad categories: (a) 01–24 has been classified as agricultural items and (b) 25–99 has been considered as manufacturing items. As all the items belonging to the latter category needs to be manufactured in some way or the other before trading, we have accumulated the entire series into one broad head.

In order to calculate State *i*'s manufacturing (agriculture) exports, first, we computed State *i*'s manufacturing (agriculture) share in India's total manufacturing (agriculture) output, which is the summation of the manufacturing (agriculture) output of all the States. Next, from the CMIE data we assessed the total manufacturing (agricultural) exports of India, i.e. the summation of the trade values of items ranging from HS Code 25 to 99 (01 to 24). State *i*'s manufacturing (agriculture) share has been multiplied by India's total manufacturing (agriculture) exports in order to get an estimate of State *i*'s manufacturing (agriculture) exports. We termed it as the "rule of thumb" in calculating the different States' export figures. But we have used a different way in order to calculate the imports of manufacturing (agricultural) items for each of the States. We divided total imports of manufacturing (agriculture) by India's population to get per capita manufacturing (agriculture) imports. Subsequently, the above share has been multiplied with the respective State's population in order to estimate each respective State's import figures for manufacturing (agriculture). This is based on the assumption of homothetic preference for imports across all States. Finally, the export and import figures for each of the States estimated are added to arrive at the total trade for a State.

Measurement of the degree of openness of any State has been done by calculating the State's total trade balance, exports, and manufacturing trade as a percentage of the Net State Domestic Product (NSDP) of that State.

We understand that these are not the actual trade figures from the State but since no data are available for trade from the State, we can perhaps use these estimates as proxies.

References

Bajpai, N. and J. Sachs, "Trends in Inter-State Inequalities of Income in India," Discussion paper 528, Harvard Institute for International Development, Harvard University (1996).

Barua, A. and A. Bandyopadhyay, "Structural Change, Economic Growth and Regional Disparity in the North-East: Regional and National Perspectives," in A. Barua (ed.), *India's North-East: Developmental Issues in a Historical Perspective*, New Delhi: Manohar–CSH Publication (2005): 239–81.

Chenery, C. and M. Syrquin, *Patterns of Development, 1950–1970*, New York: World Bank and Oxford University Press (1977).

Chenery, C., S. Robinson, and M. Syrquin, *Industrialization and Growth: A Comparative Study*, New York: World Bank and Oxford University Press (1988).

Das, S. K. and A. Barua, "Regional Inequalities, Economic Growth and Liberalization: A Study of the Indian Economy," *Journal of Development Studies* 32 (1996):364–90.

Dasgupta, D., P. Maiti, R. Mukherjee, S. Sarkar, and S. Chakrabarti, "Growth and InterState Disparities in India," *Economic and Political Weekly*, 35, 1 July (2000):1637–48.

Dastidar, A. G., "Income Distribution, Structural Change and International Trade: A Developing Countries Perspective with Special Reference to India," in A. Barua and R. Stern (eds), *The WTO and India: Issues and Negotiating Strategies*, New Delhi: Orient Blackswan (2010):321–46.

Elizondo, R. L. and P. Krugman, "Trade Policy and the Third World Metropolis," NBER working paper 4238 (1992).

Gajwani, K., R. Kanbur, and X. Zhang, "Comparing the Evolution of Spatial Inequality in China and India: A Fifty-Year Perspective," Annual World Bank Conference on Development Economics (2007).

Marjit, S., S. Kar, and B. S. Maiti, "Regional Trade Openness Index and Income Disparity: A New Methodology and the Indian Experiment," *Economic and Political Weekly*, 3 March (2007):757–69.

Rao, M. G., R. T. Shand, and K. P. Kaliranjan, "Convergence of Income across Indian States: A Divergent View," *Economic and Political Weekly*, 27 March (1999):769–78.

Sachs, J., N. Bajpai, and A. Ramiah, "Understanding Regional Economic Growth in India," CID working paper 88, Harvard University (2002).

Shankar, R. and A, Shah, "Bridging the Economic Divide within Nations: A Scorecard on the Performance of Regional Policies in Reducing Regional Income Disparities," World Bank Policy Research working paper 2717 (2001).

Silva, J. A. and R. A. Leichenko, "Regional Income Inequality and International Trade," *Economic Geography* 80 (2004):261–86.

Zhang, X. and S. Fan, "Infrastructure, Openness, and Regional Inequality in India," paper prepared for the American Agricultural Economics Association Annual Meeting at Long Beach, CA, 28–31 July (2002).

Notes

1. The latter issue has been examined by Dastidar (2010).
2. The study by Das and Barua (1996) provides a comprehensive survey of the earlier literature on the subject. References for other studies are: Bajpai and Sachs (1996), Rao et al. (1999), Dasgupta et al. (2000), Shankar and Shah (2001), Sachs et al. (2002), Barua and Bandyopadhyay (2005), and Marjit et al. (2007).
3. A State of Indian Union is assumed to be a distinct region in India.
4. See Das and Barua (1996) on the statistical properties of this measure.
5. One plausible explanation might be that private infrastructure investments may have crowded in the metropolitan regions to take advantage of the liberal trade regime.
6. The unregistered manufacturing sector is essentially the unorganized industrial sector of the economy and is generally unskilled labor intensive.
7. The results are not reported due to space constraints.
8. We have excluded the infrastructure inequality in the equation since we have found that the manufacturing and infrastructure inequalities are highly correlated.
9. See Chenery and Syrquin (1977, pp. 142–44) and Chenery et al. (1988).
10. See Barua and Bandyopadhyay (2005) for an earlier analysis on this issue.
11. Not reported due to space constraints.
12. Not reported due to space constraints.
13. We have attempted the other variables of openness such as manufacturing trade to the NSDP and exports to the NSDP ratios but the results are not unalike and therefore we do not report the estimates here.