RIS Discussion Paper Series

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Discussion Paper # 279

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April 2023

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Core IV-B, Fourth Floor, India Habitat Centre
Lodhi Road, New Delhi – 110 003 (India)
Tel: +91-11-2468 2177/2180; Fax: +91-11-2468 2173/74
Email: dgoffice@ris.org.in

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Abstract: After following import substituting policies for nearby three decades, India opted for liberal economic regime in early 1990s. Since than it has emerged as one of the fastest growing economies in the world. However, concerns have been raised about the distributional consequences of liberalization. This paper attempts to quantify the impact of trade on wage inequality in Indian manufacturing sector. Estimating a relative wage equation with a panel of 49 manufacturing industries, paper found a positive association between increased trade and wage disparity in Indian manufacturing but the association is contingent on the direction of trade. Our results show that after controlling for skill biased technological change and other variables, trade, especially exports to developed and developing countries, have an opposite impact of wage disparity.

JEL Classification: F16, J31, O12

Keywords: wages inequality, trade, skill bias technological change

Introduction

Phenomenal decline trade and investment barriers have been the hall mark of last three decades. Since mid-1980s, a large number of developing countries have switched from inward looking to outward looking policies by dismantling trade and investment barriers. This along with massive technological advancement which facilitated production fragmentation has unleashed an unprecedented wave of globalization. There are ample evidences to show that increase in cross flow border trade and investment has accelerated economic growth in developing countries

* Associate Professor, RIS. Email: pankaj.vashisht@ris.org.in

Author is thankful to Author is immensely grateful to Professor Sachin Chaturvedi, Director General, RIS for his comments and suggestions. The views expressed personal. Usual disclaimers apply.

leading to higher level of per capita income (Irwin 2022). However, rapid globalization has also coincided with marked increase in wage inequality across the globe. This concurrence has sparked an intense debate about the distributional consequences of globalization in general and trade liberalization in particular.

Theoretically, impact of international trade on wage inequality is a contentious issue. The traditional trade theory (Heckscher-Ohlin model), which for long has been used as analytical framework for understanding the distributional consequences of economic liberalization predicts a favorable impact of trade/trade liberalization on within country wage inequality in developing countries. Assuming that the pattern of international trade is determined by factor endowment, it suggests that removal of trade and investment barriers triggers resource re-allocation in favour of unskilled labour-intensive sectors which reduces the wage disparity (Robertson, 2000). The Stopper Samuelsson (S-S) Theorem provides a convincing mathematic manifestation of this argument. In a simple two country, two products and two factors of production model, with certain assumptions, S-S theorem elegantly demonstrates how trade induced change in relative products prices alter the relative factor prices. It shows that removal of tariff by developing countries increases the relative prices and hence the relative profitability of unskilled labour-intensive products which induces reallocation of resources from the production of skill intensive products to unskilled intensive products, leading to increase in aggregate demand of unskilled labour. Since factor supply is assumed to be constant and market is fully competitive, it implies an increase in the relative return to unskilled labour and thus decline in wage inequality (Wood, 1994).

Despite theoretical brilliance, the traditional trade theory/S-S theorem has received a lot of criticism recently as it has failed to explain two stylized facts about the change in wage /income inequality observed during last three decades. First, the evidences have shown that contrary to the prediction of traditional trade theory, wage inequality, during last three decades, has increased in several developing countries which

opted for liberal trade and investment regime after mid 1980s (Robbins, 1996, Robbins and Gindling, 1999, Gorg and Strobl, 2002, Mazumdar and Agnoli, 2002). Second and more importantly, the rise in wage inequality in most of the countries, post globalization, have been primarily driven by within sector increase in wage inequality rather than between sector reallocation of labour. These anomalies motivated scholars to theoretically revisit the relation between trade and wage inequality. One strand of theoretical literature tried to explain the rise in wage inequality in developing countries by relaxing some of the assumptions of traditional trade theory/S-S theorem. These models showed that when traditional trade model is extended to more than two countries, factor abundance in relation to global economy becomes irrelevant (Davis, 1996). These models argue that a country which has unskilled labor abundance in relation to the global economy could still have abundance of skill labour in comparison to other countries which have similar resource endowments and range of products[1]. In such a case, the distributional consequence of economic liberalization could be opposite to what is predicted in S-S model. For example, India could be an unskilled labour abundant country in comparison to the world. However, it is not the case when India is compared to Bangladesh. Therefore, in case of trade liberalization, India can witness an increase in income inequalities as a result of surge in imports from Bangladesh and other least developed countries. This increase in inequalities can outweigh the equalizing effect of trade with developed countries, leading to an increase in overall wage inequality.

Though the extension of traditional trade theory to more than two countries provided a reasonable theoretical rationale for rise in wage inequality in developing countries post liberalization, these models did not address the issue of within sector rise in wage inequality. During 1990s, several studies demonstrated that wage inequality in developing as well as developed countries were primarily driven by within sector increase in wage inequality and between sector reallocation of employment was insignificant. Moreover, these studies also found a very strong relation between various proxies of technological change and within sector increase in wage inequality /wage gap (Davis and

Haltiwanger, 1991, Lawrence and Slaughter, 1993, Berman *et al.*, 1994). These evidences along with absence of any theoretical framework for linking trade with increase in within sector increase wage inequality motivated scholars to argue that rising wage inequality was primarily driven skill biased technological change (SBTC) and trade has no significant role in it (Berman *et al.*, 1994).

However, during late 1990s, few scholars internalize the complexities of modern production process in trade model to demonstrate channels through which trade directly contribute to increase in within sector wage inequality. One strand of this theoretical literature extended the traditional trade model to incorporate trade in intermediate goods. Highlighting the fact that modern day trade is driven by intra industry trade, these models argue that production of final goods can be split into intermediate stages and that different intermediate inputs differ in their skill intensities. These models assert that opening up of economy coupled with improved means of communication and transportation motivates producers in north to shift the production of low skill intensive intermediate products to developing countries, through outsourcing and /or FDI (Feensta and Henson, 1996, 1997). They further argue that products which are less skill intensive in the context of developed countries are expected to be skill intensive in the context of developing countries' labour markets. Therefore, the openness induced production fragmentation or outsourcing increase the within sector skill demand in developing countries leading to higher wage disparity. In another words, with the liberalization of FDI and trade, developing countries corner new skill intensive products which increase the within sector demand of skill labour leading to increase in within sector wage inequality both in developed as well as in developing countries (Hellier and Chusseau, 2013). Apart from highlighting the role of intermediate goods in international trade, few other trade models pointed out that modern production process includes combination of several activities such as manufacturing tasks, marketing, distribution, export services and so forth. These models argue that exporting, specially to developed countries is a skill intensive activity as it requires expertise in international business and social peculiarities of overseas market

(Matsuyama, 2007; Verhoogen, 2008; Brambilla *et al.* 2010). Therefore, participation in exports market increases the skill demand in all industry leading to higher wage inequality even if the manufacturing task is not skill intensive (Brambilla *et al.* 2010).

More recently, empirical evidences have shown that due to labour market imperfection such as search & matching frictions and efficiency/ fair wage, different firms within a sector pay different wages to workers with same characteristics and firm wage vary with revenue/ size of firm (Amiti and Devis, 2012; Davidson and Matusz, 2010). This coupled with the seminal work of Melitz (2003) which exhibit that trade liberalization affects firms unevenly within a sector, opened up another channel for trade to affect within sector wage inequality. These models of firm heterogeneity and international trade suggest that trade liberalization induced surge in import results in a reallocation of resources toward more productive firms within a sector as less productive firms exit, intermediate-productive domestic firms shrink and high-productive exporting firms expand (Akerman *et al*. 2013). During this process, within sector wage inequality could rise due to wage dispersion between firms within a sector.

After pursuing inward looking policies for more than three decades, India started opening up to international trade and investment in early 1990s. Since than it has gradually phased out all restrictions on foreign direct investment and has also reduced tariff and well as non-tariff barriers on imports phenomenally. Given the noticeable increase in GDP growth since the adoption of liberal economic policies, there is little doubt that increased trade and investment integration has augur well for India (Joseph *et al*. 2018). However, the question is whether the gains form higher foreign trade and investment has been distributed equally? Few studies have attempted to answer this question by analyzing the wage disparity between skill and unskilled workers. These studies differ significantly in their estimation methodology, time period of analysis, as well as conclusion arrived. Given the scarcity of data, most of the Indian studies have examined the distributional consequences of

economic liberalization by using the industry level data from Annual Survey of Industry (Banga, 2005; Ramaswami, 2008 and Sen, 2009). These studies unanimously reported an increase in wage inequality after the adoption of liberalized economic regime in 1991-92. However, they differ significantly in their explanation for rising wage inequality. Using demand supply framework, Banga (2005) attributed the rise in wage inequality exclusively to FDI and trade (import of capital goods) induced skill biased technological change (SBTC). She reported that increase in exports raised the demand for unskilled workers in Indian manufacturing sector. However, the FDI and trade induced SBTC outweigh the equalizing effect of exports leading to increase in overall wage inequality.

Sen (2009), on the other hand provided two explanations for increasing wage inequality in Indian manufacturing. He asserted that trade apart from inducing SBTP, have also contributed to increase in wage inequality through price channel (S-S effect). He pointed out that unskilled intensive industries witnessed a higher decline in effective rate of protection during 1980 to 1997 which reduced the relative prices of unskilled labour-intensive products, leading decline in relative return to unskilled labour. He, therefore, asserted that part of the increase in wage inequality could be explained through S-S theorem. Ramaswami (2008) extended the analysis of wage inequality to 2004. He examined the impact of trade, technology and labour regulations on wage inequality in Indian manufacturing from 1980 to 2004. Estimating the variable cost function, he identified SBTP and restrictive labour regulations as key responsible factors for increasing wage inequality. Interestingly, he did not find any significant relation between trade and wage inequality. However, he argued that skill biased technological change has been an endogenous response to trade liberalization.

Notably, studies on wage disparity in India are quite dated. All the studies mentioned above primary deals with the decades of 1980s and 1990s and hence ignores some key policy changes such as the removal

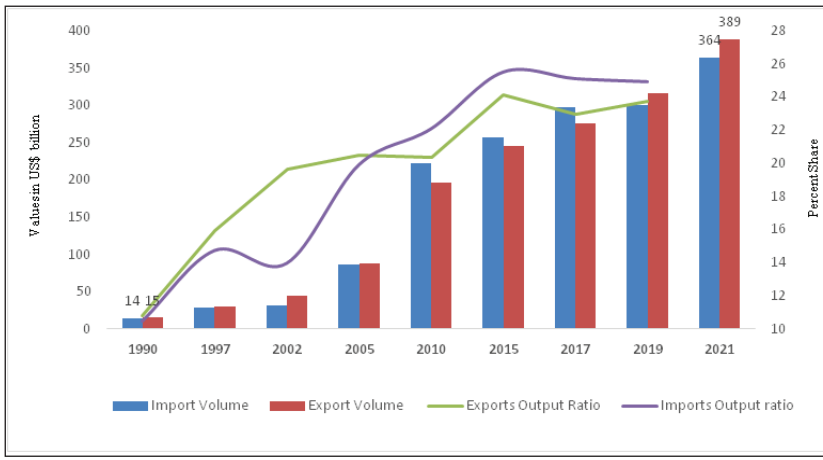
of quantitative restrictions on the import of consumer goods and the removal of reservation for small-scale units. These policy changes can potentially have significant implications for trade and income/wage inequality. Moreover, none of these studies have attempted to segregate the impact of trade with developed and developing countries on wage disparity in India. Against this backdrop, this paper revisits the impact of international trade and wage inequality in Indian manufacturing using a dynamic panel of 49 manufacturing industries. Based on most recent available data, empirical evidence presented in this paper shows that trade liberalization in India is indeed been associated with increased wage inequalities in Indian manufacturing. However, the association is contingent to the direction of trade as trade with developed countries is positively associated with wage inequalities while trade with developing countries, especially export, have negative association with wage disparity.

The paper is structured as follow: After introduction, section 2 provides some stylized fact about the economic liberalization and wage disparity in Indian manufacturing sector. Section 3 deals with estimation methodology and lists the data sources used while empirical results are reported in section 4. Finally, section 5 concludes the paper with recapitulation of main findings.

Economic Liberalization and Wage Inequality: Some Stylized Facts

Indian economic policy has completed a full circle over the last seven decades. After inheriting a liberal economic regime from its colonial rulers, Indian policy makers adopted import substitution policies to fuel industrialization in mid-1950 (Panagariya, 2004). Gradually an unscalable wall of tariff and non-tariff barrier was built which completely isolated Indian economy from rest of the world for next three decades. However, import substitution policies, despite giving some impetus to industrialisation, failed to put India on the path of rapid industrialisation,

Figure 1: Global Integration of Indian Manufacturing Sector



Source: Author's calculation from UNCOMTRADE and ASI data.

forcing the policy makers to rethink the developmental strategy. Recognising the role of technology in fuelling long run growth, Indian policy makers started liberalizing the imports of capital goods in 1978 (Vashisht, 2016). However, the liberalisation till early 1990s remained confined to selected capital goods and key raw materials only. Indian trade policy took a radical change in early 1990s when India faced a serious balance of payment crisis.

A process of radical trade liberalization was initiated in 1991 and sustained in following years. Post 1991 trade reforms were caried out in three distinct phases (Panagariya, 2004). During first phase, 1991 to 1998, trade reforms remained concentrated on gradual reduction of tariff without removing the quantitative restrictions on the imports of consumer goods. In second phase, 1998 to 2001, focus shifted to removal of quantitative restrictions on imports while keeping the tariff rate intact. The third phase started in 2004 when India embarked on the path of pre announced tariff liberalisation that brought the average tariff on industrial

goods to below 10 per cent. This massive easing of tariff and non-tariff barriers resulted in a significant increase in imports of manufactured products. The volume of imports which was below US$15 billion in 1990-91 jumped to US$364 billion in 2020-221. Notably, growth in import outperformed the growth in domestic production during this period leading to rapid surge in import to output ratio from around 10 per cent in 1990-91 to more than 25 per cent in 2017-18.

During the import substitution era, India followed a fixed exchange rate regime and exchange rate was kept very high to facilitate the import of selected capital goods deemed essential for industrialisation. The artificial high exchange rate worked as a major deterrent and kept the Indian exports very low. In order to remove the inherent bias against exports, Indian government started devaluating Indian rupee in mid 80s before switching to a floating exchange rate regime in 1993. The devaluation of rupee boosted the export competitiveness. Consequently, volume as well as export intensity of Indian manufacturing witnessed a surge in post reform period (Figure 1). Exchange rate and trade liberalisation were also accompanied by removal of restriction on foreign direct investment which led to increase in foreign direct investment inflow in Indian industries.

Wage Inequality

Change in trade and FDI policy in India has coincided with a significant change in wage inequality within Indian manufacturing sector. An analysis of real wages in Indian manufacturing show that the real wage rate of skilled (managerial and supervisors Staff) and unskilled workers (production workers) grew hand in hand during 1980s. In fact, the real wage of unskilled workers grew slightly at a higher rate as compare to the growth in real wage of skilled workers (Table 1). Consequently, the wage inequality[2] in Indian manufacturing witnessed a marginal decline during the decade of 1980s (Table 2). Similar trend was observed among most of the industries at 3-digit level of NIC.[3] An analysis of wage inequality by type of industries shows that all export-oriented industries put together[4] witnessed a decline of 4.04 per cent in wage inequality, while it came

down by 3.67 per cent in other industries during 1980s. However, the biggest decline in wage inequality was observed in import competing industries where it declined by 8.33 per cent.

Table 1: Average Annual Growth Rate of Real Wage Rate of Skilled and Unskilled Workers

	1980-81-1989-90		1989-90-1996-97		1996-97-2017-18	
	Skilled Workers	**Unskilled Workers**	**Skilled Workers**	**Unskilled Workers**	**Skilled Workers**	**Unskilled Workers**
All Industries	2.71	3.37	1.89	1.09	2.19	0.64
Export Oriented	1.24	1.47	0.80	-0.67	1.83	0.74
Import Competing	2.00	3.35	2.57	1.67	2.90	0.21
Other	3.39	4.55	2.02	1.77	2.10	0.76

Source: Authors' Compilation from ASI data.
Note: ASI data provides information number of managerial and supervisory staff and production workers and their wage bill nominal price separately. Using this information, we first calculated the wage rate of skilled and unskilled workers and then used consumer price index to get the real wage rate.

The real wage of skilled and unskilled workers witnessed a completely opposite trend after the implementation of radical economic reform of 1990s, especially after 1996-97. The average real wage of unskilled workers maintained an upward trend till mid-1990s. However, the trend reversed as the real wage of unskilled workers started stagnating from 1995-96 onward. From 1996-97 to 2010-11, the real wage rate of unskilled workers witnessed a negative growth while the real wage of skilled workers, during same period, witnessed an impressive growth leading to around 81 percent increase in wage disparity between skilled and unskilled workers (Table 2). After remaining stagnant for more than a decade, the real wage of unskilled workers registered respectable growth after 2011-12 which led to the margin decline in wage inequality.

However, wage inequality has remained much higher than the level of pre-reform period. At disaggregate level, though all 3-digit industries witnessed an increase in wage inequality in post reform period, the rate of increase has been particularly high among the import competing and other industries. The increase in wage disparities has been least pronounced in export-oriented industries (Table 2).

Table 2: Wage Inequality between Skilled and Unskilled Workers

	1980-81	1989-90	1996-97	2009-10	2017-18
All Industries	2.03	1.99	2.09	3.79	3.21
Export Oriented	1.76	1.69	1.86	2.99	2.77
Import Competing	1.86	1.71	1.83	3.45	3.26
Others	2.19	2.11	2.12	3.92	3.18

Source: Authors' calculation from Annual Survey of Industry

Decomposition of Wage Inequality

Increase in wage inequality between skilled and unskilled workers reported in section above implies an outward shift in relative demand curve for skilled workers in Indian manufacturing sector during post reform period. At aggregate level, this shift can occur due to shift of in employment from low skill intensive sectors to high skill intensive sector or increase in relative demand for skilled workers within all industries. As per tradition trade theory, trade openness affects wages through inter-industry reallocation of labour. However, skilled biased technological Change hypothesis as well as New Trade theory suggest that within industry reallocation can also drive the relative shift in labour demand curve. In order to examine whether overall wage inequality in Indian manufacturing is driven by employment reallocation between sector or within sector, we decompose the overall change in wage inequality into within and between-group components[5]. Despite being sensitive to the level of aggregation, decomposition analysis provides useful insights.

The results of decomposition exercise, reported in Table 3, clearly shows that increase in wage inequality between skilled and unskilled workers in Indian manufacturing sector is driven by within sector/ industry change as between industry allocation is insignificant.

Table 3: Decomposition of Change in Wage Inequality

	1980-81 to 1990-91	1991-91 to 2017-18
Change in Wage Inequality	-0.12	1.30
Within Industry Change	-0.13	1.27

Source: Author's calculation based on ASI data

Methodology and Data Sources

The previous Section clearly shows widening wage disparity in Indian manufacturing sector after the implementation of liberal economic policy. Moreover, the change in wage inequality is driven by within sector effect. Has trade played role in widening the within sector wage inequality? In order to answer this question, we employ relative wage equation which is rooted in demand supply framework. Following seminal work of Katz and Murphy (1992), the demand supply framework can be represented by two factor CES production function with unskilled labour (U) and skilled (S) labour as follow:

$$Y = f\,(S_t, U_t) = [\,\lambda\,(\varphi_{Ut}\,U_t)^{\rho} + \,(1-\lambda)\,(\varphi_{St} S_t)^{\rho}\,]^{\frac{1}{\rho}} \qquad \ldots.1$$

Where Y is output, λ is technology parameter, U is unskilled labour, S is skilled labour, φ_U and φ_S are skill specific technology level or accumulated human capital, which are functions of labour efficiency units and the parameter $\rho < 1$ and t stands for time. The elasticity of substitution between unskilled and skilled labour is $\sigma = 1/(1-\rho)$.

Under certain assumptions one can derive a formula for the wage of skilled relative to unskilled workers (wage gap) as follow[6].

$$\ln\left(\frac{W_{St}}{W_{Ut}}\right) = \frac{1}{\sigma}\left(D_t - \ln\left(\frac{S_t}{U_t}\right)\right) \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Equation 2 shows that change in relative wage is a function skill intensity and other demand shifting factors which may include trade, technology, etc. The skill intensity has a negative relation with wage inequality. The impact of demand shifter on wage inequality is ambiguous and depends on the elasticity of substitution. Change in D_t can occur due to several factor such as technological change or change in product demand. For empirical purpose, the unobservable time series of D_t can be substituted with a time trend and/or with proxies for change in trade, technology etc. By replace D_t with proxies of trade and technology, equation 2 can be rewritten in a panel format as follow.

$$\ln\left(\frac{W_{Sit}}{W_{Uit}}\right) = a + b_0 \ln X_{it} + b_1 \ln Y_{it} - b_2 \ln\left(\frac{S_{it}}{U_{it}}\right) + \tau_i + \epsilon_{it} \quad \ldots\ldots 3$$

Where $\left(\frac{W_{Sit}}{W_{Uit}}\right)$ annual real wage of skilled workers relative to unskilled workers, X represent various proxies of trade such as tariff rates, import, export, Y represents technological change and penetration of foreign firms, τ is sector specific fixed effect and ϵ is random disturbance term, i stands for sector and t stands for time.

Equation 3 is static relative wage equation which assumes instant adjustment. However, given the labour laws which prohibits hire and fire, instant adjustment of labour force in Indian manufacturing is not possible. In such a case, labour market variable become path dependent which makes it mandatory to control for the lag of independent variable. Keeping this in mind, we use following dynamic relative wage equation to examine the impact of trade and technology on wage inequality in Indian manufacturing.

$$\ln\left(\frac{W_{Sit}}{W_{Uit}}\right) = a + b_0 \ln X_{it} + b_1 \ln Y_{it} - b_2 \ln\left(\frac{S_{it}}{U_{it}}\right) + b_3 \ln\left(\frac{W_{Sit}}{W_{Uit}}\right)_{t-1} + \tau_i + \epsilon_{it} \quad \ldots\ldots 4$$

Estimation Technique

Panel data estimation requires handling sector specific fixed effect. Fixed effect and random effect are commonly used estimation techniques while dealing with panel data. However, in case of a dynamic panel such as our, use of even these techniques is problematic because the presence of lagged dependent variable on the right-hand makes the LSDV and GLS estimators biased and inconsistent (Baltagi 2005). Two alternatives have been developed to deal with this problem. One option is to use various version of Generalized Method of Moments (GMM) while another option is to uses bias corrected LSDV estimator and selection between these two depends on data dimension. Though GMM have become extremely popular, they are ideal for data with very large N and small T (number of cross-sections and number of time-periods respectively). Studies have shown that GMM does not have any advantage when T and N are of a similar dimension and that the within-group estimator is clearly better when T > N (Alvarez and Arellano 2003). In other words, GMM are ideal for firm and plant level data which tend to have very small number of time period and very large number of cross sections entries. Since we have data on 49 manufacturing industries, spreading over a period of 29 years (1990-2018), the N in our data is modest and should be treated as fixed. Various Monte Carlo simulations have shown that in case of dynamic panel such as ours, the biased corrected LSDV estimator outperform the GMM estimators (Judson and Owen (1999). Hence, in this study we use bias-corrected LSDV (Least Squares Dummy Variable) technique, developed by Bruno 2004, to estimate our dynamic relative wage equation.

Data Sources

Estimation of equation 4 requires data on relative wage, trade as well as other control variables such as FDI and proxies of technological change. Unfortunately, data on all these variables is not available at one place. Therefore, we compile the required data from three data sources (i) the Annual Survey of Industries (ASI) published by Central Statistical Organization, (ii) UNCOMTRADE and (iii) Prowess. The Annual

Survey of Industry (ASI) provides the most reliable and comprehensive disaggregated data on the various aspects of manufacturing sector in India. However, there have been frequent changes in National Industrial Classification (NIC),[7] which makes the older series and new series of ASI data incomparable. Therefore, for any meaningful time series analysis of the manufacturing sector, it is essential to work out a concordance between different National Industrial Classifications. The Economic and Political Weekly Research Foundation (EPWRF) has created a consistent electronic database by using the summery results of ASI from 1973 to 2003-04. We draw data up to 2003-04 from EPWRF CD Volume II. For the remaining years, we have taken the data from ASI summary results, after working out a concordance using the concordance table provided by the Central Statistical Organization (CSO). The industry wise import tariff, imports and exports volume data have been compiled from UNCOMTRADE. Technology[8] and FDI related variables have been compiled from the Prowess database. Prowess provides firm-level data with coverage of more than 10,000 firms. It allows identifying sectors in which a firm is operating at the four-digit level of the National Industrial Classification (NIC). We extracted share of FDI firm in total sale and share of imported capital in total capital stock from Prowess and aggregated the firms for each sector at the 3-digit level of NIC to make it comparable with ASI data.

Result and Discussion

We estimated equation 4 with a panel of 49 industries using Biased Corrected Least Square estimator (Bias Corrected LSDV) and results are reported in Tables 4 and 5. Column 1 of Table 4 shows the estimated result of our base equation, where wage inequalities have been regressed on relative skill intensity and lag of independent variable. The equation is well specified as all coefficients are significant with expected signs. Results show that wage inequality in Indian manufacturing sector is strongly associated with past value which confirms the rigidities in labour market. The coefficient of skill intensity is negative and significant at one percent. The estimated elasticity of substitution is $-(1/-0.411) = 2.43$ which implies that one per cent increase in the relative employment

of skilled labour reduces wage inequality by 2.43 per cent. A positive and significant coefficient of time trend indicates that there has been an exogenous increase in relative wage of skilled workers, which is independent from the substitution effect mentioned above.

Table 4: Relative Wage Equation for Manufacturing Sector: Results

Dependent Variable: Log Wage Inequality			
	1	**2**	3
Log Wage Ineqiality$_{t-1}$	0.553*	0.541*	0.538*
	(20.03)	(19.68)	(19.52)
Log Skill Intensity	-0.411*	-0.401*	-0.405*
	(-13.08)	(-12.45)	(-12.49)
Time	0.012*	0.010*	0.009*
	(9.31)	(5.76)	(4.33)
Log Tariff		-0.100*	
		(-2.41)	
Log Export / Output Ratio			-0.004
			(-0.26)
Log Imports /Output Ratio			0.041*
			(2.96)
Log Share of Foreign firms in Sale		-0.005	-0.007
		(-0.35)	(-0.42)
Log Share of Imported Capital		0.022***	0.026***
		(1.66)	(1.78)
Industry Dummies	Yes	Yes	Yes
Time Period	1990-2018	1989-2018	1989-2018
Observations	1372	1372	1372

Note: (*), (***) significant at 1 and 10 percent respectively. Absolute values of z statistics in parentheses

Since we are interested in examining the role of international trade, FDI and technology in accelerating the wage disparity, we re-estimated the basic relative wage equation after augmenting it with these variables.

To start with, we estimated our equation by using import tariff as an indicator of trade liberalization. The results are reported in column 2. It is evident that the relative wage equation is robust to the inclusion of trade and technology proxies1 as the coefficients of other variables remained unchanged. Results show that import tariff is negatively related with the wage inequality. A statistically significant coefficient of -0.143 implies that reduction in import tariff has contributed to within sector increase in wage inequality significantly. This is consistent with heterogenous firm models which show that heightened import competition triggers resource reallocation within sector leading to rise in wage inequality. The proxy of technological change turnout to be positively associated with wage inequality. Our results show that share of imported capital in gross fixed capital stock is positively associated with wage disparity in Indian manufacturing. It is very much in line with general perception which states that adoption of imported technology increases the demand for skilled workers and hence leads higher wage inequality. With respect to indicators of investment integration, we find that after controlling for other variables, inward FDI, measured as share of foreign firms in total sale, has a negative but insignificant relation with wage inequality. Given the fact that FDI in India has remained restricted to services and couple of manufacturing sectors, insignificant association between wage disparity in manufacturing sector is not very surprising.

In column 3 we replace import tariff with import and export output ratios. Results in column 3 show that import to output ratio has positive and significant relation with wage inequality which is consistent with the theoretical preposition of new trade theory. Notably, the coefficient of export to output ratio turned out to be negative but insignificant. Though the coefficient is insignificant at conventional level, it underlines the fact that import and export is having different implications for wage inequality in Indian manufacturing.

Results reported in Table 3, use aggregate imports and exports and do not take into account the destination of exports and origin of imports. There are theoretical reasons to believe that trade especially exports to developed and developing countries could potentially have

different implication for skill demand and therefore for wage inequality (Brambilla *et al*. 2010). Keeping this point in mind, in Table 4, we have investigated whether trade with developed and developing countries differ in their impacts on wage inequality. Results show that imports from developed as well as developing countries are positively related with wage inequality. However, the coefficient is significant only in case of imports from developed countries. In contrast, the impact of exports to develop and developing countries on wage inequality turned out to be completely opposite to each other. A negative and significant coefficient of exports to developing countries shows that exports to developing countries increase the demand of unskilled labour and hence reduce the wage gap between skill and unskilled workers. In comparison to this, the coefficient of exports to developed countries turned out to be positive but insignificant. Despite being insignificant, it indicates that exports to developed countries tend to increase the demand for skilled workers in developing countries. These results are consistent with the findings of Brambilla (2010) which using Argentine data show that activities needed to access high income countries needs more skill labour which increases wage inequality.

Table 5: Relative Wage Equation for Manufacturing Sector, Trade by Origin

Dependent Variable: Log wage inequality	
	1
Log Wage Inequalityt$_{-1}$	0.525*
	(18.49)
Log Skill Intensity	-0.410*
	(-12.14)
Time (γ_1)	0.010*
	(4.77)
Log Share of Foreign Firms in Sale	0.002
	(0.16)
Log Imports from Developing Countries	0.018
	(1.21)

Log Imports from Developed Countries	0.039***
	(1.73)
Log Exports to Developed Countries	0.011
	(0.31)
Log Exports to Developing Countries	-0.046**
	(-2.31)
Log Imported Capital Share	0.019**
	(2.25)
Industry Dummies	Yes
Time Period	1990-2018
No. of Observation	1372

Note: (*), (**), (***) significant at 1, 5 and 10 percent respectively Absolute values of z statistics in parentheses

Conclusion

Phenomenal increase in globalization has been the hall mark of last three decades. Since mid-1980s, several developing countries have dismantled trade and investment barriers which have led to multifold increase in cross border trade and investment. Though these changes have accelerated economic growth across most of the countries, concern has been raised about the distributional consequences to globalization. India too has been one of the prominent countries which embraced liberal economic regime in mid-1980s. Since then, it has reduced restriction on foreign trade and investment. These changes have coincided with an impressive acceleration in economic growth. However, few scholars have argued that the rising tide has not lifted all boasts. Studies have shown that wage inequality in India has increased after the adoption of liberal economic regime. However, most of Indian studies on wage inequality are dated and do not examine the impact of trade on wage inequality according to the direction of trade. Against this backdrop, this paper revisited the issue of international trade and wage inequality in Indian manufacturing sector.

Our analysis show that wages of skilled and unskilled workers witnessed a similar trend during 1980s. In fact, the wage of unskilled workers grew at a higher rate as compared to wage of skill worker leading

to a moderate decline in wage inequality during the decade of 1980s. However, the trend of skilled and unskilled wage started diverging after the implementation of economic reforms in early 1990s and divergence became glaring after 1998 when India removed the quantitative restriction on the imports of consumer goods. In line with this, aggregate wage inequality in Indian manufacturing has increased vertically, especially after 1998. Notably, the wage disparity has increased in all industries at 3-digit level of NIC. However, the increase in wage inequality has been significantly higher in import competing industries as the wage inequality in these industries increased by around 90 per cent from 1989-90 to 2017-18. In comparison to this, the export oriented have witnessed less than 64 per cent increase in wage inequality.

We estimated the relative wage equation to test whether trade, FDI and imported technology has played any direct role in widening wage inequality. The relative wage equation is estimated for a panel of 49 manufacturing industries at 3-digit level of NIC spanning the period of 1989-90 to 2017-18. The results show that use of imported capital has a very strong positive association with wage inequality which is very much in line with the hypothesis of skill Bias technological Progress. However, we did not find any significant relation between share of foreign firms in wage disparity. Regarding trade, our results show very interesting insights. We found that import liberalization is associated with increase in wage disparity. Unlike other Indian studies, we found a strong positive relation between increased import penetration and increase in wage inequality in Indian manufacturing sector. However, the association is contingent to direction of trade as our econometric analysis shows that imports from developed and developing countries differ in their impact on wage inequality. We found that, though, imports from developed as well as developing countries are positively related with wage inequality, the relation is significant only for imports from developed countries only. Regarding exports, our results are more telling as we found that impact of exports on wage inequality varies as per destination. Our results shows that exports to developing countries has reduced wage inequality while exports to developed countries is not associated with such positive outcome.

Acknowledgements: The author is grateful to Dr. Badri Narayanan Gopalakrishnan, Former Head, Trade, Commerce and Strategic Economic division of NITI Aayog for the useful comments and suggestions on an earlier version of this article. Needless to mention, he is not responsible for any errors that remain.

Endnotes

1 Davis (1996) describes a group of countries which have similar resource endowment proportion and produce similar range of goods as 'cone of diversification'.

2 Following standard international and Indian literature, wage inequality is defined as ratio between wages of skilled workers (managerial and supervisory staff) and wages of unskilled workers (production workers).

3 We have analyzed the wage inequality by clubbing all 3-digit industries into three groups (export oriented, import competing and others). At this aggregation, wage inequality declined in all three groups. However, it does not mean that wage inequality declined in all manufacturing sectors in1980s. An analysis of wage inequality for each industry separately shows that 13 industries witnessed a moderate to high increase in wage inequality during 1980s.

4 Following Ghose (2000), we have used net export as a ratio to total domestic output to identify the import competing and export-oriented industries. All industries which have net imports in access to five percent of their domestic output are categorized as import competing, while all industries which have net exports in access to five percent of their domestic output are classified as export oriented. The remaining industries are classified as others.

5 Mathematically, decomposition of change in wage disparity can be depicted as $\Delta RW_{jt} = \sum_i (\Delta RW_{it}\ E^*_i) + \sum_i (\Delta E_{it} RW^*_i)$ where E is the share of the sector in total employment, RW is relative wage of skill workers to unskilled workers, i stands for the sector/industry, t stands for time, overhead * denotes the average over time. The first term in the equation captures the within sector effect while second terms capture the between sector effect.

6 For step-to-step derivation of equation 2 from equation 1 please see Galego (2006)

7 The NIC classification is a standardized categorization of economic activities, according to which economic data is tabulated

8 Measuring technological change is a very difficult task. Scholars have used various proxies such as accumulation of ICT capital, imports of capital goods, change in Total Factor Productivity (TFP) etc. to capture the technological change. Among these, share of ICT capital is the most appropriate indicator of technological change. ASI unit level data provides information on ICT capital. However, ICT capital data reported in ASI in its current form seriously underestimates the extent of ICT capital as it only accounts for office equipment and computer-linked production machines are not included in it.

[9] We also experimented with TFP as indicators of technological change instead of share of imported capital. The inclusion of TFP did not affect our results pertaining to other variables. However, the coefficient of TFP did not turn out to be significant. Therefore, we persisted imported capital as an indicator of technological change.

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Core IV-B, Fourth Floor, India Habitat Centre
Lodhi Road, New Delhi-110 003 India., Tel. 91-11-24682177-80
Fax: 91-11-24682173-74, Email: dgoffice@ris.org.in
Website: http://www.ris.org.in