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Is there any relationship between Marginal Intra-Industry Trade and Employment Change? Evidence from Indian Industries

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Abstract

While India has developed deeper integration with global trade flows since the economic reforms initiated in 1991 in general, the simultaneous exports and imports with partner countries have witnessed considerable rise in particular. There exists a rich literature on India's aggregate as well as sectoral overlapping trade, termed as Intra-Industry Trade (IIT). It is however argued that the static measures of IIT fails to capture the dynamism involved, and Marginal Intra-Industry Trade (MIIT) index is used to compute the trade overlap for this purpose. The current analysis observes a rising trend in India's MIIT in select industrial sectors since 2001. However, India is also suffering from a rising trade deficit in several industrial sectors, and a possible trade-led employment effect cannot be ruled out. Given this background, the current analysis explores the relationship between MIIT and employment changes in the selected sectors. In addition, the stability analysis explores the differing influence of the independent variables on employment changes, based on trade balance pattern. The empirical results indicate that MIIT, increase in productivity, skilled workforce intensity, trade balance, trade openness and FDI inflows significantly influence absolute employment changes. Moreover, sectors with higher MIIT, high relative growth rate, skill intensity and trade balance facilitate higher absolute changes in employment.

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1. Introduction

Since 1960s trade overlap, i.e., simultaneous exports and imports within sectors, emerged as a major phenomenon in industrial trade. This overlapping trade has been termed as 'intra-industry trade' (IIT) in the literature (Balassa, 1966; Grubel and Lloyd, 1975). It is often argued that liberalization measures may increase the share of IIT in a country's trade flows (Globerman and Dean, 1990; Veeramani, 2003). India initiated a series of tariff and industrial policy reforms in 1991, with further interventions on FDI policy, ease of doing business, infrastructure etc. in subsequent period (Tendulkar and Bhavani, 2012; PHDCCI-KPMG, 2018). As part of its multilateral commitment, the country has also significantly recued its import tariffs since inception of WTO in 1995 (Mattoo and Stern, 2003; Veeramani, 2009; Bown and Tovar, 2011). The country also entered into a number of regional trade agreements (RTAs) since 2010-11, e.g., the Early Harvest Programme (EHP) under the Indo-Thai FTA (2004), Indo-Singapore Comprehensive Economic Cooperation Agreement (CECA) (2005), ASEAN-India FTA (2010), India-South Korea Comprehensive Economic Partnership Agreement (CEPA) (2010), India-Japan CEPA (2011) and Indo-Malaysia CECA (2011). It has been observed that apart from trade in general, IIT is prevalent in India's trade with the RTA partner countries as well (Ramakrishnan and Varma, 2014). However, it has been observed that India's growing imports from RTA partners, at a preferential tariff, can lead to threats for domestic players (Sahu and Surabhi, 2017).

In particular, over the last decade India has deepened its participation in Asian international production networks (IPNs) for several key industrial sectors (Anukoonwattaka and Mikic, 2011; Athukorala, 2014). It has been observed that India's manufacturing trade is considerably overlapped (Veeranmani, 2009; Aggarwal and Chakraborty, 2017), with the IIT being predominantly vertical in key manufacturing sectors (Veeramani, 2002; Aggarwal and Chakraborty, 2020). It has been argued that the industries characterized by higher IIT indices may witness less structural changes in the post-reform period, as reflected from change in sectoral employment pattern (Brulhart and Elliott, 2002) and vice versa (Hamilton and Kniest, 1991). This phenomenon is known as the 'Smooth Adjustment Hypothesis' (SAH) in the literature. The lower adjustment costs for high-IIT sectors can be explained by reallocation of resources among firms within the same industry (Brulhart *et al*., 2006) and the consequent intra-sector readjustment-related advantages (e.g., lower labour re-training cost). While India's trade has increased significantly through the multilateral, regional as well as unilateral initiatives, the trade balance has however been negative vis-à-vis a number of RTA partners as well as non-partner countries (Chakraborty *et al*, 2019; Sarma, 2020). The growing trade deficits, resulting from reduction of preferential tariff barriers, may lead to adjustment cost concerns (Chaudhuri, 2013).

In this background, the current analysis explores interrelationship between IIT and labour market adjustment effects involving seven Indian manufacturing sectors over 2001-15.[1] The analysis is arranged along the following lines. First, a brief review of literature and the indices used are presented. The empirical model and data for the analysis are explained next. Finally, based on obtained results, certain policy conclusions are drawn.

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[1] A modified version of this analysis has been selected for publication at the *Journal of South Asian Development* (Aggarwal and Chakraborty, forthcoming).

2. Capturing Both-way Trade Dynamism

There is a rich literature on measuring simultaneous exports and imports through the IIT index, following the Grubel-Lloyd (1975) method and other indices (Aquino, 1997). However, it has been argued that while measuring the structure of the change in trade flows, the G-L index suffer from certain limitations (Hamilton and Kniest, 1991). Hence, a number of studies have attempted to formulate a dynamic measure on IIT, namely the Marginal IIT (MIIT) index (Greenaway *et al.*, 1994; Brulhart, 1994; Lovely and Nelson, 2000, 2002; Brulhart et al., 2006). A number of MIIT indices have been proposed over the years in the context of analysing the trade-led adjustment effects. The MIIT measure proposed by Hamilton and Kniest (1991) deserves mention here ($MIIT_{HK}$). However, pointing to non-random omission of a significant number of statistical observations in this measure, Greenaway *et al.* (1994) proposed a modified index ($MIIT_{GHME}$) for capturing the MIIT. Pointing a limitation of $MIIT_{GHME}$, where IIT is not expressed as a ratio, Brulhart (1994) proposed a new measure, which was free from the shortcomings of both $MIIT_{HK}$ and $MIIT_{GHME}$. The index (B) is computed as:

$$B = \frac{\sum[(|\Delta X_{it}| + |\Delta M_{it}|) - |\Delta X_{it} - \Delta M_{it}|]}{\sum(|\Delta X_{it}| + |\Delta M_{it}|)} * 100$$

where, X_{it} and M_{it} represent the exports and imports of the i-th sector in period t respectively. The index varies from 0 to 100, where 0 indicates marginal trade in the particular industry to be completely of the inter-industry type and 100 represents marginal trade consisting entirely of IIT type. As the extent of changes in exports (ΔX) and imports (ΔM) determine the value of B, the index captures trade dynamism one hand and possess all the desired qualities of an index on the other.

While the B-index has been extensively used in the literature for exploring the influence of IIT on industrial adjustment (Brulhart and Thorpe, 2000; Veeramani, 2004), other MIIT indices have also been proposed in subsequent period. For instance, Azhar and Elliott (2004) have proposed the S-index, which depend on the relative sizes of opposing net trade changes. The S-index, which ranges between -1 and 1, is computed by the following formula:

$$S = \frac{\Delta X_t - \Delta M_t}{2(\max\{|\Delta X_t|, |\Delta M_t|\})}$$

The S-index is positive if sectoral trade balance improves, and negative otherwise. While a section of the literature has used this methodology for analysing the relationship between MIIT and employment change dynamics (Ferto, 2009; Azhar and Elliott, 2008), the current analysis uses the B-index for the empirical modelling.

3. MIIT and Labour Market Adjustment: Literature Review

A number of studies have attempted to compute MIIT index both for developed (Erlat and Erlat, 2003; Cabral and Silva, 2006; Ferto, 2009; Cernosa, 2012) and developing countries (Oliveras and Terra, 1997; Brulhart and Thorpe, 2000; Veeramani, 2007) and link the same to the employment change scenario (Brulhart and Elliot 1998; Sarris *et al.*, 1999; Tharakan and Calfat 1999; Brulhart and Thorpe 2000; Ferto 2009; Thorpe and Leitao 2012). A major section of the literature observed that sectors characterized by higher IIT indeed witness lower employment change dynamics, primarily involving the developed countries, e.g.: Australia (Thorpe and Lietao, 2012), Hungary (Ferto, 2009), Portugal and UK (Cabral and Silva, 2006), Turkey (Erlat and Erlat, 2003), UK (Brulhart *et al*., 2006). On the other hand, another section of the literature, involving both developed (Central Europe, Cernosa, 2012; UK, Haynes *et al*., 2002) and developing (Malaysia, Brulhart and Thorpe, 2000; Turkey, Erlat and Erlat, 2006; Aggarwal and Chakraborty, forthcoming) countries, observed no conclusive evidence on this front. The mixed evidence underlines the possible importance of the country as well as industry-specific factors in influencing the employment pattern for sectors characterised by IIT.

While in the pre-reform days India witnessed a modest IIT trend (Pant and Barua, 1986), in the post-reform period a general rise in IIT, both at aggregate and sectoral levels, has been observed (Chakraborty, 2002; Veeramani, 2002; Veeramani, 2004; Chakraborty and Chakraborty, 2005; Burange and Chaddha, 2008; Aggarwal and Chakraborty, 2017; Burange *et al*., 2017; Aggarwal and Chakraborty, forthcoming). In line with rise in IIT, a rise in the MIIT indices across Indian manufacturing segments have been reported in the post-reform period as well, underlining the trade dynamism (Veeramani, 2002; Veeramani, 2004; Kelkar and Burange, 2016; Aggarwal and Chakraborty, forthcoming). The rise in trade in general and IIT in particular has however not led to significant impact on employment creation (Das *et al*., 2014; Raj and Sasidharan, 2015). The literature on trade-employment interrelationship in India attribute the absence of trade-induced employment growth to multiple factors, namely: skill-intensive nature of India’s exports, growth in labour productivity and shedding of excess labour by many manufacturing units and so on (Raj and Sen, 2012). In all, the trade induced employment growth effect has not been strong in India, contrary to the evidence of other Asian neighbours (Vashisht, 2015).

4. Data, Indices and Model

4.1 Data

The study period of the current study is 2001-15. The sectors for the current analysis have been selected by evidence on higher IIT in global sectoral trade on one hand and the same in the Indian context on the other (Aggarwal and Chakraborty, 2019). The selected manufacturing sectors include: chemicals, leather and footwear, textiles and garments, iron and steel, base metals, electrical machinery and equipment and vehicles and auto-components. For the purpose of the current analysis, data on 56 manufacturing segments at National Industrial Classification (NIC) 4-digit levels have been drawn from Annual Survey of Industries (ASI) results (GoI, undated). The data for this study period has been reported in three classifications, namely: NIC-1998, NIC-2004 and NIC-2008. All the industry-related and employment-specific variables for the period are collected directly from ASI. In addition, certain industry-specific data has been drawn from PROWESS database (CMIE, undated). On the other hand, trade data at HS 4-digit level (i.e., tariff headings), available in Harmonized System (HS) classification, are drawn from Trade Map database, maintained by International Trade Centre (ITC) (ITC, undated).[2]

[2] For the empirical analysis, a concordance between the trade codes (reported in HS) and the corresponding industry codes (reported in NIC) has been developed by matching the nearest product descriptions (Aggarwal and Chakraborty, forthcoming).

4.2 Trade Overlap, IIT and Cross Sectional MIIT

Table 1 reports the importance of the selected commodities in India's trade basket. It is observed that the collective importance of the commodities has gradually declined in India's export basket upto 2015, but improved in the subsequent period. A similar trend is noticed on the import front as well. The result underlines the possible influence of the 'Make-in-India' initiative launched in 2014 on one hand and the growing integration of the country in the Asian IPNs on the other (Nag, 2016).

Table 2 notes the trade balance scenario involving the sectors selected for the analysis. It is observed that while the aggregate trade balance was positive during 2001-05, it has turned negative in the subsequent period. Interestingly, for the labour-intensive (e.g., textile, footwear) and low-to-moderate capital-intensive segments (e.g., leather, iron and steel) the country is enjoying trade surpluses. On the other hand, barring the exception of auto-components and transport equipment, the country's trade balance is generally negative for the sectors with higher capital-intensity (e.g., chemicals, machinery). Of course, several auto-components produced by micro, small and medium enterprises (MSMEs) are also classified within this sector. As the low-technology sectors are also labour-intensive in nature, an interesting dynamic resulting from trade liberalization may be noticed in the labour market.

To understand the reform perspective in the selected sectors, the average applied tariff, maximum value of applied tariff imposed within the product group (i.e., at the HS 2-digit or HS section level) and the percentage share of duty-free imports for the corresponding product segments are reported in Table 3. An interesting picture emerges from the Table. While the sectoral tariff barriers have generally come down upto 2015, an increasing trend is noticed in the subsequent period. In addition, the declining trade balance in sectors like machinery and equipment, as reported in Table 2, can be directly linked with the progress in tariff reforms. In particular, from 2010-11, the rising imports from RTA partner countries increased, which led to significant import stress on the domestic sectors and concerns towards further reforms through preferential routes were expressed (Gaur, 2019). The gradual reduction in import tariffs have considerably facilitated the both-way trade in the selected products in the country. Therefore, the recent inclination towards protectionism need to be viewed in light of the emerging threats to the industries. The possibility of employment repercussions arising from these trade reforms and their interrelationship with the dynamic IIT pattern can therefore provide interesting insights.

IIT measurement can be conducted with the Grubel-Lloyd Uncorrected (GLU) formula, computed for country *j* involving industry *i* as the following:

$$\text{GLU} = \frac{\sum(X_{\text{ij}} + M_{\text{ij}}) - \sum|X_{\text{ij}} - M_{\text{ij}}|}{\sum(X_{\text{ij}} + M_{\text{ij}})} \times 100 \ldots\ldots (1)$$

where, X_{ij} and M_{ij} denote the value of export and imports of the home country with country *j* at HS 4-digit level respectively. For aggregate IIT, one need to consider all the HS 4-digit codes, while for sectoral IIT, one need to consider only the sector level classifications (e.g., for HS 42, from HS 4201 to HS 4206).

Table 1: Importance of Selected Indian Sectors in India's Trade Flows (average Percentage Share)

Commodity Groups	HS Codes	Exports (%)				Imports (%)			
		2001-05	2006-10	2011-15	2016-19	2001-05	2006-10	2011-15	2016-19
Inorganic Chemicals	28	0.69	0.68	0.49	0.56	1.82	1.30	1.15	1.37
Organic Chemicals	29	4.15	4.29	4.01	5.01	3.70	3.23	3.57	4.23
Raw Hides and Skin	41	0.87	0.46	0.39	0.27	0.31	0.16	0.13	0.14
Leather Products	42	1.57	0.85	0.77	0.82	0.02	0.03	0.06	0.10
Footwear	64	1.21	0.88	0.83	0.94	0.05	0.06	0.09	0.15
Textile and Garments	50-63	20.71	13.46	12.11	12.16	2.44	1.29	1.20	1.59
Iron and Steel	72	3.61	3.71	2.71	3.13	2.54	3.32	2.65	2.38
Articles of Iron and Steel	73	2.47	2.89	2.36	2.23	0.77	1.16	0.90	0.97
Base Metals	74-83	2.33	3.31	2.59	2.93	1.96	2.00	2.26	3.01
Machinery and Equipment	84	3.73	4.10	4.12	5.93	8.68	9.20	7.39	8.76
Electrical and Electronics Machinery and Equipment	85	2.79	3.91	3.36	3.60	7.67	7.99	7.12	10.47
Vehicles and Auto-components	87	2.55	3.32	4.32	5.56	0.66	0.95	1.08	1.23
Aggregate		**46.67**	**41.87**	**38.06**	**43.11**	**30.64**	**30.69**	**27.60**	**34.37**

Source: Author's computation from Trade Map data, International Trade Centre (undated)

Table 2*:* Average Trade Balance Scenario in India's Trade for Selected Sectors

Commodity Groups	HS Codes	Average Trade Balance (USD Billion)			
		2001-05	2006-10	2011-15	2016-19
Inorganic Chemicals	28	-1.02	-2.22	-3.75	-4.49
Organic Chemicals	29	-0.34	-1.40	-4.02	-3.75
Raw Hides and Skin	41	0.31	0.32	0.58	0.19
Leather Products	42	0.96	1.32	2.04	2.02
Footwear	64	0.73	1.29	2.09	2.14
Textile and Garments	50-63	11.19	19.06	30.96	29.45
Iron and Steel	72	0.17	-2.62	-3.71	-1.12
Articles of Iron and Steel	73	0.99	1.90	3.06	2.37
Base Metals	74-83	-0.06	0.38	-2.42	-4.68
Machinery and Equipment	84	-4.89	-17.10	-21.03	-21.02
Electrical and Electronics Machinery and Equipment	85	-4.78	-14.26	-21.77	-35.82
Vehicles and Auto-components	87	1.20	3.14	8.09	11.19
Aggregate		**4.47**	**-10.19**	**-9.89**	**-23.53**

Source: Author's computation from Trade Map data, International Trade Centre (undated)

Table 3: Import Tariff Scenario in India for Select Sectors

Commodity Groups	HS Codes	2005			2010			2015			2019		
		MFN Applied Duty (%)		Duty Free Import (%)	MFN Applied Duty (%)		Duty Free Import (%)	MFN Applied Duty (%)		Duty Free Import (%)	MFN Applied Duty (%)		Duty Free Import (%)
		Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum	
Cotton	52	17.0	30	0.0	12.0	30	98.0	6.0	30	99.9	26.0	30	0.0
Chemicals	28-38	15.0	100	0.4	7.9	10	1.9	7.9	10	2.2	10.2	100	0.2
Textiles	50-51, 53-60	20.2	268	0.0	14.7	170	0.0	11.8	147	0.0	22.3	112	0.0
Clothing	61-63	22.4	103	0.0	13.4	83	0.0	12.3	53	0.0	23.9	69	0.0
Leather and Footwear	41, 42, 64	15.4	70	0.1	10.2	70	0.0	10.1	70	0.1	13.1	70	0.0
Non-Electrical Machinery	84	14.3	15	27.6	7.3	10	17.0	7.1	10	23.3	8.1	20	19.0
Electrical Machinery	85	12.3	15	53.8	7.2	10	54.6	7.2	10	56.6	9.1	20	29.6
Vehicles and Auto-components	87	24.8	100	0.0	20.7	100	2.6	19.4	100	0.8	31.2	125	0.0

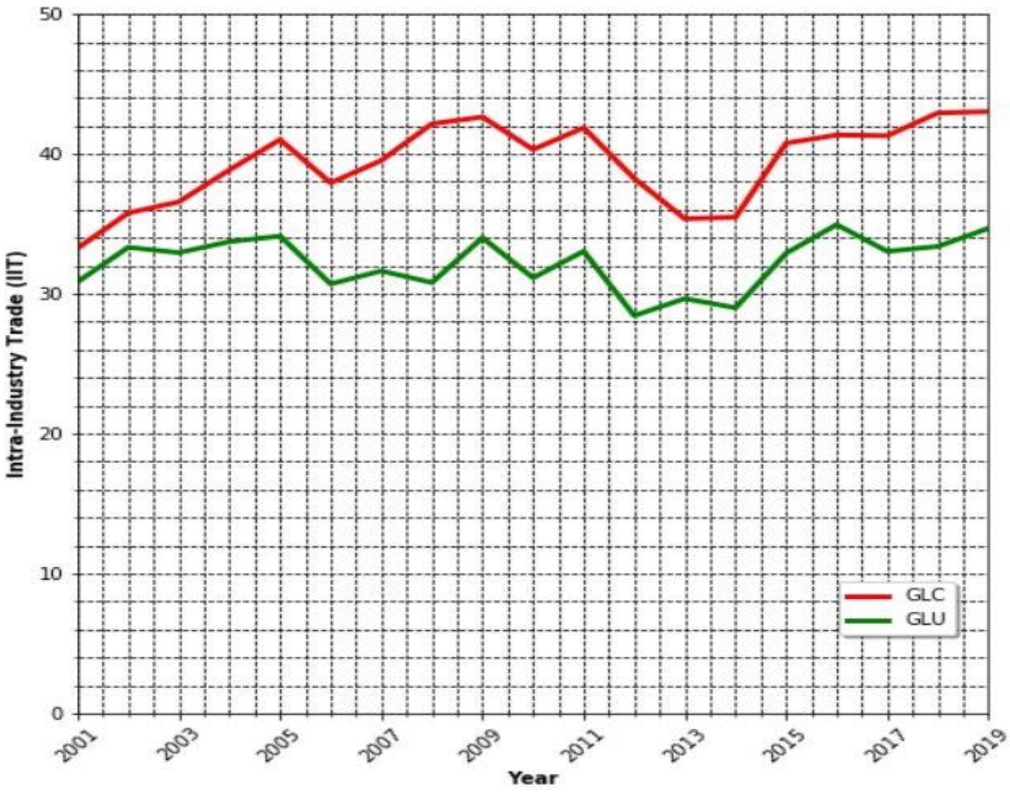
Source: Author's compilation from World Tariff Profiles, WTO (2006, 2011, 2015, 2020)

The bilateral IIT, computed either at aggregate or the sectoral trade level, was initially measured by the Grubel-Lloyd Uncorrected (GLU) index. However, it was later noted that the index leads to underestimation of IIT while measuring the trade overlap between countries with dissimilar development profile, owing to the trade imbalance effect. The problem was addressed by the Grubel-Lloyd Corrected (GLC) index, which computes IIT between home country and partner country *j* with the following formula (Grubel and Lloyd, 1975):

$$\text{GLC} = \frac{\sum(X_{ij} + M_{ij}) - \sum|X_{ij} - M_{ij}|}{\sum(X_{ij} + M_{ij}) - |\sum X_{ij} - \sum M_{ij}|} \times 100 \;\ldots..\;(2)$$

The current analysis first reports the aggregate IIT for India over 2001-19 by using both the G-L indices, which are reported in Figure 1. The figure clearly indicates that the IIT level has generally increased in the country over the years, though fluctuations in the index value have been observed. The figure further underlines the implications of the tariff reform measures in the country over the last two decades and the resulting rise in both-way trade.

Figure 1: India's Aggregate IIT with ROW (2001-2019)



Source: Authors' computation

The current analysis computes both the MIIT indices proposed by Brulhart (1994) and Azhar and Elliott (2004) for the selected product groups. The computed indices for five different years are reported in Table 4. The B index displays a fluctuating trend in MIIT over 2001-18, both at the aggregate and sectoral levels, though a general upward rising trend is observed. The upward trend in MIIT (B-index) implies lower divergence between the export and import changes over the period, underlining dynamism in India's IIT pattern. On the other hand, recently India's deeper integration with the world economy has led to deterioration of sectoral trade balances (as observed from Table 2 earlier), resulting considerable stress on domestic players (Chakraborty et al, forthcoming). The trade deficits are consequently reflected in negative S-index values for several industry-year combinations. Given the fact that unlike S-index, the B-index shows only positive values, the current study uses them for the empirical modelling part.[3]

4.3 Employment Scenario

While the service sector in India is characterized by 'jobless growth', the agriculture sector is suffering from disguised unemployment. Hence, for a country with India's population profile, the manufacturing sector holds immense importance for absorbing the country's growing workforce. It has often been noted that industrial sector growth in India has not been accompanied by a commensurate employment growth, as the sector is characterised by lower employment elasticity (IBEF, undated).

Share of employment in selected sectors (reported as percentage of overall employment in industrial sector) during 2001-15 are shown in Table 5. While the selected sectors continue to account for more than 50 percent of total employment across the industrial sectors, an interesting and mixed cross-sector dynamics is observed. While the employment shares of chemical and textile and clothing sectors have declined, there has been a rise in the corresponding figures in leather and footwear, iron and steel and vehicle and auto-components. It deserves mention that the footwear and automobile sectors are characterized by trade surpluses. The employment shares in capital-intensive sectors (base metals, machinery and equipment) has remained relatively stagnant. In other words, upward and downward employment changes are observed both in low as well as high capital-intensive sectors, underlining the role of sector-specific comparative advantages and growth path. The average compound annual growth rates (CAGR) of total employment in these sectors are also reported for three periods, namely: 2001-05, 2006-10 and 2011-15 respectively. A dampening employment growth trend in Indian industrial sector is clearly observed in recent period, in line with growing casualization of the workforce (Goldar and Aggarwal, 2010). At the sectoral level, decline in employment CAGR can be observed in chemicals, iron and steel and electrical machinery and equipment sectors during 2011-15, and all of these sectors are characterized by trade deficits. This observed correspondence between worsening of trade balance and employment contraction underlines the crucial implications of the tariff reform process and the consequent labour market adjustments involved.

[3] Annex 1 represents scatter plots of the S and B indices against change in employment for selected Indian industries from 2001-15.

Table 4: Marginal IIT in India's Trade across Commodity Sections

Commodity Groups	HS Codes	B Index					S Index				
		2001	2005	2010	2015	2018	2001	2005	2010	2015	2018
Chemicals	28, 29	22.98	62.04	90.09	50.68	75.37	-0.04	-0.26	-0.08	0.32	-0.19
Leather and Footwear	41, 42, 64	10.54	48.45	71.21	8.12	65.87	0.18	0.26	0.10	-0.58	-0.24
Textile and Garments	50-63	22.76	38.22	18.08	17.77	18.52	-0.17	0.23	0.17	-0.18	-0.25
Iron and Steel	72, 73	8.44	28.61	23.23	20.86	46.38	-0.12	0.13	0.31	-0.24	-0.24
Base Metals	74-83	38.96	92.23	64.89	52.45	48.45	0.05	-0.02	-0.01	-0.17	-0.39
Electrical and Electronics Machinery and Equipment	84, 85	26.33	42.33	24.35	18.35	45.94	0.29	-0.34	-0.09	-0.06	-0.19
Vehicles and Auto-components	87	29.19	45.20	47.07	24.11	56.59	0.15	0.32	0.02	-0.44	0.23
Aggregate		**36.78**	**73.71**	**68.58**	**87.30**	**59.97**	**0.83**	**-0.20**	**-0.23**	**0.11**	**-0.28**

Source: Author's computation from Trade Map data, International Trade Centre (undated)

Table 5: Employment share and Trade Balance scenario across sectors

Commodity Groups	HS Codes	Employment Share (%)				Employment CAGR (%)			Average Trade Balance Scenario (USD Billion)		
		2000	2005	2010	2015	2001-05	2006-10	2011-15	2001-05	2006-10	2011-15
Chemicals	28, 29	2.75	1.87	1.78	1.81	-3.71	6.31	-0.03	-1.36	-3.62	-7.77
Leather and Footwear	41, 42, 64	1.73	1.91	2.31	2.66	4.43	13.86	5.65	2.00	2.93	4.71
Textile and Garments	50-63	20.59	20.90	18.94	19.09	5.67	-0.03	2.58	11.19	19.06	30.96
Iron and Steel	72, 73	8.55	8.66	12.04	10.21	5.21	12.31	-2.30	1.16	-0.72	-0.65
Base Metals	74-83	2.20	2.49	2.72	2.67	8.23	7.76	1.09	-0.06	0.38	-2.42
Electrical and Electronics Machinery and Equipment	84, 85	9.88	9.64	10.81	9.69	3.88	9.45	-1.59	-9.67	-31.36	-42.8
Vehicles and Auto-components	87	4.82	5.60	7.08	8.27	8.27	10.80	4.19	1.2	3.14	8.09
Total		**50.52**	**51.08**	**55.67**	**54.39**	**4.13**	**5.29**	**1.58**	**4.47**	**-10.19**	**-9.89**

Source: Author's computation from Annual Survey of Industries, GoI (undated) and Trade Map data, International Trade Centre (undated)

4.4 Empirical Model

In line with the existing literature, the following panel data model is estimated to explore the relationship between the absolute value of total employment changes in Indian industries and the dynamic IIT and other independent variables:

$$|\Delta \mathrm{EMPL}|_{it} = \alpha_0 + \beta_1 |\Delta \mathrm{EMPL}|_{it-1} + \beta_2\, MIIT_{it} + \beta_3\,(MIIT * RGR)_{it} + \beta_4 (MIIT * \left(\frac{S}{U}\right))_{it} + \beta_5 (MIIT * TO)_{it} + \beta_6 (MIIT * WAGE)_{it} + \beta_7 TO_{it} + \beta_8 \left(\frac{S}{U}\right)_{it} + \beta_9\, WAGE_{it} + \beta_{10} CR_{it} + \beta_{11} LFDI_{it} + \beta_{12} PROD_{it} + \beta_{13} (PROD * LFDI)_{it} + TB_{it} + \varepsilon_{it} \quad \text{........ (3)}$$

where,

α	represents the *constant* term
βs	are *coefficients*
L	represents logarithmic transformation of the variables
Δ	represents absolute change of the variables
$EMPL_{it}$	represents employment in the *i*-th industry in the *t*-th period
$EMPL_{it-1}$	represents employment in the *i*-th industry in the (*t-1)*-th period
$MIIT_{it}$	represents the marginal intra industry trade (MIIT computed through B-index) in the *i*-th industry in the *t*-th period
$(MIIT *RGR)_{it}$	represents the interaction term between MIIT and relative growth rate in the *i*-th industry in the *t*-th period
$(MIIT *(S/U))_{it}$	represents the interaction term between MIIT and ratio of skilled workers to unskilled workers in the *i*-th industry in the *t*-th period
$(MIIT *TO)_{it}$	represents the interaction term between MIIT and trade openness in the *i*-th industry in the *t*-th period
$(MIIT *WAGE)_{it}$	represents the interaction term between MIIT and unskilled wage in the *i*-th industry in the *t*-th period
TO_{it}	represents imports plus exports as a share of output in the *i*-th industry in the *t*-th period
$(S/U)_{it}$	represents ratio of skilled workers to unskilled workers in the *i*-th industry in the *t*-th period
$WAGE_{it}$	represents unskilled wage rate in the *i*-th industry in the *t*-th period
CR_{it}	represents concentration ratio (Herfindahl-Hirschman Index) in the *i*-th industry in the *t*-th period
FDI_{it}	represents foreign direct investment in the *i*-th industry in the *t*-th period
$PROD_{it}$	represents labour productivity in the *i*-th industry in the *t*-th period
$(PROD*LFDI)_{it}$	represents the interaction term between labour productivity and logarithmic transformation of foreign direct investment in the *i*-th industry in the *t*-th period
TB_{it}	represents a dummy variable which takes the value of 1 if India's trade balance in the *i*-th industry in the *t*-th period is positive and 0 otherwise

The stationary analysis for all the explanatory variables in the proposed model has first been undertaken. All the variables used in the regression analysis are found to be stationary except FDI variable. Therefore, the regression model uses logarithmic transformation of FDI variable, so that the modified series becomes stationary.

The dependent variable $|\Delta \text{Empl}|_{it}$, absolute change in the employment in the *i*-th industry in the *t*-th period, is a proxy for adjustment effects (Brulhart, 1999). Following Thorpe and Leitao (2012), the variable is computed from ASI data as follows:

$$\Delta EMPL = 2(EMPL_t - EMPL_{t-1})/(EMPL_t + EMPL_{t-1})$$

Two variables are included in all the regression models. First, given the dynamic nature of employment changes, past changes of the series have been considered as an explanatory variable (Ferto, 2009). Second, it is expected that the dependent variable will have a negative relationship to MIIT or interaction terms with the same (Brulhart and Elliott, 1999).

A set of trade-related control variables have been included in the model in line with existing literature. Trade Openness (TO) of the sector have been included as a key independent variable, as greater openness is expected to influence competitiveness of domestic firms and in turn, induce consequent employment dynamics (Brulhart, 2000). A Trade Balance (TB) dummy, which takes the value of 1 if India's trade balance in a particular industry is positive and 0 otherwise, is also included. The dummy is expected to have a positive coefficient, since improvement in trade performance will necessitate increase in the demand for labour which is an indicator of an expanding industry with growing employment opportunities (Brulhart and Elliott, 1998).

A set of labour-related control variables have also been included. The current analysis incorporated ratio of skilled to unskilled workers (S/U) in the model, as rising skill-intensity among workers may reflect higher absolute changes in employment. Moreover, wage rate is expected to have a negative influence on employment changes (Brulhart and Elliott, 2002; Brulhart *et al*., 2006). In the current context, unskilled wage rate prevailing in an industry is considered as an independent variable.

Finally, a set of industry-related control variables have been included. A negative relationship between employment changes and market concentration is expected, as due to lack of competitive pressures, a highly concentrated industry will experience relatively low intra-sectoral employment reallocation (Ferto, 2009). The relationship between sectoral FDI inflows and corresponding employment effects may however be dubious. If FDI is concentrated in labour-intensive industries, a positive impact on level of employment is expected (Ghosh and Sinha Roy, 2015). Alternatively, investments by the multinational enterprises in highly capital-intensive industries are expected to have lower employment elasticity of output as compared to domestic firms adopting labour-intensive techniques of production (Pradhan *et al*., 2004). Labour productivity is expected to be positively associated with employment changes (Brulhart and Thorpe, 2000).

The present analysis proposes five important interaction terms in the regression model. First, apart from the MIIT term, an interaction term between MIIT index and relative growth rate (i.e., ratio of i-th industry's output growth rate to aggregate output growth rate of the industrial sector) has been incorporated. A positive relationship for this interaction variable (MIIT*RGR) is expected, i.e., a sector witnessing relatively higher growth and MIIT, may employ more workers. Second, an interaction term between MIIT index and skilled worker intensity in an industry, namely (MIIT*(S/U)), has been included. The sign of the coefficient is dubious as sectors characterized by rising skill intensity and MIIT may require different level of employment adjustments, given the technology-intensity. Third, an interaction term between MIIT index and trade openness of an industry, namely (MIIT*TO), has been included. A positive relationship for this interaction variable is expected, i.e., a sector with relatively higher trade intensity may witness greater employment fluctuations. Fourth, an interaction term between MIIT index and unskilled wage prevailing in an industry, namely (MIIT*WAGE), has been included. The sign of the coefficient is however dubious as sectors characterized by lower wage and MIIT may result in different level of employment adjustments, given the inherent competitiveness patterns. Finally, the expected sign of the interaction term between labour productivity and log of FDI (LFDI*PROD) is dubious, as depending on the nature of the FDI the employment would display diverging dynamics.[4]

5. Empirical Results

The summary statistics for the variables selected for the empirical analysis is provided in Table 6. Panel data regression analysis has been undertaken with help of STATA Software (version 14). Hausman test is first conducted, which indicates the presence of underlying random effect model (-16.05). LM Test is then performed to detect the presence of first order autocorrelation. It is observed that chi-square test statistic of 58.93 (Prob: 0.00) is statistically significant. Breusch-Pagan / Cook-Weisberg test for heteroscedasticity has been conducted to check the existence of heteroscedasticity in the estimated model. The chi-square test statistic is 688.92 (Prob: 0.00). Estimated mean variance inflation factor (VIF) is 1.59 and the values of VIF are within the tolerance limit of multicollinearity for all the variables.

Table 6: Summary Statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
ΔEMPL(t)	840	0.150	0.203	0.000	1.848
ΔEMPL(t-1)	840	0.144	0.202	0.000	1.848
MIIT	840	0.332	0.325	0.000	0.999
MIIT*RGR	840	0.012	6.970	-111.961	87.008
MIIT* (S/U)	840	0.120	0.181	0.000	3.849
MIIT*TO	840	0.457	2.126	0	25.758
MIIT* Wage	840	0.322	0.413	0	3.836
TB	840	0.400	0.490	0	1
TO	840	1.219	4.669	0.001	98.890
S/U	840	0.369	0.416	0.121	10.738
WAGE	840	0.972	0.530	0.236	4.480
CR	840	0.250	0.113	0.145	0.719
LFDI	840	10.173	0.708	6.544	11.424
PROD	840	4.896	4.127	-0.568	26.336
PROD * LFDI	840	51.081	44.435	-5.187	287.771
S Index	840	-0.000	0.459	-0.992	0.991

Source: Author's estimation

Based on the diagnostic tests, the present analysis adopts Feasible General Least Squares (FGLS) method with time-specific random effects. The empirical estimates for India's industry-level adjustment effects are summarized in models 1-10 in Table 7. Several

[4] Annexes 2-8 reports a few scatter diagrams, representing the pattern of relationship between several key variables included in the model during the study period.

conclusions emerge from the empirical results. First, the coefficients of the lagged employment changes $|\Delta\text{EMPL}|_{i(t-1)}$ is positive and significant for all the model specifications, indicating that lagged changes in employment level influence the present variations in the series.

Second, the relationship between MIIT (B-index) and absolute change in employment is positive and significant. In other words, sectors characterized by higher MIIT levels are witnessing greater employment adjustments. Along similar lines, three of the interaction terms involving MIIT, namely: MIIT*RGR, MIIT*(S/U) and MIIT*TO are positively related to employment change and significant. The result indicates that, high relative growth rate in an industry which also witness rise in IIT-type trade, may lead the firms to expand and employ more productive and competitive resources, including labour. Similarly, sectors characterized by higher MIIT and rising skill-intensity are also witnessing higher employment adjustments. Finally, higher MIIT in sectors characterised by deeper trade openness may lead to greater employment fluctuations, employment growth in trade surplus (i.e., winner) segments and vice versa. The interaction term of MIIT and unskilled wage is however found to be insignificant, implying absence of any systemic influence of the variable on absolute employment change.

Third, trade flows influence the employment changes significantly. In line with theoretical predictions, the coefficient of TO is positive and significant for all model specifications. The result indicates that greater trade openness lead to higher employment fluctuations. Also, the TB dummy is found to be positive and significant for all model specifications. The result can be attributed to the fact that favourable trade performance (i.e., generation of an export surplus) will boost the demand for labour in an expanding industrial segment with growing employment opportunities. Similarly, import threat may lead to greater adjustments in uncompetitive (i.e., characterized by trade deficit) sectors.

Fourth, the labour market related factors play a key role in the adjustment process. The coefficients of (S/U) are positive and significant for all specifications, i.e., a larger relative presence of skilled workforce vis-à-vis unskilled ones is associated with grater absolute employment changes. It has been observed that Indian exports from skill-intensive sectors (e.g., leather and footwear) are on the rise, which may lead to scale expansion and consequent rise in labour demand. The coefficient of WAGE is found to be negative and significant, indicating that low unskilled wages may generate a demand for labour and in turn lead to greater changes in employment levels. Labour productivity (PROD) on the other hand is positively associated with employment changes, signifying greater employment rise in more productive sectors.

Finally, the influence of the industry-level variables is found to be significant and in line with the theoretical predictions. Industrial concentration (CR) is found to be negatively associated with employment changes, signifying that a highly-concentrated industry will experience relatively low intra-sectoral employment reallocation. The coefficients of change in FDI inflow (LFDI) is negative and significant, implying that rise in incremental FDI inflows negatively influence change in employment. The result may indicate that foreign investment and technology inflow in industries (e.g., machinery and equipment, automobiles) is expected to lead to lower employment elasticity of output because of the growing capital-intensity. The interaction term between labour productivity and FDI inflow (PROD*LFDI) is also found to be negative and significant, indicating that increase in FDI inflow in more productive sectors of the economy may lead to lower employment elasticity of output, explained by rising capital-intensity therein.

The robustness check of the models has been conducted by splicing the dataset (56 industries) into two groups on the basis of their trade balance pattern (trade surplus and trade deficit) and separately estimating them. The results for trade surplus and trade deficit sectors are reported in models 11 and 12 respectively. The results indicate that estimated models are robust and signs and level of significance of the coefficients are largely stable.

First, for both groups, the coefficient of the lagged employment changes of the variable $|\Delta \text{EMPL}|_{i(t-1)}$ is positive and significant, but the coefficient is higher for the former group. In other words, in sectors characterized by export surplus, past values of changes in employment level exerts greater influence on the variations in current period, linking the industrial expansion with growing employment opportunities. Second, the coefficient of MIIT is positive and significant for industries with positive trade balance. The result implies that export surplus sectors characterized by higher MIIT levels are witnessing greater employment adjustments. On the other hand, the relationship is not significant for the trade deficit sectors, possibly underlining limited role of IIT in explaining contraction process witnessed in these sectors. Third, the coefficient of TO is positive and significant for the latter group indicating that greater trade openness lead to higher labour market adjustments. On the other hand, the coefficient is non-significant for trade surplus segments, possibly because of differing influence of productivity rise across sectors on employment therein.

Fourth, the coefficient of (S/U) is positive and significant for both the groups, but the same is higher for the trade deficit sectors, indicating greater labour market adjustments therein. Fifth, the coefficient of WAGE is found to be negative and significant for the former group, indicating that due to competitive pressure in the export products, low unskilled wages may generate a demand for labour and in turn lead to greater changes in employment levels. For the latter group though the sign is also negative but non-significant, possibility underlining their weaker expansion capability.

Sixth, the coefficient of labour productivity (PROD) is found to be positive and negative for the trade surplus and trade deficit sectors respectively. In trade surplus sectors, increase in productivity leads to greater demand for labour and hence higher employment changes. On the other hand, trade deficit might be associated with less demand of labour in a contracting industrial segment. Finally, the interaction term (PROD*LFDI) is found to be negative and significant for export-surplus sectors, indicating that FDI inflow in productive sectors may reduce employment changes, possibly due to technology transfer and growing capital intensity. However, the coefficient is positive for trade deficit industries, indicating that FDI inflow in this case might target the growing domestic market without much technology transfer, resulting in larger absolute employment changes in labour-intensive segments.

6. Conclusion

One major objective of the recent policy interventions in the country, e.g. - ‘Make-in-India’ and ‘Atmanirbhar Bharat Abhiyan’ schemes and so on, is to secure employment growth, in light of the unemployment concerns (Vashisht, 2015). As India is increasingly wooing FDI inflows in the country, it is expected that the resulting technology transfer would facilitate higher export growth and deeper IPN participation. This development, in turn, is expected to benefit the exporting firms and fulfil the policymaker’s long-run objective of job creation. Higher MIIT, reflecting within sector both-way trade flows, is crucial in this context as this is expected to result in relatively modest job market restructurings.

While India has significantly reformed over the last two decades, the TB scenario varied across sectors and the consequent employment fluctuations got influenced by the collective effects of trade, industry and labour market related factors. As a number of sectors faced trade deficits, loss of employment therein had been a reality. The empirical results indicate that MIIT, increase in productivity, skilled workforce intensity, trade balance, trade openness and FDI inflows positively influence absolute employment changes, whereas industrial concentration and unskilled wage exerts a negative impact on the same. The obtained results do not support the negative relation between MIIT and labour market dynamics, as observed in a section of the SAH literature (Brulhart, 1999, 2000). The analysis further concludes that high relative growth rate and skill intensity in a sector, also characterized by higher MIIT, may lead the firms to employ more productive and competitive resources, resulting higher absolute changes in employment. Conversely, FDI-related determinants negatively influence absolute labour market adjustment, possibly owing to adoption of more capital-intensive techniques of production (Tejani, 2015). The results call for closer focus by the policymakers, given the long-run objectives under the 'Make-in-India' and 'Atmanirbhar Bharat' schemes.

One limitation of the present analysis is that due to paucity of data on inter-sectoral movements of labour, it has not been possible to evaluate overall reallocation adjustment effects of IIT in the aggregate industrial sector. Future research therefore could focus on that aspect, if time-series data on inter-sectoral movements of labour is obtained across Indian industrial classifications. In addition, the empirical results on industrial adjustment may be sensitive to the choice of a MIIT index as well as the aggregation level (Brulhart, 2000). Therefore, an analysis with further disaggregated NIC data may provide deeper insights. Finally, one interesting area for future research would be to separately conduct the analysis for industries characterized by high and low tariff barriers respectively, so as to understand the interrelationship between labour market adjustment process and dynamic both-way trade (i.e., MIIT) for sectors associated with liberal as well as protectionist outlooks.

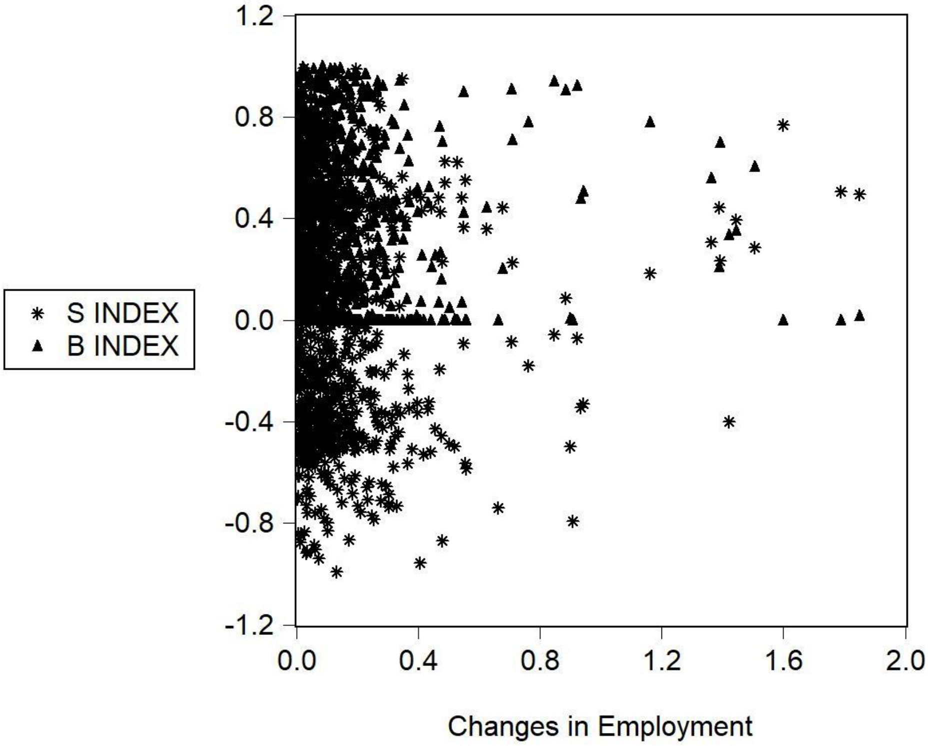
Table 7: Regression Results on Determinants of Change in Employment

Independent Variables	Dependent Variable: |ΔEmpl(t)|											
	Baseline Regressions										Robustness Check	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11 (TB > 0)	Model 12 (TB < 0)
Constant	0.064***	0.072***	0.023**	0.051***	0.339**	0.329**	0.037**	0.280*	0.266*	0.381***	0.084***	0.031*
	(0.011)	(0.009)	(0.010)	(0.016)	(0.137)	(0.137)	(0.016)	(0.148)	(0.149)	(0.146)	(0.032)	(0.018)
|ΔEmpl(t-1)|	0.431***	0.429***	0.410***	0.410***	0.413***	0.426***	0.415***	0.410***	0.421***	0.413***	0.466***	0.271***
	(0.031)	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)	(0.029)	(0.030)	(0.043)	(0.041)
MIIT	0.019				0.031*						0.071**	0.001
	(0.019)				(0.018)						(0.037)	(0.017)
MIIT*RGR		0.002*	0.002*	0.002*		0.001*	0.001*					
		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)					
MIIT*(S/U)						0.067**						
						(0.035)						
MIIT*TO									0.002**			
									(0.002)			
MIIT*WAGE										0.006		
										(0.015)		
TO	0.003***	0.003***	0.004***	0.004***	0.004***		0.004***	0.004***		0.004***	0.001	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.007)	(0.001)
S/U			0.121***	0.123***	0.123***	0.111***	0.123***	0.124***	0.122***	0.122***	0.107***	0.187***
			(0.014)	(0.014)	(0.014)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.020)	(0.023)
WAGE				-0.026**			-0.040**	-0.050***	-0.051***		-0.147***	-0.011
				(0.012)			(0.016)	(0.017)	(0.017)		(0.041)	(0.014)
CR					-0.156**	-0.140**		-0.139**	-0.130**	-0.152**		
					(0.066)	(0.066)		(0.066)	(0.066)	(0.067)		
LFDI					-0.027**	-0.026**		-0.019	-0.017*	-0.031***		
					(0.012)	(0.012)		(0.014)	(0.013)	(0.013)		
PROD							0.073***	0.005***	0.005***	0.001*	0.133***	-0.053*
							(0.025)	(0.002)	(0.002)	(0.001)	(0.043)	(0.028)
PROD*LFDI							-0.006***				-0.010***	0.004*
							(0.002)				(0.004)	(0.002)
TB	0.030**	0.027**	0.045***	0.038***	0.032**	0.030**	0.035***	0.037***	0.032**	0.031**		
	(0.012)	(0.012)	(0.012)	(0.012)	(0.014)	(0.014)	(0.013)	(0.015)	(0.015)	(0.015)		
N	840	840	840	840	840	840	840	840	840	840	336	504
F-Statistics	224.65	227.87	316.95	324.38	324.36	316.45	341.66	333.77	320.54	321.74	190.26	154.03

Source: Author's estimation

Notes: Figure in the parenthesis shows the standard errors of the estimated coefficient.
∗∗∗, ∗∗, and ∗ implies estimated coefficient is significant at 0.01, 0.05, and 0.10 level, respectively.

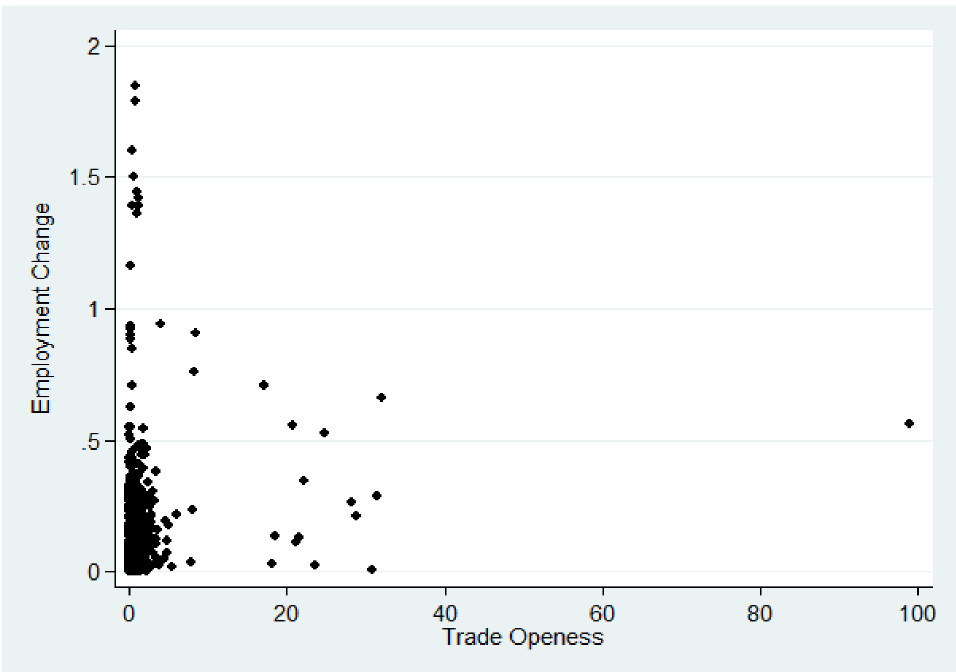
Annex 1: The relationship between S and B indices and Employment Change



Source: Author's estimation

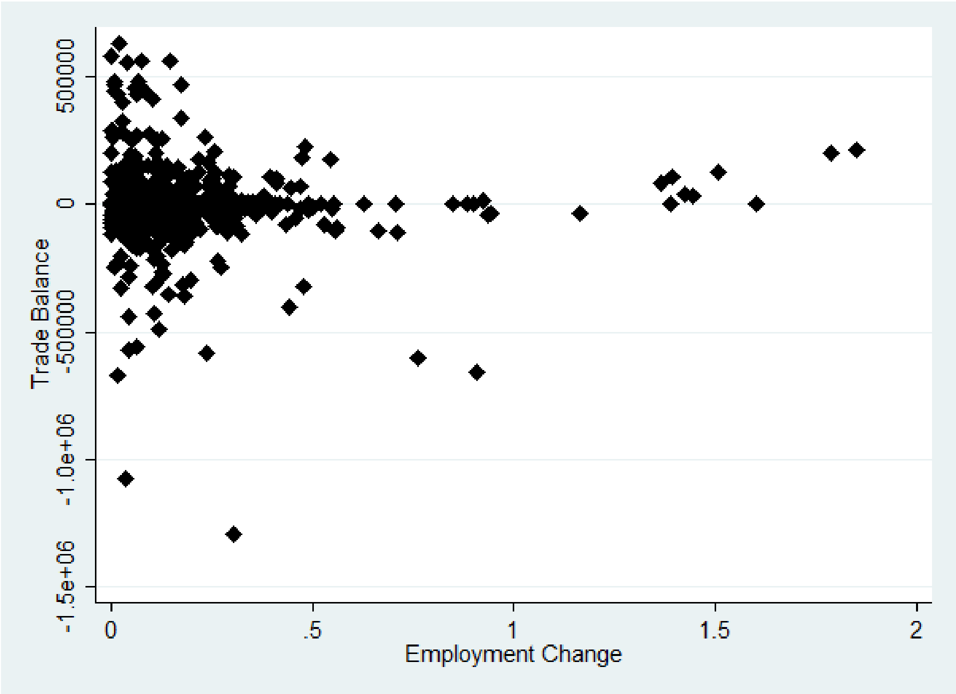
Note: Change in employment is calculated as follows:
$\Delta EMPL = 2(EMPL_t - EMPL_{t-1})/(EMPL_t + EMPL_{t-1})$

Annex 2: Relationship between Employment Change and Trade Openness



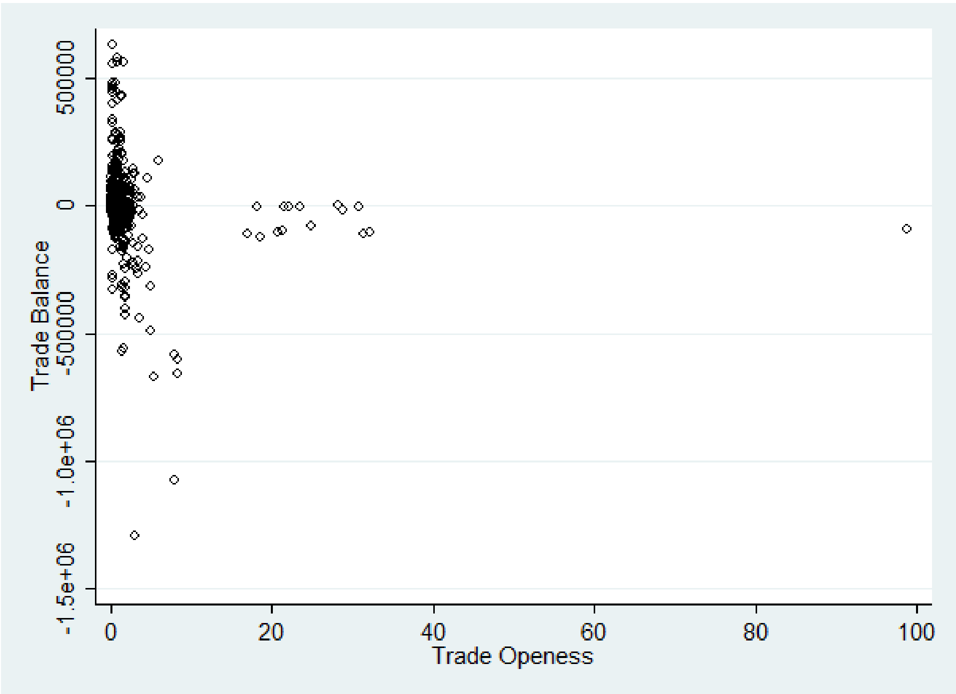
Source: Author's estimation

Annex 3: Relationship between Trade Balance and Employment Change



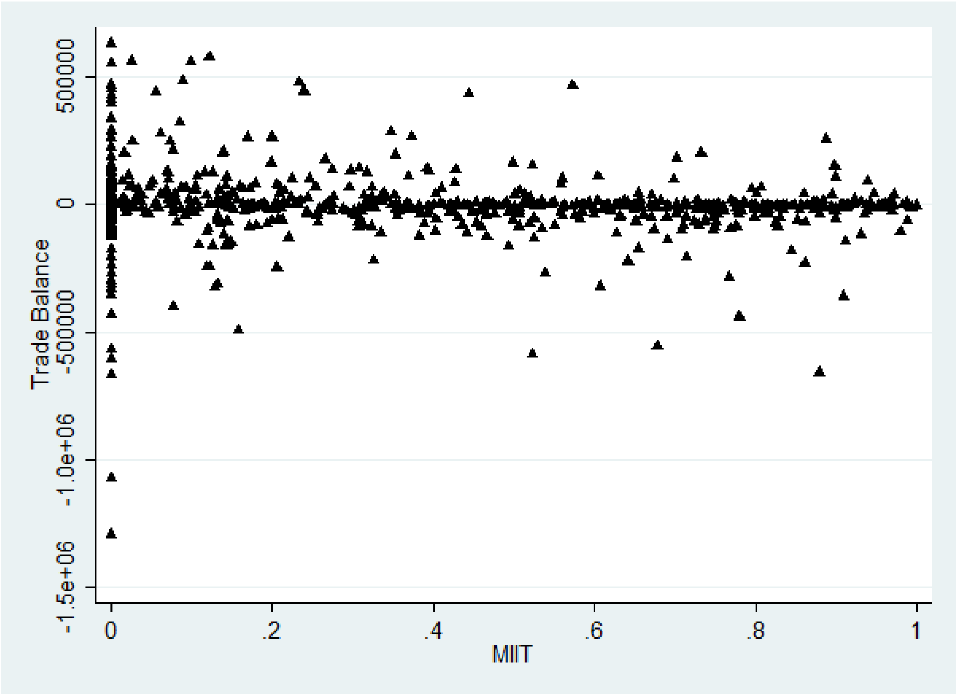
Source: Author's estimation

Annex 4: Relationship between Trade Balance and Trade Openness



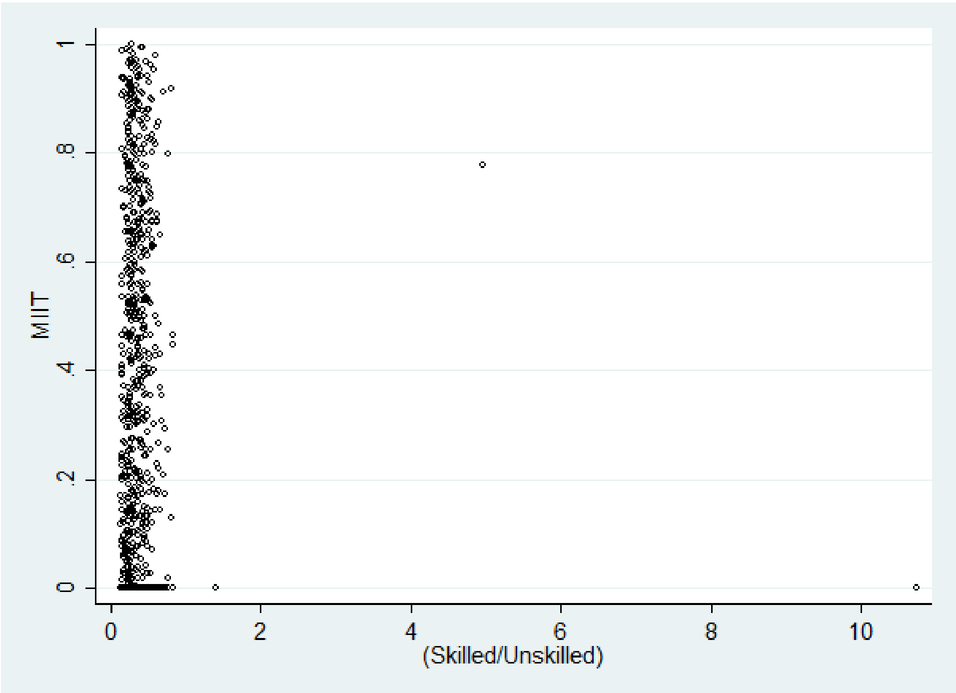
Source: Author's estimation

Annex 5: Relationship between Trade Balance and MIIT index



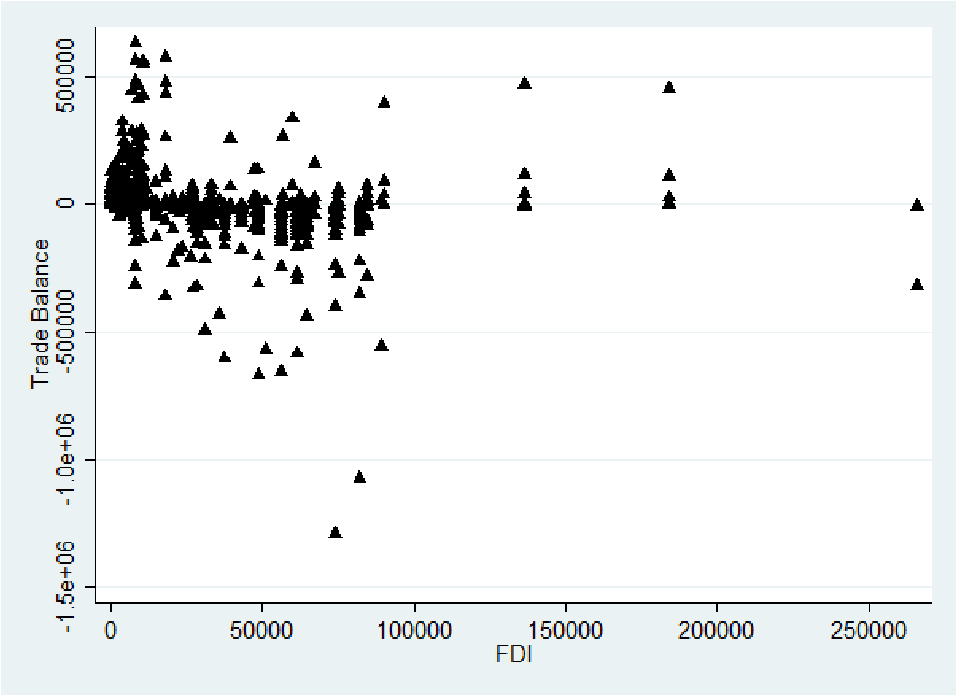
Source: Author's estimation

Annex 6: Relationship between MIIT index and (Skilled/Unskilled) workers



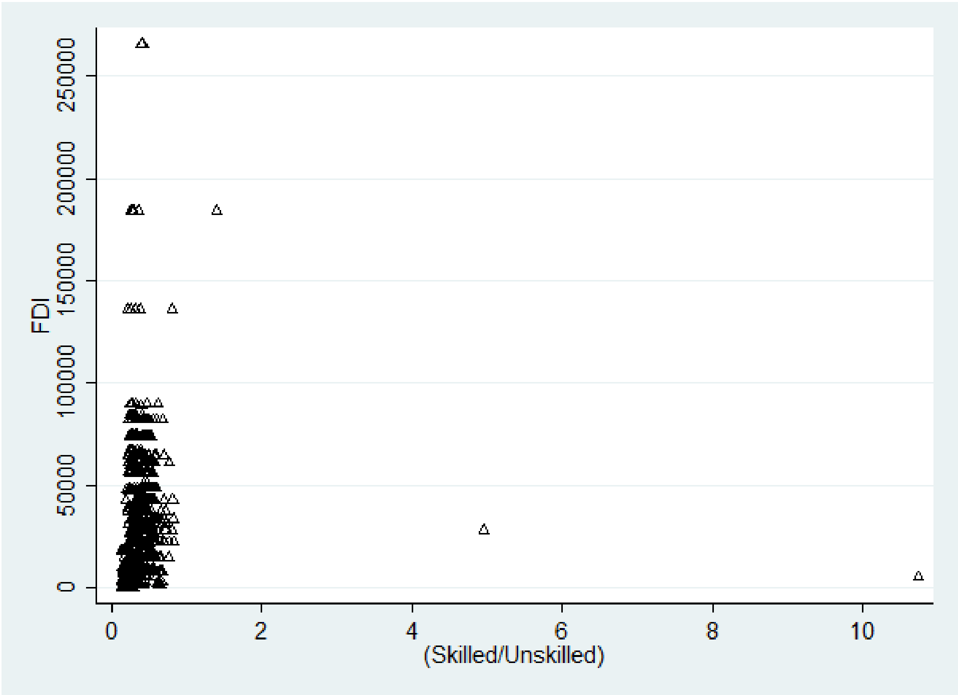
Source: Author's estimation

Annex 7: Relationship between Trade Balance and FDI



Source: Author's estimation

Annex 8: Relationship between FDI and (Skilled/Unskilled) workers



Source: Author's estimation

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