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Keywords: Global value chains, Backward GVC participation, Employment, Wage Inequality, India

JEL Code: F14, F16, F66, J24, J31

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Several studies show that countries increasingly participate in Global Value Chains (GVC) by specialising in intermediate goods. Theoretical fragmentation models suggest that backward GVC participation has a double advantage for a low-skilled, labour-abundant country like India. It increases employment, and it reduces wage inequality. This paper assesses the impact of backward GVC participation on employment, wages, and labour productivity of workers engaged in Indian organised manufacturing industries. We use plant-level data provided by the Annual Survey of Industries (ASI) for 2008-09 till 2019-20. We find that GVC plants employ more workers and pay higher wages but find no significant differences in labour productivity. The share of female and contractual workers is not significantly different from non-GVC plants, but the share of production workers is slightly higher in GVC plants. We also find a lower wage gap between male and female workers; and contractual and non-contractual workers but a higher wage gap between production and non-production workers for GVC plants.

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1 Introduction

According to a recent Report from the McKinsey Global Institute, between 2023 and 2030, India must create at least 90 million new non-farm jobs to absorb the 60 million new workers who will enter the workforce based on current demographics and an additional 30 million workers who could move from farm work to non-farm sectors (Sankhe et al., 2020). However, given the increasing debt burden of households, firms, and governments, it is unlikely that the domestic market will emerge as the engine of Indian growth in the medium term (Chatterjee and Subramanian, 2023). On the other hand, India has a vast unexploited export opportunity, particularly in low-skill manufacturing (Chatterjee and Subramanian, 2023; Veeramani and Dhir, 2016). India also has significant unexploited export potential in industries where global value chains (GVCs) are most common and entrenched (Athukorala et al., 2014; Veeramani and Dhir, 2019). It includes network product industries such as electronics, electrical machinery, computers, and road vehicles and the traditional unskilled labour-intensive industries such as apparel, footwear, and leather.

Several studies show that countries are increasingly participating in Global Value Chains (GVC) by specialising in intermediate goods (Hummels, Ishii, and Yi, 2001; Johnson and Noguera, 2012, 2017; Kimura, Takahashi, and Hayakawa, 2007). GVC participation rather than traditional trade is a fast-track way to achieve industrialization for developing countries. They only need to develop infrastructure for a particular stage in the production process rather than building up the whole industry as noted by Baldwin (2011). Theoretical fragmentation models like the one presented in Arndt (1997) suggest that developing countries with a relative abundance of low-skilled workers should experience increased employment of low-skilled workers when they participate more in lower levels of value chains. Thus, backward GVC participation has a double advantage for the low-skilled, labour-abundant country. One, it increases employment, and two, it reduces inequality.

Further, in the aftermath of the COVID-19 pandemic, there is a growing realisation among multinational enterprises (MNEs) that they need to diversify their supply chains in the future. Even before the pandemic, the US-China trade war, the ageing population, and

rising wages in China have already incentivised some MNEs to relocate supply chains to other parts of Asia. Potential realignment of the global value chains (GVCs) provides an opportunity for India to replace China as the significant assembly hub for manufactured exports, which can create millions of jobs for India's low-skilled labour by accelerating the process of the so-called Lewisian transformation whereby surplus labour from agriculture is transferred to high productivity activities in the modern sectors.

India has a comparative advantage in downstream production due to the abundance of low-skilled labour. Therefore, backward GVC participation has more significant potential to create employment opportunities for the masses. This paper uses data from the Annual Survey of Industries (ASI), India. This dataset contains detailed information on establishment year, ownership, region of operation (rural/urban), labour, capital, inputs used, output produced, and imports at the plant level. We lose out on data before 2008-09, as the share of products exported is only available since 2008-09, and so we have an unbalanced panel of 12 years from 2008-09 till 2019-20. Our data allows us to compare the impact of backward GVC participation on labour market outcomes for different categories of workers (Male/Female, Contractual/Non-Contractual, Production/Non-Production)[1]. We consider plants that import and export in the same year as GVC plants and take the imported input content of exports to construct a backward GVC Index at the plant level. We have around 5% GVC observations after standard data cleaning procedures were carried out.

The existing studies have mostly looked at the impact of offshoring (another term used for trade similar to GVC) on employment and wages for advanced countries like the US, Germany, and Denmark, which participate more in forward GVC and at higher chain levels. The converse is true for developing countries, and the impact of GVC participation on employment, wages, and labour productivity depends on the positions in the value chain and the nature of GVC participation. Also, there has yet to be a consensus on how GVC participation affects labour market outcomes in advanced countries. Feenstra and Hanson

[1]ASI provided data on production workers (engaged in feeding raw materials, assembling, maintenance, and repair) and non-production workers (engaged in supervisory and managerial tasks). Production workers are categorised as contractual and employed directly. Directly employed production workers are further classified into male and female workers.

(1996), Hijzen, Görg, and Hine (2005), and Geishecker and Görg (2008) show adverse effects, while Amiti and Wei (2005, 2009); Hijzen and Swaim (2007) show a positive impact on employment and wages due to offshoring. We contribute to this existing literature by looking at these issues from a developing country perspective and using unit-level data, which provides detailed information on each plant for different categories of workers.

We begin by comparing the labour market outcomes for GVC and non-GVC plants. We find that the employment, wage rate, and labour productivity of workers in GVC plants are significantly higher than those working in non-GVC plants. We compare these outcomes for different categories of workers. We find that the results remain unchanged for each type of worker. We calculate the wage gap for all three categories of workers. We find that wage gaps between male and female workers and production and non-production workers in GVC and non-GVC plants are significantly lower. The difference in wage gaps for contractual and non-contractual workers is insignificant. The proportion of female workers compared to male workers, the proportion of contractual workers compared to non-contractual and the proportion of production workers compared to non-production workers is higher for GVC plants.

We run the pooled OLS model, random effects model and fixed effects model to estimate the impact of backward GVC participation on employment, wages and labour productivity. Our Breusch and Pagan Lagrangian multiplier test and Hausman test point out that the fixed effects model would be the best-fit model. After controlling for plant-specific characteristics, plant-fixed effects, industry-fixed effects at four-digit National Industrial Classification (NIC), and year-fixed effects, we find that GVC plants hire 4% more workers and pay 2% higher wages. These results are significant at a 1% level. However, we have not found significant results for labour productivity. Similarly, we do not find significant differences in shares of female employees, contractual employees, and production employees between GVC and non-GVC plants. We find that GVC plants have significantly lower wage gaps for all three categories of workers.

2 Literature Review

The literature on the impact of GVC participation on employment and wages is vast and has been increasing rapidly during the past decade. This interest is partly motivated by the growing depiction that trade harms job opportunities in the home country (Hummels, Munch, and Xiang, 2018) and partly because the impact remains an empirical puzzle. For instance, Amiti and Wei (2005, 2009) estimated an overall positive effect of offshore outsourcing (widely used to refer to phenomena like GVC in the extant literature) on employment/wages for the US economy. On the other hand, Acemoglu et al. (2016) found that import competition from China reduced employment growth in the US manufacturing sector between 1999 and 2011. Monarch, Park, and Sivadasan (2017) find a negative effect of offshoring by US firms on domestic employment but no impact on wages.

The ambiguity is not only limited to the impact of offshoring on employment and wages but also extends to its impact on skilled and unskilled workers. Several studies find a positive effect of foreign outsourcing on wages/employment for skilled workers but a negative impact on unskilled workers in manufacturing industries (see Feenstra and Hanson (1996) in the context of the US; Hijzen, Görg, and Hine (2005) for the UK; Geishecker and Görg (2008) in the context of Germany). Falk and Wolfmayr (2005) show that international outsourcing to low-wage countries results in a reduction in employment, specifically in the low-skill intensity industries of seven EU countries, and Timmer, Los, Stehrer, and De Vries (2013) found that GVC-related jobs are declining and are biased towards high-skilled workers.Ebenstein, Harrison, McMillan, and Phillips (2014) see that when US firms offshore to low-wage countries, there is a significant decline in wages for workers employed in routine tasks.

Other cross-country evidence of the impact of GVC on labour market outcomes can be found in Szymczak and Wolszczak-Derlacz (2022), Cardoso, Neves, Afonso, and Sochirca (2021), Farole, Hollweg, and Winkler (2018), and Pan (2020). In their sectoral-level analysis of 43 countries from 2000 to 2014, Szymczak and Wolszczak-Derlacz (2022) showed that backward GVC participation results in lower labour demand than traditional trade. Backward GVC participation is positively associated with labour demand only in high-income

countries, while it hurts low-skilled labour demand in middle-income countries. However, its impact on wages is modest for both high- and middle-income countries. Pan (2020) also finds a small positive effect for high-productivity countries but a weak impact of GVC participation on employment for most middle and low-productivity countries. They find that backward GVC participation is more effective in creating jobs in the context of developing countries than forward GVC participation.

Our paper contributes to this existing strand of literature in the following ways. Firstly, these studies have been mainly in the context of advanced countries. As pointed out by Kee and Tang (2016), Constantinescu, Mattoo, and Ruta (2019), and Freund, Mattoo, and Antràs (2020), the labour market implications of GVC participation depend on the nature of participation (forward or backward) and position (higher or lower) in the chain which is significantly different for developing countries. Few studies like Thangavelu and Chongvilaivan (2011) and Durongkaveroj (2022) (for Thailand); Ge, Fang, and Jiang (2019) and Wang, Chen, and Yin (2022) (for China) have focused on developing countries.

Our study contributes to the impact of GVC participation on employment, wages, and labour productivity in India. The only closely related studies to our paper are Banga (2016) and Veeramani and Dhir (2022), which only look at the impact of GVC participation on overall employment. They both used industry-level estimates and presented opposing results. Our paper adds to this by looking into the wage and labour productivity along with the employment impact of GVC participation. We also try to look at these impacts for different categories of workers (Male/Female, Contractual/Non-Contractual, and Production/Non-Production). This study adds to the literature by providing insights from the plant-level estimates. Several sector-level, industry-level, and firm-level studies related to this issue exist. However, plant-level estimates are rarely used to assess backward GVC participation's impact on employment, wages, and labour productivity.

3 Data

We use data from the Annual Survey of Industries (ASI) conducted under the Collection of Statistics Act, 2008. ASI is the principal source of data on industrial firms. It is a rich and nationally representative data set for the organised manufacturing sector in India. ASI provides annual data for industrial units registered under Sections 2m(i) and 2m(ii) of the Factories Act, 1948. Since 2015-16, the coverage has also been extended to other[2] industrial units. Factories with 100 or more than 100 workers or those that belong to less industrialised states/UTs of Manipur, Meghalaya, Nagaland, Tripura, Andaman & Nicobar Islands are included in the census sector. Data on all of these units are collected every year. The remaining units are included in the sample sector, where only a sample of industrial units are surveyed using a circular systematic sampling technique. Each stratum is divided into four sub-samples. Two subsamples from each stratum are surveyed by the state government and the other by the central government (MOSPI, 2022). Thus, we created a highly unbalanced panel using this dataset where few plants appear for all the years, and most appear irregularly.

We use ASI instead of CMIE Prowess data (which provides data on firms) because we need our estimates from the plant-level analysis, which is only available at ASI. Also, CMIE Prowess is not considered a nationally representative data set because it only surveys firms that publicly disclose their annual financial reports. Since small firms generally do not publish such statements, it is said to have a biased representation of large firms. The information on the value of products that a plant exports has only been available since 2008-09. Hence, we restrict the time frame of our analysis from 2008-09 to 2019-20. The description of the variables used in the study is given in Table A1 and Table A2 in the Appendix.

[2]Industrial units registered under any of the seven Acts, Boards, or Authorities, viz., the Companies Act, 1956, the Factories Act, 1948, the Shops and Commercial Establishment Act, the Societies Registration Act, the Cooperative Societies Act, the Khadi and Village Industries Board, the Directorate of Industries (District Industries Centre), and the Business Register of Establishments (BRE), as prepared by the state governments and available with the National Accounts Division, the Central Statistics Office, and verified by the Field Operations Division (FOD), NSSO (MOSPI, 2022).

4 Descriptive Statistics

Our data set contains around 26,412 observations on GVC plants out of 479,139 observations after standard data cleaning procedures were carried out. GVC observations are those that import and export during the same year. Table 1 shows that GVC plants, on average, have a higher number of employees, real wage rate, and labour productivity than non-GVC plants. When comparing medians, a better measure for highly skewed data like ours gives us the same results. Comparing total employees, real wage rate, and labour productivity in Tables 2, 3, and 4 for every category of workers for GVC and non-GVC plants, we get similar results. GVC plants have higher mean and median values for all outcomes and for all categories of workers. All these mean differences are significant at 1%.

Table 1: Overall labour Market Outcomes for GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Total Number of Persons Engaged	26412	660.63	289.00	2	121007
Real Wage Rate	26412	1967.79	1511.61	13.13	317746.28
labour Productivity	26412	0.01	0.01	-17.10	6.72
Non-GVC Plants					
Total Number of Persons Engaged	452727	196.43	49.00	1	87427
Real Wage Rate	452727	1212.76	928.01	0.00	716842.63
labour Productivity	452719	0.01	0.00	-9.14	14.31

Source: Based on authors' calculations using ASI data

Table 5 shows the average employment share of different categories of workers, indicating that GVC plants have a higher proportion of female, contractual, and non-production workers compared to non-GVC plants. Table 6 then compares wage gaps by category, showing that GVC plants have lower gender and production-role wage gaps. These differences are significant at 1% except for the wage gap between contractual and non-contractual workers, which is not significant even at 10%.

We compare GVC and non-GVC plants using other plant characteristics in Table 7. We find that the differences in means are significant at 1% (except for skill intensity). In addition, GVC plants have higher mean and median values of assets, sales, and labour intensity. This leads us to conclude that GVC and non-GVC plants have little in common. Therefore,

Table 2: Total Employees for each category of workers in GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Female Workers	17216	153.99	14.00	0	45591
Male Workers	25785	249.02	90.00	0	20339
Contractual Workers	18256	243.64	87.00	0	23576
Non-Contractual Workers	25829	351.23	124.00	0	65463
Production Workers	26404	512.04	213.00	0	65463
Non-Production Workers	26311	68.02	22.00	0	17710
Non-GVC Plants					
Female Workers	246700	31.29	1.00	0	53297
Male Workers	428585	81.03	19.00	0	27057
Contractual Workers	269071	103.84	14.00	0	49472
Non-Contractual Workers	430509	98.60	22.00	0	71587
Production Workers	452208	155.65	35.00	0	71587
Non-Production Workers	423199	19.97	4.00	0	29549

Source: Based on authors' calculations using ASI data

Table 3: Real Wage Rate for each category of workers in GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Female Workers	13107	1088.43	813.28	0	63649.50
Male Workers	25407	1380.61	1065.85	0	139931.05
Contractual Workers	14383	965.12	827.45	0	238846.48
Non-Contractual Workers	25376	5164.71	2246.53	32.61	1901297.40
Production Workers	26397	1151.39	950.76	22.31	107634.05
Non-Production Workers	26280	8165.45	5110.19	0	5930521.50
Non-GVC Plants					
Female Workers	131347	813.65	633.98	0	283949.28
Male Workers	413530	941.21	747.34	0	338182.09
Contractual Workers	165949	789.07	680.68	0	296215.41
Non-Contractual Workers	391414	2662.89	1280.25	0	1812901.50
Production Workers	451694	817.14	700.72	0	338182.09
Non-Production Workers	408471	4816.81	2583.29	0	73775200.00

Source: Based on authors' calculations using ASI data

Table 4: labour Productivity for each category of workers in GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Female Workers	13107	0.86	0.03	-89.97	299.40
Male Workers	25407	0.06	0.02	-20.76	21.77
Contractual Workers	14383	0.07	0.02	-9.54	49.21
Non-Contractual Workers	25467	0.05	0.01	-20.76	21.77
Production Workers	26280	0.16	0.07	-290.64	271.91
Non-Production Workers	26397	0.02	0.01	-20.76	18.05
Non-GVC Plants					
Female Workers	131346	0.36	0.02	-367.12	359.35
Male Workers	413523	0.03	0.01	-9.07	64.46
Contractual Workers	165947	0.04	0.01	-9.66	71.41
Non-Contractual Workers	416638	0.03	0.01	-9.07	64.46
Production Workers	408464	0.11	0.04	-17.70	171.94
Non-Production Workers	451686	0.01	0.01	-7.78	33.27

Source: Based on authors' calculations using ASI data

Table 5: Share in Employment of different categories of workers in GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Share of Female Workers	16855	0.27	0.14	0	1
Share of Contractual Workers	18250	0.44	0.46	0	1
Share of Production Workers	26304	0.14	0.10	0	1
Non-GVC Plants					
Share of Female Workers	233005	0.20	0.06	0	1
Share of Contractual Workers	268642	0.40	0.34	0	1
Share of Production Workers	422694	0.15	0.11	0	1

Source: Based on authors' calculations using ASI data

Table 6: Wage Gap between different categories of workers in GVC and Non-GVC plants

	N	Mean	Median	Min	Max
GVC Plants					
Gender Wage Gap	25465	0.48	0.01	-7.68	1
Contractual Wage Gap	26396	0.42	0.00	-8.31	1
Production Wage Gap	26411	-1.05	0.00	-15283.83	1
Non-GVC Plants					
Gender Wage Gap	416508	0.68	1.00	-19.31	1
Contractual Wage Gap	451583	0.39	1.00	-59271.99	1
Production Wage Gap	452387	-13.14	0.01	-342454	1

Source: Based on authors' calculations using ASI data

the difference in employment, wages, and labour productivity cannot be attributed to their participation in the GVC.

Table 7: Other Characteristics of GVC and Non-GVC Plants

	N	Mean	Median	Min	Max
GVC Plants					
Plant Age	26336	20.34	17.00	0	315
Sales	26412	32.45	5.63	0	32267.41
Assets	26403	14.03	1.32	0	12577.76
labour Intensity	26399	10.00	0.000	0	222361.42
Skill Intensity	26311	0.11	0.08	0	1
Non-GVC Plants					
Plant Age	450039	18.96	15.00	0	358
Sales	452727	8.82	0.73	0	31562.94
Assets	451904	3.62	0.14	-135.87	19285.19
labour Intensity	451549	9.82	0.00	-.01	289542.78
Skill Intensity	423199	0.12	0.10	0	1

Source: Based on authors' calculations using ASI data

5 Methodology

To correctly attribute the difference in employment, wages, and labour productivity to GVC participation, we estimate multivariate regression models that control for various characteristics of the plant. We use the following equation:

$$Y_{pt} = \beta_0 + \beta_1 \text{GVC}_{pt} + \beta_2 \text{Plant\_Controls}_{pt} + \lambda_p + \lambda_i + \lambda_t + \varepsilon_{pt}$$

Where Y_{pt} represents the labour market outcomes like total employees, real wage rate, and labour productivity; GVC_{pt} is a dummy variable which takes value 1 if the plant participates in backward GVC and takes value 0 if the plant does not participate in backward GVC; $\text{Plant\_Controls}_{pt}$ is a vector of plant-specific controls which include different combinations of plant characteristics such as plant age, plant size, sales, labour intensity, skill intensity, wages rate, and labour productivity; λ_p is the plant-level fixed effect; λ_i is the industry-level fixed effect; and λ_t is the year fixed effect. Both the Breusch and Pagan Lagrangian multiplier test for random effects and the Hausman specification test indicate that we should use a

fixed-effects model as it accounts for plant-specific unobserved heterogeneity, which biases pooled OLS and Random-effects estimates. The appendix shows the results of the pooled OLS, random effects and fixed effects models for total employees, wage rate, and labour productivity, in Tables A3, A4, and A5, respectively. We see that backward GVC participation significantly increases total employment, but the magnitude decreases dramatically as we move from pooled OLS to random effects and further to fixed effects, reflecting bias reduction by controlling for unobserved heterogeneity. GVC participation positively affects wages, but the effect diminishes after controlling unobserved plant effects, indicating earlier estimates were biased upwards. Table A4 suggests that GVC participation has no significant impact on labour productivity in both pooled OLS model and fixed effects model. The modified Wald statistic indicates that heteroscedasticity exists in the fixed effects model; hence, standard errors should be either robust or clustered. We cluster standard errors at the industry (4-digit NIC) and state level.

6 Results

After controlling for plant characteristics such as plant size, age, sales, labour intensity, skill intensity, wage rate, and labour productivity, we present detailed regression results in Tables 8, 9, and 10. Table 8 summarizes the primary labour market outcomes, namely total employment, real wage rate, and labour productivity. Our results indicate a robust and statistically significant positive impact of backward GVC participation on employment and wage rates. Specifically, GVC plants hire approximately 4.72% more employees than non-GVC plants. This result aligns with theoretical predictions that firms integrated into global value chains experience enhanced production demands, thus requiring additional labour inputs.

Similarly, our analysis reveals a modest yet significant wage premium associated with GVC participation. Employees at GVC-integrated plants earn, on average, 2% higher wages compared to non-GVC plants, consistent with existing literature which argues that GVC firms often need to maintain competitive labour standards and skills to meet international production standards and quality benchmarks.

In contrast, labour productivity outcomes do not differ significantly between GVC and non-GVC plants. The lack of a statistically significant productivity differential could suggest that productivity enhancements from GVC participation might be offset by other plant-specific factors not captured in the model. It could also indicate that productivity gains are not uniformly distributed across all GVC-integrated firms. Additionally, these findings emphasize the importance of distinguishing between employment and wage benefits and productivity effects when evaluating the impact of backward GVC participation.

Further, exploring the distributional characteristics of labour across GVC-integrated plants, Table 9 investigates whether GVC participation influences the shares of specific worker groups. Intuitively, due to international market pressures and competitive production demands, GVC firms might seek more flexible and cost-effective labour arrangements, potentially hiring more female or contractual workers. However, our results reveal no significant differences in the share of female or contractual employees between GVC and non-GVC plants. One possible explanation could be prevailing rigidities or social norms within the Indian labour market limiting adjustments in workforce composition based purely on international market pressures.

Interestingly, we find a slightly higher proportion of production workers in GVC plants, significant at the 10% level. This suggests that GVC participation might particularly favour employment opportunities for production-level, possibly lower-skilled workers, reflecting India's comparative advantage in low-skilled labour-intensive activities within global value chains.

Table 10 offers insights into the wage inequalities between various categories of workers. Importantly, GVC plants exhibit a significantly lower gender wage gap (16%) compared to non-GVC plants, indicating a noteworthy advancement in gender equity associated with integration into global value chains. This could reflect international standards or pressures from global buyers or multinational corporations, promoting more equitable labour practices.

Moreover, the wage gap between contractual and non-contractual workers is 11% lower in GVC plants, significant at the 5% level. This indicates improved wage equity among

these two distinct groups within GVC firms, likely due to international scrutiny and compliance with global labour standards. Conversely, the wage gap between production and non-production workers is 1.5% higher in GVC plants, significant at the 1% level. This finding is somewhat counterintuitive and suggests a premium on managerial and supervisory roles within GVC plants, possibly due to higher skill requirements for coordinating complex production processes involved in international value chains.

7 Conclusion

This paper highlights the importance of backward GVC participation in providing decent non-farm jobs in India. The paper assesses the impact of GVC participation on employment, wages, and labour productivity. Our analysis indicates that a plant participating in backward GVC tends to employ more workers and pay higher wages than one that does not participate in a GVC. However, we do not find any significant difference in labour productivity for the two kinds of plants.

The share of female workers and the share of contractual workers in GVC plants is not significantly different from that in non-GVC plants. The share of production workers is higher for GVC plants. This implies that GVC plants can be more helpful in creating jobs for low-skilled workers, which are abundant in India. We find a lower wage gap between male and female workers and contractual and non-contractual workers but a higher wage gap between production and non-production workers. GVC participation can thus help reduce wage inequality to some extent between male and female workers and contractual and non-contractual workers.

Overall, greater engagement in GVCs appears to benefit the Indian workforce rather than harm it. Policy environments such as import tariff cuts, especially on intermediate inputs, export subsidy, promoting foreign direct investment, and special economic zones promoting activities like assembling and packaging foreign products should be in place to reap the maximum benefits of GVC participation.

Table 8: Fixed Effects regression of log values of labour market outcomes on GVC status and plant-specific controls.

VARIABLES	(1) **Log Total Employees**	(2) **Log Wage Rate**	(3) **Log labour Productivity**
GVC = 1	0.047***	0.020***	-0.001
	(0.006)	(0.005)	(0.000)
Log Total Employees		-0.067***	
		(0.008)	
Log Real Wage Rate	-0.077***		0.004***
	(0.009)		(0.001)
labour Productivity	-0.280***	0.292***	
	(0.062)	(0.109)	
Plant Size (Small)	0.431***	0.017***	-0.001
	(0.015)	(0.006)	(0.001)
Plant Size (Medium)	0.844***	0.041***	-0.002***
	(0.027)	(0.010)	(0.001)
Plant Size (Large)	1.310***	0.087***	-0.003*
	(0.040)	(0.014)	(0.001)
Log Plant Age	0.066***	0.060***	0.000*
	(0.006)	(0.005)	(0.000)
Log labour Intensity	0.000*	0.000	0.000**
	(0.000)	(0.000)	(0.000)
Log Skill Intensity	0.281***	-0.043***	-0.002***
	(0.015)	(0.004)	(0.000)
Constant	1.341***	7.401***	-0.016***
	(0.133)	(0.032)	(0.005)
Observations	373,464	373,464	373,464
R-squared	0.962	0.865	0.555
Plant F.E.	Yes	Yes	Yes
Industry F.E. (4-digit NIC)	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 9: Fixed Effects regression of log values of share of workers on GVC status and plant-specific controls.

VARIABLES	(1) **Log Share of Female Employees**	(2) **Log Share of Contractual Employees**	(3) **Log Share of Production Employees**
GVC = 1	-0.005	0.006	0.004*
	(0.010)	(0.007)	(0.002)
Log Total Employees	0.064***	0.372***	-0.039***
	(0.018)	(0.010)	(0.003)
Log Gender Wage Gap	0.053***		
	(0.003)		
Log Contractual Wage Gap		0.128***	
		(0.003)	
Log Production Wage Gap			-0.001
			(0.001)
Log Real Wage Rate	-0.075***	-0.083***	0.021***
	(0.013)	(0.010)	(0.003)
labour Productivity	0.199	0.052	-0.000
	(0.173)	(0.035)	(0.009)
Plant Size (Small)	0.029	-0.008	0.000
	(0.016)	(0.025)	(0.003)
Plant Size (Medium)	0.019	-0.008	0.004
	(0.023)	(0.029)	(0.004)
Plant Size (Large)	0.004	0.005	0.007
	(0.031)	(0.031)	(0.005)
Log Plant Age	0.016	-0.035***	0.006***
	(0.011)	(0.008)	(0.002)
Log labour Intensity	-0.001	0.006	-0.002**
	(0.006)	(0.004)	(0.001)
Log Skill Intensity	0.027***	-0.039***	0.966***
	(0.007)	(0.005)	(0.004)
Constant	-0.627***	-0.922***	0.079***
	(0.141)	(0.111)	(0.022)
Observations	83,702	98,392	356,377
R-squared	0.901	0.806	0.986
Plant F.E.	Yes	Yes	Yes
Industry F.E. (4-digit NIC)	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Fixed Effects regression of log values of wage gap on GVC status and plant-specific controls.

VARIABLES	(1) **Log Gender Wage Gap**	(2) **Log Contractual Wage Gap**	(3) **Log Production Wage Gap**
GVC = 1	-0.160***	-0.110**	0.015***
	(0.050)	(0.045)	(0.006)
Log Total Employees	-0.974***	-1.461***	-1.990***
	(0.052)	(0.052)	(0.006)
labour Productivity	-0.264*	0.584**	0.208***
	(0.149)	(0.275)	(0.070)
Plant Size (Small)	-0.055	0.025	0.013
	(0.038)	(0.031)	(0.011)
Plant Size (Medium)	-0.020	0.003	0.030**
	(0.062)	(0.051)	(0.015)
Plant Size (Large)	-0.013	-0.051	0.047**
	(0.080)	(0.078)	(0.019)
Log Plant Age	-0.048	0.012	0.014**
	(0.035)	(0.023)	(0.006)
Log labour Intensity	0.030**	-0.044***	-0.008*
	(0.014)	(0.013)	(0.004)
Log Skill Intensity	-0.012	0.293***	-2.106***
	(0.022)	(0.021)	(0.005)
Constant	1.465***	4.409***	-0.823***
	(0.220)	(0.201)	(0.033)
Observations	317,600	321,947	356,716
R-squared	0.789	0.783	0.977
Plant F.E.	Yes	Yes	Yes
Industry F.E. (4-digit NIC)	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

8 Limitations

These are just the preliminary results, and we understand that our results can be biased due to potential endogeneity concerns arising from omitted variables, reverse causality and simultaneity. We can look at the two-step system GMM and instrumental variable approach to establish causality while addressing these concerns. These are yet to be explored in our context.

References

Acemoglu, D., Autor, D., Dorn, D., Hanson, G. H., & Price, B. (2016). Import competition and the great us employment sag of the 2000s. *Journal of Labor Economics*, *34*(S1), S141–S198.

Amiti, M., & Wei, S.-J. (2005). Fear of service outsourcing: Is it justified?

Amiti, M., & Wei, S.-J. (2009). Service offshoring and productivity: Evidence from the us. *World Economy*, *32*(2), 203–220.

Arndt, S. W. (1997). Globalization and the open economy. *The North American Journal of Economics and Finance*, *8*(1), 71–79.

Athukorala, P.-c., et al. (2014). How india fits into global production sharing: Experience, prospects, and policy options. *India policy forum*, *10*(1), 57–116.

Baldwin, R. E. (2011). 21st century regionalism: Filling the gap between 21st century trade and 20th century trade rules. *Available at SSRN 1869845*.

Banga, K. (2016). Impact of global value chains on employment in india. *Journal of Economic Integration*, 631–673.

Cardoso, M., Neves, P. C., Afonso, O., & Sochirca, E. (2021). The effects of offshoring on wages: A meta-analysis. *Review of World Economics*, *157*, 149–179.

Chatterjee, S., & Subramanian, A. (2023). India's inward (re) turn: Is it warranted? will it work? *Indian Economic Review*, 1–25.

Constantinescu, C., Mattoo, A., & Ruta, M. (2019). Does vertical specialisation increase productivity? *The World Economy*, *42*(8), 2385–2402.

Durongkaveroj, W. (2022). Employment effects of joining global production networks: Does domestic value added matter? *Review of Development Economics*, *26*(3), 1269–1285.

Ebenstein, A., Harrison, A., McMillan, M., & Phillips, S. (2014). Estimating the impact of trade and offshoring on american workers using the current population surveys. *Review of Economics and Statistics*, *96*(4), 581–595.

Falk, M., & Wolfmayr, Y. (2005). The impact of international outsourcing on employment: Empirical evidence from eu countries. *2nd Euroframe Conference on economic policy issues in the European Union*.

Farole, T., Hollweg, C., & Winkler, D. (2018). *Trade in global value chains: An assessment of labor market implications*. World Bank.

Feenstra, R. C., & Hanson, G. H. (1996). Globalization, outsourcing, and wage inequality.

Freund, C. L., Mattoo, A., & Antràs, P. (2020). *World development report 2020: Trading for development in the age of global value chains*. World Bank Group.

Ge, Y., Fang, T., & Jiang, Y. (2019). Access to imported intermediates and intra-firm wage inequality. *The World Economy*, *42*(8), 2364–2384.

Geishecker, I., & Görg, H. (2008). Winners and losers: A micro-level analysis of international outsourcing and wages. *Canadian Journal of Economics/Revue canadienne d'économique*, *41*(1), 243–270.

Hijzen, A., Görg, H., & Hine, R. C. (2005). International outsourcing and the skill structure of labour demand in the united kingdom. *The Economic Journal*, *115*(506), 860–878.

Hijzen, A., & Swaim, P. (2007). Does offshoring reduce industry employment? *National Institute Economic Review*, *201*, 86–96.

Hummels, D., Ishii, J., & Yi, K.-M. (2001). The nature and growth of vertical specialization in world trade. *Journal of international Economics*, *54*(1), 75–96.

Hummels, D., Munch, J. R., & Xiang, C. (2018). Offshoring and labor markets. *Journal of Economic Literature*, *56*(3), 981–1028.

Johnson, R. C., & Noguera, G. (2012). Accounting for intermediates: Production sharing and trade in value added. *Journal of international Economics*, *86*(2), 224–236.

Johnson, R. C., & Noguera, G. (2017). A portrait of trade in value-added over four decades. *Review of Economics and Statistics*, *99*(5), 896–911.

Kee, H. L., & Tang, H. (2016). Domestic value added in exports: Theory and firm evidence from china. *American Economic Review*, *106*(6), 1402–1436.

Kimura, F., Takahashi, Y., & Hayakawa, K. (2007). Fragmentation and parts and components trade: Comparison between east asia and europe. *The North American Journal of Economics and Finance*, *18*(1), 23–40.

Monarch, R., Park, J., & Sivadasan, J. (2017). Domestic gains from offshoring? evidence from taa-linked us microdata. *Journal of International Economics*, *105*, 150–173.

MOSPI. (2022). *Asi write up 2019-20*. Ministry of Statistics; Programme Implementation, Government of India.

Pan, Z. (2020). Global value chain, productivity and job market effect. *Journal of economic and social development*, *7*(1), 7–16.

Sankhe, S., Madgavkar, A., Kumra, G., Woetzel, J., Smit, S., & Chockalingam, K. (2020). *India's turning point: An economic agenda to spur growth and jobs* (tech. rep.). McKinsey Global Institute.

Szymczak, S., & Wolszczak-Derlacz, J. (2022). Global value chains and labour markets–simultaneous analysis of wages and employment. *Economic Systems Research*, *34*(1), 69–96.

Thangavelu, S. M., & Chongvilaivan, A. (2011). The impact of material and service outsourcing on employment in thailand's manufacturing industries. *Applied Economics*, *43*(27), 3931–3944.

Timmer, M. P., Los, B., Stehrer, R., & De Vries, G. J. (2013). Fragmentation, incomes and jobs: An analysis of european competitiveness. *Economic policy*, *28*(76), 613–661.

Veeramani, C., & Dhir, G. (2016). India's exports of unskilled labour intensive products: A comparative analysis. *International trade and industrial development in India: Emerging trends, patterns and issues. Hyderabad: Orient Blackswan.*

Veeramani, C., & Dhir, G. (2019). Reaping gains from global production sharing: Domestic value addition and job creation by indian exports.

Veeramani, C., & Dhir, G. (2022). Do developing countries gain by participating in global value chains? evidence from india. *Review of World Economics*, *158*(4), 1011–1042.

Wang, S., Chen, H., & Yin, K. (2022). The employment effect of chinese industrial enterprises embedded in environmental cost-adjusted global value chains. *Environmental Science and Pollution Research*, 1–17.

Appendix

Table A1: Description of Dependent Variables

Variables	**Definition**
Total Employees	Total Number of Persons Engaged in a plant.
Real Wage Rate	Wages & Salaries in million Rs. / Total Employees. This is deflated by the Consumer Price Index for Industrial Workers (CPI-IW) from RBI
labour Productivity	Real Gross Value Added in million Rs. / Total Employees
Share of Female* Workers	Number of Female Workers / (Number of Female Workers + Number of Male Workers)
Share of Contractual* Workers	Number of Contractual Workers / (Number of Contractual Workers + Number of Non-Contractual Workers)
Share of Production* Workers	Number of Production Workers / (Number of Production Workers + Number of Non-Production Workers)
Gender Wage Gap	(Wage Rate of Male Workers - Wage Rate for Female Workers) / Wage Rate of Male Workers
Contractual Wage Gap	(Wage Rate of Non-Contractual Workers - Wage Rate for Contractual Workers) / Wage Rate of Non-Contractual Workers
Production Wage Gap	(Wage Rate of Non-Production Workers - Wage Rate for Production Workers) / Wage Rate of Non-Production Workers

* The number of workers in each category is calculated using ASI Tabulation Program 2019-20, Srl. A. Wages for all such workers are calculated using ASI Tabulation Program 2019-20, Srl. C, and the wage rate is calculated by dividing the total wages of each category of workers by the number of workers. Real Gross Value Added is calculated using ASI Tabulation Program 2019-20 (in million Rs.) and deflated by Wholesale Price Index from RBI.

Table A2: Description of Independent and Control Variables

Variables	**Definition**
GVC	Indicates whether a plant is GVC or not. It takes value 1 if a plant is GVC and 0 otherwise. A plant is GVC if it imports and exports in the same year.
Plant Age	Year of Survey – Year of Initial Production. Plant age is replaced by 0 if plant age < 0 and considered missing if the initial year of production < 1600 and < 2020.
Plant Size	Based on Fixed Capital as given by ASI Tabulation Program 2019-20 deflated by WPI-PA. Below 25 percentile are considered micro, and it takes value 0; above 25 percentile but below 50 percentile are considered small, and it takes value 1; above 50 percentile but below 75 percentile are considered medium and it takes value 2: and above 75 percentile are considered large plants and it takes value 3.
labour Intensity	Total Employees / Real Fixed Capital in Rs.

Table A2: Description of Independent and Control Variables

Variables	**Definition**
Skill Intensity	Number of Supervisory and Managerial Staff / Total Employees

Table A3: Results from pooled OLS, random effect, and fixed effect model

	(1)	**(2)**	**(3)**
Total Employees	**Pooled OLS**	**Random Effects**	**Fixed Effects**
GVC = 1	0.347***	0.098***	0.030***
	(0.005)	(0.003)	(0.003)
Log Real Wage Rate	0.338***	0.161***	-0.059***
	(0.002)	(0.002)	(0.005)
labour Productivity	-0.003	-0.137***	-0.197***
	(0.019)	(0.014)	(0.036)
Log labour Intensity	0.396***	0.307***	0.282***
	(0.001)	(0.001)	(0.007)
Log Skill Intensity	-0.435***	-0.293***	-0.200***
	(0.002)	(0.001)	(0.003)
Plant Size (Small)	1.084***	0.812***	0.427***
	(0.004)	(0.003)	(0.006)
Plant Size (Medium)	2.239***	1.672***	0.825***
	(0.004)	(0.004)	(0.010)
Plant Size (Large)	3.842***	2.520***	1.252***
	(0.005)	(0.005)	(0.015)
Log Plant Age	0.104***	0.118***	0.160***
	(0.001)	(0.002)	(0.003)
Constant	-3.649***	-1.289***	1.457***
	(0.016)	(0.016)	(0.062)
Observations	431,479	431,479	431,479
R-squared	0.765		0.361
Number of Plants		137,059	137,059

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A4: Results from pooled OLS, random effect, and fixed effect model for wage rate regression

	(1)	(2)	(3)
Wage Rate	**Pooled OLS**	**Random Effects**	**Fixed Effects**
GVC = 1	0.120***	0.038***	0.014***
	(0.004)	(0.003)	(0.003)
Log Total Employees	0.173***	0.113***	-0.050***
	(0.001)	(0.001)	(0.004)
labour Productivity	0.596***	0.353***	0.269**
	(0.013)	(0.011)	(0.112)
Log labour Intensity	-0.096***	-0.105***	-0.065***
	(0.001)	(0.001)	(0.002)
Log Skill Intensity	0.313***	0.166***	0.098***
	(0.001)	(0.001)	(0.002)
Plant Size (Small)	0.167***	0.070***	-0.031***
	(0.003)	(0.003)	(0.004)
Plant Size (Medium)	0.237***	0.118***	-0.053***
	(0.004)	(0.004)	(0.006)
Plant Size (Large)	0.220***	0.125***	-0.049***
	(0.006)	(0.005)	(0.008)
Log Plant Age	0.081***	0.118***	0.161***
	(0.001)	(0.001)	(0.003)
Constant	7.111***	7.036***	7.361***
	(0.006)	(0.006)	(0.018)
Observations	431,479	431,479	431,479
R-squared	0.426	0.110	
Number of Plants	137,059	137,059	137,059

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A5: Results from pooled OLS, random effect, and fixed effect model for labour productivity regression

	(1)	(2)	(3)
labour Productivity	**Pooled OLS**	**Random Effects**	**Fixed Effects**
GVC = 1	-0.000	-0.001***	-0.001
	(0.000)	(0.000)	(0.001)
Log Real Wage Rate	0.008***	0.007***	0.007***
	(0.000)	(0.000)	(0.001)
Log labour Intensity	-0.003***	-0.002***	-0.003***
	(0.000)	(0.000)	(0.001)
Log Skill Intensity	-0.001***	0.000	0.001*
	(0.000)	(0.000)	(0.000)
Plant Size (Small)	-0.005***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.001)
Plant Size (Medium)	-0.008***	-0.004***	-0.005***
	(0.000)	(0.000)	(0.001)
Plant Size (Large)	-0.006***	-0.003***	-0.006***
	(0.000)	(0.001)	(0.002)
Log Plant Age	0.000	0.001***	0.004***
	(0.000)	(0.000)	(0.000)
Constant	-0.027***	-0.025***	-0.029***
	(0.001)	(0.002)	(0.009)
Observations	431,479	431,479	431,479
R-squared	0.015		0.006
Number of Plants	137,059	137,059	137,059

Source: Based on authors' calculations using ASI data. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$