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Does Economic Policy Uncertainty Impact Firm GVC Participation? Microdata Evidence from India

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Abstract: *In this study, we examine the implications of economic policy uncertainty on global value chain (GVC) participation and the integration of Indian manufacturing firms using firm-level data. Using panel data from 2004 to 2021, we find that economic policy uncertainty (EPU) impedes GVC participation and firm integration. Further, we find that the impact of EPU on GVC participation operates through the financial constraint channel with highly leveraged and low-liquidity firms. Using survival analysis, we also highlight that higher EPU results in higher exit from GVCs and reduces entry into GVCs.*

Keywords: Economic policy uncertainty; GVC participation; Manufacturing firms

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1. Background and Objective

Global value chains (GVCs) over the past two decades have featured as a key development strategy for most developing and emerging economies. However, real economic shocks have hindered the growth of GVCs at both the regional and global levels. According to the World Bank (2020), GVC growth peaked in 2007 and dwindled with the onset of the global financial crisis (GFC). Post-GFC, global trade recorded subdued growth, which was further exacerbated by the onset of the Covid-19 pandemic. A common feature of these global shocks is the inherent economic uncertainty associated with them. This uncertainty results in a 'wait-and-watch' problem for firms, wherein firms' uncertainty induces inactivity amongst firms and leads to a reduction in their level of investment (Bloom, 2009). Similarly, Arellano et al. (2019) highlight that with higher uncertainty, firms try to minimise their risks by reducing their inputs, heightening the 'wait-and-watch' problem. This behaviour can also alter the landscape of exchange and trade. For instance, Constantinescu et al. (2020) argue that the effect of economic policy uncertainty is higher for GVCs than other trade due to the interdependence of intermediate trade and interlinkages in the GVC activities that increase the economic policy uncertainty (EPU) levels in an economy. This has a direct impact on the investment decisions of firms and changes firms' investment patterns as they may choose to postpone their investment activities.

The implications of uncertainty on trade outcomes have gained momentum in the international trade literature post-GFC. Novy and Taylor's (2020) theoretical framework shows that firms importing from foreign suppliers are likely to reduce their orders in light of increased economic uncertainty. Further, Handley and Limão (2015) model the sunk costs associated with trade, which highlights the delay in firms' entry into global markets due to trade policy uncertainty. Crowley et al. (2018) note that perceived tariff increases that do not materialise have a negative impact on trade, highlighting how uncertainty directly hampers trade and output growth. In another study, Handley and Limão (2017) find that a reduction in uncertainty concerning United States (US) tariffs on China's exports could be attributed to nearly 30% of China's export growth with the US. On the other hand, Crowley et al. (2018), using Chinese transaction-level data, document that tariff scares (the possibility of tariff increases in the future) resulted in a reduction in the entry of Chinese firms into foreign markets. EPU also may affect trade via the exchange rate channel. Krol (2014) highlights that EPU results in an increase in exchange rate volatility. Further, Hlatshwayo and Saxegaard (2016) note that high EPU via

the exchange rate channel leads to a reduction in the responsiveness of exports to the real effective exchange rate, which adversely impacts export performance.

Our study complements this particular strand of literature by focusing on the role of EPU in the GVC participation of Indian manufacturing firms. By doing so, we contribute to the rising literature on uncertainty and trade. To begin with, the focus of this study is on the GVC dynamics associated with EPU. Therefore, we deviate from the burgeoning literature on trade and EPU at an aggregate level. In this context, GVC participation involves engaging in intermediate trade in both imports and exports; thus, there is a greater need for investment. The intermediate trade and interlinkages create greater sunk costs associated with GVC participation, and these are likely to be larger in comparison with other modes of trade integration[4] (Constantinescu et al., 2020). Further, the two-way trading nature of a GVC firm also implies that EPU can impact GVC operations from both the demand and supply sides. In a recent study, Kumar et al. (2021) report that an EPU shock operates as a demand shock in advanced economies. However, in the case of emerging economies, it can be characterised as a supply shock. Hence, it becomes important to examine the firm-level dynamics associated with the EPU-GVC nexus.

Second, we also explore the channel through which EPU transmits to GVCs. More specifically, we explore the interplay between EPU and the financial constraints of firms and the impact on GVC participation. The underlying rationale is that GVC participation is a long-term investment process in terms of backward and forward linkages, and it is also likely to be a 'lumpy' investment. Hence, in the presence of uncertainty, financially constrained firms may expect greater trade contraction in comparison to unconstrained firms. We explore this channel empirically in our study.

Finally, the current study attempts to examine this nexus from the emerging market perspective of India. In this regard, our decision to examine the nexus between EPU and GVC participation for Indian firms is driven by multiple factors. Firstly, India's manufacturing sector has stagnated over the past two decades, so there is a significant policy push to rejuvenate the manufacturing sector (Bhattacharjee and Chakrabarti, 2013). Economic Survey (2018) highlights the policy framework of GVC integration as a means to boost the manufacturing sector. As a result, it becomes important to examine the factors that can significantly shape the GVC participation of Indian firms. In this study, we use rich micro data on Indian manufacturing

[4] Pure exporters are firms that only export and do not import. Pure importers are firms that only import but do not export

firms over the period 2004–2021 to analyse the impact of global economic uncertainty pertaining to manufacturing firms' integration into GVCs.

The results of our findings, using a binary dependent model, highlight that higher EPU reduces the GVC integration of Indian manufacturing firms. Further, the main findings are robust to alternative measures of GVC integration and economic uncertainty. The rest of the paper is organised as follows. Section 2 describes the data and empirical methodology. Section 3 presents the empirical results. Finally, Section 4 concludes our study.

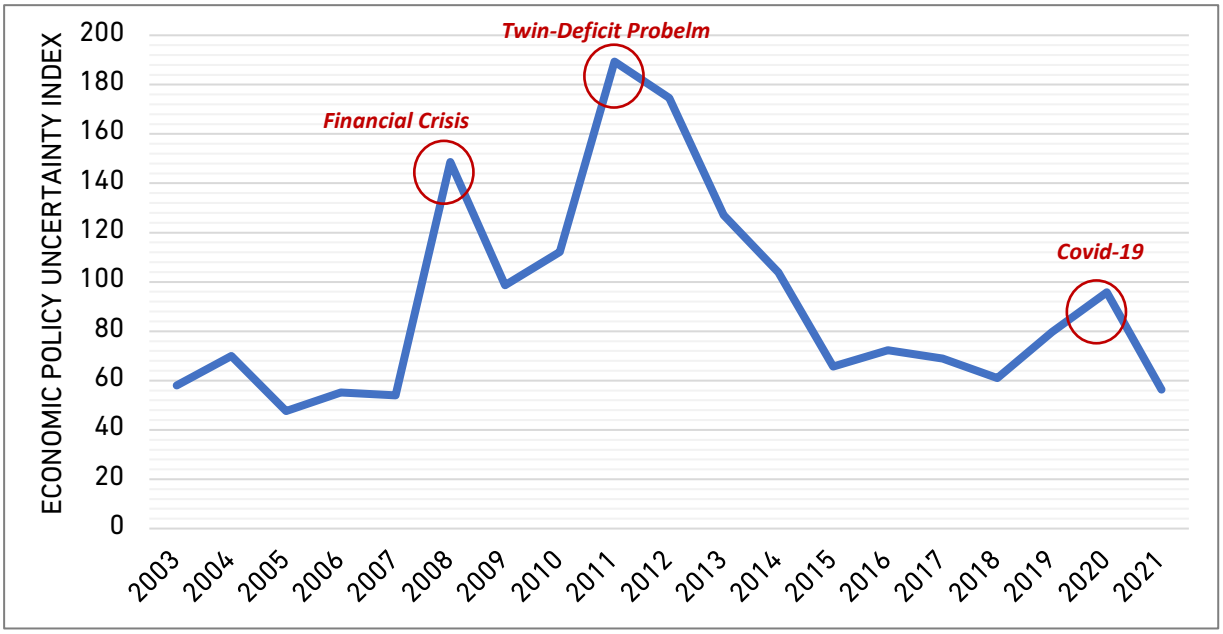
2. Data and Methodology

In this section, first, we describe the data sources used in the study. In the next section, we provide information on the variables used in the empirical estimations and outline the empirical model specification.

2.1 Data

The data for this study come from two sources. First, data on Indian manufacturing firms are obtained from the CMIE-Prowess database, which is a proprietary database maintained by the Centre for Monitoring Indian Economy (CMIE). The CMIE-Prowess database compiles firm-level information on the sales, assets, and ownership structure of the firms. The database contains the balance sheet information and annual reports of the firms, including firm-level information on exports and imports. This information allows us to capture the GVC participation of the firms based on the framework provided by Reddy, Sasidharan, and Thangavelu (2023). In addition, we impose restrictions on firm exports, imports, and ownership classification as alternative means of capturing firms involved in GVCs and to validate the robustness of our main results. Further, the CMIE-Prowess database also provides the largest coverage of manufacturing firms' (both listed and unlisted firms) activities in the Indian economy. The firms featured in the database account for over 75% of corporate taxes and 70% of organised activity in the country (Stiebale and Vencappa, 2018). This database has been used for studies related to trade and Indian manufacturing (see De Loecker et al. (2016) and Reddy, Sasidharan, and Thangavelu (2023)) and is widely acknowledged as a comprehensive database on the Indian corporate sector.

Figure 1: Economic Policy Uncertainty in India



Source: Authors.

Second, we draw information on EPU from the pioneering work of Baker et al. (2016). The EPU index developed by Baker et al. (2016) is available for 22 economies based on the frequency counts of the terms 'economy', 'policy', and 'uncertainty' featured in newspaper articles. Previously, Constantinescu et al (2020) used this index for trade-related issues. In line with the existing literature, our study also measures economic policy uncertainty as the yearly weighted average of the monthly EPU index. Figure 1 depicts the monthly weighted EPU index for India from 2003 onwards. From Figure 1, we observe three distinctive peaks. The first peak coincides with the GFC, where we observe a peak point of EPU. Second, we also note a peak of policy uncertainty during 2011–2012, which represents the periods of high twin deficits and high inflation in the Indian economy (Economic Survey, 2018). Further, the observed policy uncertainty in Figure 1 shows a significant decline post-2011 with a lower trend from 2015. However, we also observe an increase in uncertainty in the Covid-19 pandemic period, during which the EPU significantly increased in 2019 before declining in the post-Covid-19 pandemic period.

2.2. Variables and Methodology

Using a combination of detailed firm-level data from Prowess and macroeconomic indices of economic uncertainty, we employ panel data models to examine the nexus between

EPU and the GVC integration of Indian manufacturing firms. Specifically, we estimate the following discrete-choice probit model:

$$\Pr\left(GVC_{ijt} = 1\right) = \phi(\beta_1 + \beta_2 EPU_{t-1} + \boldsymbol{Z} + \mu_{ijt}) \qquad (1)$$

where *i* represents the firm, *j* represents the two-digit industry the firm operates in, $\boldsymbol{Z}$ represents a vector of firm-level controls, and *t* represents the year. The model is estimated using a panel data sample of over 7,000 Indian manufacturing firms during the 2004–2021 period.

The dependent variable in our model is given as a binary variable to capture the GVC participation of firms. More specifically, based on the exporting and importing activities of firms, we identify GVC firms from the sample. Recent literature highlights that a firm that simultaneously imports and exports can be identified as a GVC firm since the importing channel documents the backward integration of firms, whilst exporting activities represent forward integration (Antràs, 2020; Reddy, Sasidharan, and Thangavelu, 2023). Hence, in line with the previous studies, we identify GVC firms as those that simultaneously export and import. However, to identify firms with deeper linkages in the GVC, we impose restrictions on their minimum levels of importing and exporting activities (Reddy, Sasidharan, and Thangavelu, 2023). Therefore, the GVC participation of firms is restricted to 5% for both importing and exporting activities. Further, to establish the robustness of our results, we use two additional metrics of GVC participation. Firstly, we adjust the import and export activities by increasing the restriction on firms to 10% of their total import and export activities. Second, we consider a firm as a GVC firm based on a 5% restriction on importing and exporting activities over three consecutive years. Table 1 below summarises the three metrics of GVC firms in our sample. We lag all the time-varying variables by one period to mitigate endogeneity concerns in our sample.

In the model, the economic uncertainty variable, EPU, is taken as the weighted average of the monthly EPU index and, therefore, varies across time. The $\boldsymbol{Z}$ variable represents a vector of firm-level controls wherein we account for firm size proxied by the total assets of the firm, the ownership structure via the share of foreign promoters, the age of the firm to factor in the experience of the firm, and firm productivity (TFP). Following Melitz (2003), we control for self-selection effects, whereby the most productive self-select to participate in global markets. We measure revenue-based productivity using the semi-parametric method of Ackerberg et al.

(2015).[5] In addition to these, the vector ***Z*** also accounts for time and industry fixed effects to account for changes in the GVC participation of firms due to changes in the business environment over time and due to heterogeneity across industries. Table 2 provides a brief summary of the variables employed in our empirical analysis.

Table 1: Summary of GVC Definitions

Variable	Definition
Baseline	
GVC-1	=1 if a firm's imports and exports at least 5% of its sales
Alternate Measures	
GVC-2	=1 if a firm's imports and exports at least 10% of its sales
GVC-3	=1 if a firm's imports and exports at least 5% of its sales for three consecutive years

Source: Authors.

From Table 2, we observe that the minimum weighted EPU is 47.636, and the maximum is given at 189.3, highlighting a large variance in the spread of the uncertainty measure. This is also reflected in Figure 1, which plots the weighted EPU for India over the years and highlights that the level of uncertainty has varied throughout the study period of our sample. In terms of GVC participation, from our baseline measure (GVC-1), we note that nearly 17% of the sample's manufacturing firms can be identified as those involved in both export and import activities in regional and global GVC activities. Further, by imposing additional restrictions as summarised in Table 1, we observe that the number of GVC firms declined from 17% to 14.4% and further to 11.2%. In terms of other controls, we observe that the average age of a firm is 25 years, and over 1% of the firms have a presence of foreign ownership.

[5] We report details of the TFP estimation in the Appendix.

Table 2: Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Weighted EPU	60,678	89.188	35.751	47.636	189.341
Log Size	60,678	6.615	1.656	0.47	13.726
Log TFP	60,678	2.553	1.279	0	9.637
Age	60,678	25.435	15.185	1	100
Foreign	60,678	0.012	0.107	0	1
GVC-1	60,678	0.17	0.376	0	1
GVC-2	60,678	0.112	0.316	0	1
GVC-3	60,678	0.144	0.352	0	1
High-Leverage Dummy	60,678	0.532	0.498	0	1
Low-Liquidity Dummy	60,678	0.585	0.492	0	1

Note: We define firm leverage as the ratio of firms' debt to total assets. We use a dummy variable that takes the value of 1 if in a particular year and industry, the firm has a leverage ratio greater than the industry median and 0 otherwise (high-leverage dummy). We measure the liquidity at the firm level as the difference between a firm's current assets and liabilities as a ratio of its total assets. We create a dummy variable to identify firms with lower levels of liquidity, where the binary variable takes the value 1 if the firm in consideration has liquidity less than the median liquidity in the industry and 0 otherwise (low-liquidity dummy).
Source: Authors.

3. Empirical Findings

3.1. Baseline Results

Table 3 presents the baseline results from our probit estimation. All the columns report marginal effects [6] pertaining to the three different measures of GVC participation (as summarised in Table 1). From the coefficients reported, we observe a negative and statistically significant association of EPU on the GVC participation of Indian manufacturing firms.[7] In terms of magnitude, we observe that a one-standard-deviation increase in the EPU index decreases the probability of firm participation in GVC activities by 16% to 26%.[8] In terms of other controls, we note that across various definitions of GVCs, larger firms have greater

[6] The results are qualitatively similar when employing the logit model. The odds ratio pertaining to the logit analysis is available upon request from the authors.
[7] The negative impact of EPU on firm internationalisation persists even when considering only the exporting decision or importing decision of the firm. The results are available upon request from the authors.
[8] The standard deviation of EPU_{t-1} is 35.751. The magnitude is computed as [exp(35.751*regression coefficient on EPU)-1]*100

integration in GVCs compared to smaller firms. Similarly, we also observe that older firms and more productive firms tend to integrate into regional and global GVC activities. The coefficient of foreign ownership is insignificant, which is in line with the existing literature on GVCs in the Indian context. The findings are in line with the broader firm-level literature on GVCs (Urata and Baek, 2020; Gopalan et al., 2022) and align with the firm-level GVC literature on India, which documents a positive impact of firm size (scale effects), age (experience), and productivity on the GVC integration of firms (Reddy, Sasidharan, and Thangavelu, 2023).

Table 3: EPU and GVC Participation – Baseline Estimates

Variables	(1) GVC-1	(2) GVC-2	(3) GVC-3
Weighted EPU $_{t-1}$	-0.0087***	-0.0057***	-0.0049***
	(0.0004)	(0.0004)	(0.0002)
Log Size $_{t-1}$	0.0401***	0.0280***	0.0186***
	(0.0017)	(0.0014)	(0.0012)
Log Age $_{t-1}$	0.0230***	0.0026	0.0204***
	(0.0049)	(0.0039)	(0.0033)
Log TFP $_{t-1}$	-0.0020	-0.0028	0.0046***
	(0.0026)	(0.0022)	(0.0016)
Foreign $_{t}$	-0.0197	0.0059	0.0013
	(0.0159)	(0.0131)	(0.0092)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	53,088	53,088	53,088

Notes: All columns report marginal effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors.

3.2. Financial Constraints as the Channel of Transmission?

The baseline model establishes the negative impact of higher EPU on GVC participation. However, to document the channel via which EPU affects GVC activities, we look closely at the financial condition of the firms. More specifically, we use the leverage of the firm to proxy financial constraints, following prior literature that documents that high EPU has a negative

association with firms' cost of capital and firm investment (Liu and Wang, 2022). The underlying argument is that during times of high EPU, firms face more challenges and operational risks (Greenwald and Stiglitz, 1990). Therefore, higher risk results in a higher cost of debt for the firms. Recent studies also highlight that financial constraints impede the GVC integration of firms (Minetti et al, 2019; Reddy and Sasidharan, 2021). Hence, in our study, we are likely to observe a negative impact of EPU on GVC activities via financial constraint channels.

In our model, as mentioned, we proxy the financial health of firms using the leverage ratio. We define firm leverage as the ratio of debt to total assets, where a higher leverage ratio denotes the lower financial health of the firm. Further, to examine the interactions between EPU and firm leverage, we create a dummy variable that takes the value of 1 if in a particular year and industry, the firm has a leverage ratio greater than the industry median and 0 otherwise. From Table 4, we observe that the coefficient of the interaction term (Weighted EPU_{t-1} # High-Leverage Dummy) is negative and significant across different measures of GVC participation. This result indicates that in the presence of EPU, highly leveraged firms are less likely to be GVC firms, highlighting that EPU affects the financial health of the firms, thereby adversely affecting the GVC participation of firms.

Table 4: Financial Constraints, EPU, GVC Participation

Variables	(1) GVC-1	(2) GVC-2	(3) GVC-3	(4) GVC-1	(5) GVC-2	(6) GVC-3
Weighted EPU $_{t-1}$	-0.0087***	-0.0056***	-0.0048***	-0.0088***	-0.0056***	-0.0051***
	(0.0004)	(0.0003)	(0.0002)	(0.0004)	(0.0003)	(0.0002)
High-Leverage Dummy	0.0026	4.61e-05	0.0030*			
	(0.0029)	(0.0024)	(0.0017)			
Weighted EPU $_{t-1}$ # High-Leverage Dummy	-9.32e-05***	-6.85e-05***	-4.75e-05***			
	(2.73e-05)	(2.32e-05)	(1.62e-05)			
Low-Liquidity Dummy				-0.0009	0.0027	0.0009
				(0.0032)	(0.0027)	(0.002)
Weighted EPU $_{t-1}$# Low-Liquidity Dummy				-5.97e-05**	-3.95e-05	-3.08e-05*
				(2.92e-05)	(2.49e-05)	(1.83e-05)
Log Size $_{t-1}$	0.0404***	0.0282***	0.0187***	0.0403***	0.0280***	0.0196***
	(0.0017)	(0.0014)	(0.0012)	(0.0017)	(0.0014)	(0.0012)
Log Age $_{t-1}$	0.0221***	0.0019	0.0201***	0.0225***	0.0025	0.0221***
	(0.0049)	(0.0039)	(0.0033)	(0.0049)	(0.0039)	(0.0033)
Log TFP $_{t-1}$	-0.0023	-0.0030	0.0045***	-0.0023	-0.0028	0.0045***
	(0.0026)	(0.0022)	(0.0016)	(0.0026)	(0.0022)	(0.0016)
Foreign $_{t}$	-0.0203	0.0053	0.0011	-0.0194	0.00612	0.0015
	(0.0159)	(0.0131)	(0.0091)	(0.0159)	(0.0131)	(0.0094)
Controls						
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53,088	53,088	53,088	53,088	53,088	53,088

Notes: All columns report marginal effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors.

Alternatively, we also use another widely used measure in the literature to proxy for the financial condition of a firm, i.e. liquidity. We measure the liquidity at the firm level as the difference between current assets and liabilities as a ratio of total assets, with higher liquidity representing better financial health of the firm. In this regard, we create a dummy variable to identify firms with lower levels of liquidity, where the binary variable takes the value 1 if the firm in consideration has liquidity less than the median liquidity in the industry and 0 otherwise.

We interact this variable with EPU, and the results are reported in Columns (4)–(6) in Table 4. The interactive term highlights the negative impact of EPU on GVC participation, which suggests that the adverse impact is higher for firms with low liquidity. Hence, our analysis highlights that the financial health of a firm is a key channel, via EPU shocks that affect the GVC activities of firms.

3.3. EPU and GVC exit

In this section, we explore the association between the survival of firms and heightened economic uncertainty in regional and global GVC activities. An interesting phenomenon observed regarding the internationalisation of firms across the globe is the lower survival rate in the global market (see Cui and Liu (2018) for China; Martincus and Carballo (2008) for Peruvian firms; and Esteve-Pérez et al. (2007) for Spanish firms). The same is observed in the case of India, where Reddy and Sasidharan (2023) report that in terms of exports, only 10% of the firms continue to export in the fourth year. Similarly, from the viewpoint of GVCs, Reddy and Sasidharan (2022) find this to be less than 10% for Indian manufacturing firms. In this regard, an increase in EPU could influence the survival of GVC firms. Therefore, we attempt in this section to unravel this nexus by using survival analysis.

We begin by modifying our data to undertake survival analysis in our model. Firstly, we define our GVC exit variable using a dummy variable that equals 1 if a firm was a GVC firm (GVC-1) at t and not in $t+1$. Secondly, whilst undertaking survival analysis, we tackle the concerns of left censoring in the sample. Left censoring from a GVC perspective refers to the sample firms that were part of the GVC at the beginning of our study period, i.e. 2004. Given the lack of availability of information, we are unable to document the complete GVC history of firms. Therefore, we are unable to identify the time period when these firms began their GVC operations. Hence, to overcome the concerns of left censoring, we dropped all firms that were GVC firms at the beginning of our study period (Besedeš and Prusa, 2006). In other words, our survival sample consists of only those firms which were non-GVC firms at the beginning of our study period. Thirdly, given that our aim is to shed light on the transition of firms out of GVCs, we restrict our sample to firms that participated in GVCs during the study period. As a result, we also dropped all those firms that never participated in GVCs in the entirety of the study period.

To empirically estimate the EPU and GVC survival nexus we estimate the following probit model.

$$\Pr(GVC\ Exit_{it} = 1) = \phi(\alpha_1 + \alpha_2 EPU_{t-1} + \boldsymbol{Z} + \mu_{it}) \qquad (2)$$

It is important to note that a vast number of studies on firm survival use a Cox hazard model for survival analysis. However, Hess and Persson (2012) highlight that Cox models are inappropriate for trade data since a Cox model is a continuous time proportional model and fails to factor in unobserved heterogeneity. Hence, we estimate a probit model with random effects that factors in unobserved heterogeneity and tackles the discrete nature of trade data. The results of the survival analysis are presented in Table 5.

Table 5: EPU and GVC Survival

Variables	(1) GVC-Exit	(2) GVC-Exit	(3) GVC-Entry	(4) GVC-Entry
Weighted EPU $_{t-1}$	0.0031**	0.0030**	-0.0085***	-0.0085***
	(0.0015)	(0.0015)	(0.0027)	(0.0027)
Log Size $_{t-1}$	0.0242***	0.0234***	0.0027	0.0032
	(0.0061)	(0.0062)	(0.0024)	(0.0025)
Log Age $_{t-1}$	0.169***	0.165***	-0.0077	-0.0091
	(0.0163)	(0.0163)	(0.0060)	(0.0061)
Log TFP $_{t-1}$	-0.0187**	-0.0307***	0.0032	0.0002
	(0.0075)	(0.0097)	(0.0032)	(0.0050)
Foreign $_{t}$	0.0650	0.0736	-0.0173	-0.0174
	(0.0721)	(0.0720)	(0.0320)	(0.0323)
Year FE	Yes	Yes	Yes	Yes
Industry FE	-	Yes	-	Yes
Observations	9,309	9,309	9,315	9,315

Notes: All columns report marginal effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors.

Given that the dependent variable documents the exit of a firm from GVCs, the positive coefficient on the EPU index highlights that in the presence of greater uncertainty, a firm is more likely to exit the GVCs. We also observe that larger and older firms are less likely to survive in GVCs. The survival literature in this context provides mixed evidence, with recent studies documenting that larger firms, owing to their rigid management practices, do not survive longer in global markets (Dai et al., 2020; Reddy and Sasidharan, 2022). Similarly, there is also growing evidence that documents the greater presence of younger firms in global markets and

older firms lowering competitiveness, which may result in lower survival rates (Dai et al., 2020). Further, we also observe that more productive firms survive longer in GVCs.

Given that we are able to model the GVC exit decisions of firms, we also examine how EPU impacts GVC entry decisions.[9] Given that our preceding analysis highlights that higher uncertainty is positively related with the higher GVC exit of a firm, we expect an inverse relationship between EPU and the entry decision of a firm. Columns (3) and (4) document the results of our study. From the columns, we observe a significant and negative coefficient on the EPU index, highlighting that in line with our expectations, higher uncertainty impedes the entry of a firm into GVCs. This finding echoes Crowley et al. (2018), who report that uncertainty due to tariff 'scares' resulted in a reduction in Chinese firms' entry into the foreign market.

3.4. EPU and GVC intensity

In our study, we use the simultaneous importing and exporting nature of a firm to identify it as a GVC firm using a binary indicator. However, our dataset has more detailed information pertaining to the exporting and importing intensity of a firm. Incorporating this information, we derive a continuous measure of GVC participation to capture the GVC intensity of a firm. Specifically, we adopt the vertical special index of Hummels et al. (2001) to further document the robustness of our findings.

$$VS_{it} = \frac{Import\ of\ raw\ materials,stores\ \&\ spares}{expenditure\ on\ raw\ material\ stores\ \&spares} * \frac{Exports_{it}}{Sales_{it}} \qquad (3)$$

In equation (3), the index incorporates both the importing and exporting aspects of a firm, aligning with our primary measure of GVC integration. Previously, Reddy and Sasidharan (2022) employed this indicator to capture the GVC integration of Indian manufacturing firms. Columns (1) and (2) of Table 6 document the results of our empirical analysis. From the table, we observe, similar to our baseline results, that higher uncertainty reduces the GVC integration of Indian firms.

[9] For our analysis, we identify the GVC entry of a firm using a binary variable that takes the value of 1 if the firm was not part of GVCs in period *t* but participated in GVCs at *t+1*.

Table 6: EPU and GVC Participation: Continuous Measure of GVC

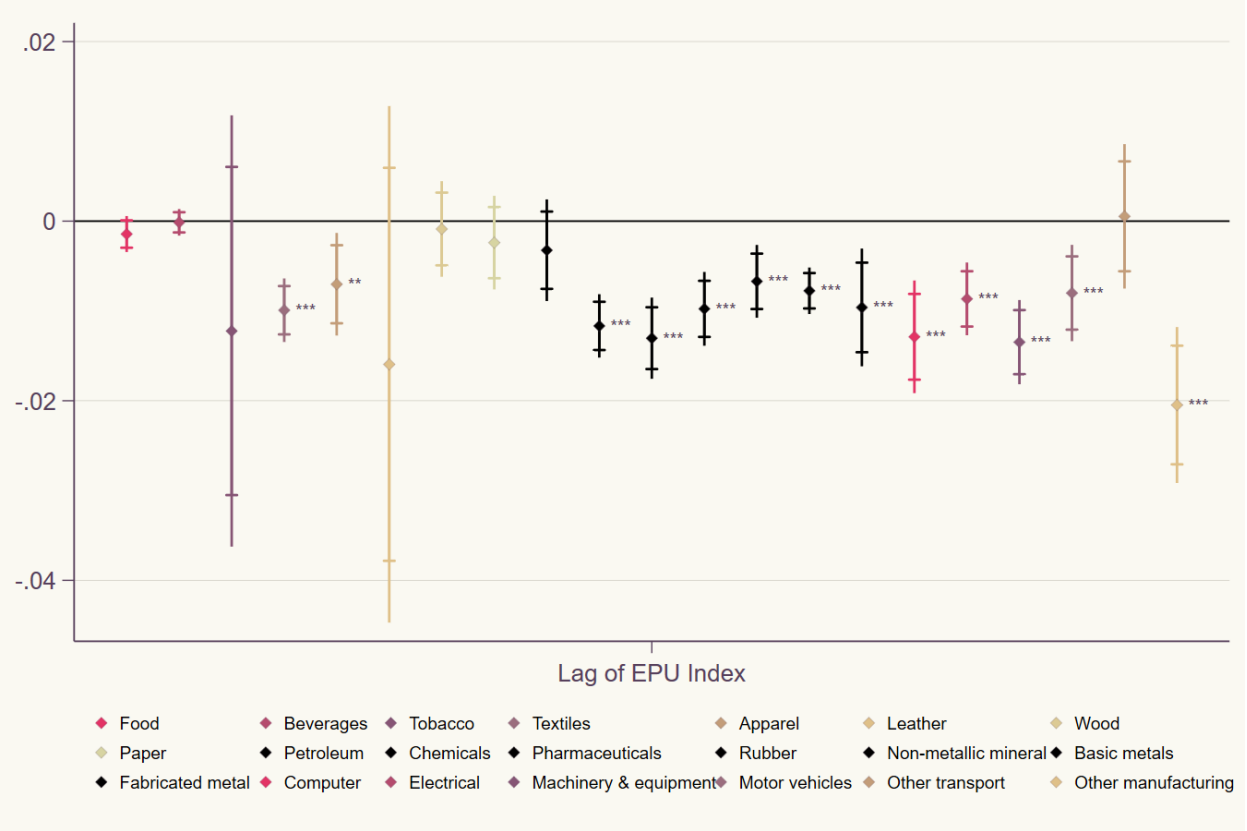
	(1) Log VS	(2) Log VS
Weighted EPU $_{t-1}$	-0.001***	
	(0.0001)	
Weighted World Uncertainty Index $_{t-1}$		-0.0774***
		(0.0700)
Log Size $_{t-1}$	0.001*	0.001*
	(0.001)	(0.001)
Log Age $_{t-1}$	0.008***	0.008***
	(0.003)	(0.003)
Log TFP $_{t-1}$	0.004***	0.004***
	(0.001)	(0.001)
Foreign $_{t}$	0.007	0.007
	(0.006)	(0.006)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	52640	52640

Notes: Standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1
Source: Authors.

3.5. Sectoral Heterogeneity

The impact of policy uncertainty in terms of the internationalisation of firms may also be driven by the industry characteristics. For instance, in India, industries such as the automotive industry have a greater global presence in terms of both importing and exporting aspects, as opposed to textiles, wherein industry involvement is majorly through a single mode (exports). In this regard, we explore the heterogeneity across sectors and find that the negative impact of EPU on GVC participation is consistent, highlighting that uncertainty at the national level has adverse effects on firm internationalisation. From Figure 2, we also observe that this adverse impact on the GVC integration of firms is significant for textiles, apparel, chemicals, pharmaceuticals, rubber, non-metallic minerals, basic metals, fabricated metals, computers, electrical, machinery, and firms from the automotive industries.

Figure 2: EPU and GVC Participation: Sectoral Heterogeneity



Source: Authors.

4. Robustness

4.1. World Uncertainty Index

To establish the robustness of our findings, we employ an alternative metric to capture the essence of economic uncertainty. Specifically, we use the World Uncertainty Index (WUI) from Ahir et al. (2018). A key advantage of this database is that they derive this measure of uncertainty for 143 economies from a single source, which is the country reports provided by the Economist Intelligence Unit.[10] The index is obtained via text-mining, factoring in the number of times the word 'uncertainty' features in these reports, which is then normalised by the total number of words in a report. Recently, Jardet et al. (2023) employed this index to investigate foreign direct investment during periods of uncertainty. We use this measure as an alternative to the EPU index developed by Baker et al. (2016). The results are presented in Table 7.

[10] https://worlduncertaintyindex.com/data/

Table 7: Robustness Check Using the World Uncertainty Index

Variables	(1) GVC-1	(2) GVC-2	(3) GVC-3
Weighted World Uncertainty Index $_{t-1}$	-0.004***	-0.003***	-0.002***
	(0.0002)	(0.0002)	(0.0001)
Log Size $_{t-1}$	0.040***	0.028***	0.018***
	(0.001)	(0.001)	(0.001)
Log Age $_{t-1}$	0.023***	0.002	0.020***
	(0.004)	(0.004)	(0.003)
Log TFP $_{t-1}$	-0.002	-0.002	0.004***
	(0.002)	(0.002)	(0.001)
Foreign $_{t}$	-0.019	0.005	0.001
	(0.015)	(0.013)	(0.009)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	53,088	53,088	53,088

Notes. All columns report marginal effects. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors.

Table 7 presents the results with the WUI as the key variable of interest. From the table, we observe that similar to our baseline results, we find higher uncertainty results in lower GVC participation. The outcome of the robustness analysis highlights that our findings are not sensitive to measures of uncertainty.

4.2. Stock price variance and GVC participation

As a further robustness check, we capture economic uncertainty at the firm level using the stock price variance for each firm. To measure stock price variance (volatility), we consider the standard deviation of stock returns over the past 12 months to capture volatility, which proxies for uncertainty in our analysis (Pandey and Sehgal, 2017). In this regard, we have consistent data for a limited sub-sample of 722 firms, on which we re-estimate our model. Table 8 documents the results of our analysis. From the table, it is evident that the results are similar to our baseline findings, where higher volatility, which proxies economic uncertainty, negatively impacts GVC participation. This further strengthens the robustness of our results.

Table 8: Stock Price Variance and GVC Participation

	(1) GVC-1	(2) GVC-2	(3) GVC-3
Volatility	-0.121**	-0.010	-0.119***
	(0.048)	(0.042)	(0.041)
Log Size $_{t-1}$	0.041**	0.028**	0.020
	(0.016)	(0.014)	(0.014)
Log Age $_{t-1}$	-0.023	0.058	-0.037
	(0.085)	(0.074)	(0.073)
Log TFP $_{t-1}$	0.029	0.027	0.053***
	(0.002)	(0.017)	(0.017)
Foreign $_{t}$	-0.006	0.114	-0.001
	(0.100)	(0.088)	(0.087)
Year FE	Yes	Yes	Yes
Observations	3723	3723	3723

Notes: All columns report marginal effects. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Source: Authors.

4.3. Endogeneity correction

There exists a possibility that the EPU index may not be exogenous since various political factors can exert influence on it (Wang et al., 2014). Hence, to ensure that our results are robust to endogeneity concerns, we use an instrumental variable (IV) approach. We instrument our endogenous lagged EPU with a two-period lagged US EPU index. A similar instrument has been previously used in earlier studies (Wang et al., 2014; Sha et al., 2020). Our findings are robust to endogeneity concerns of EPU as the coefficient of the instrument EPU is negative and significant at the 1% level, corroborating our baseline results that higher EPU deters GVC participation. Furthermore, based on the first-stage results reported, we observe that the coefficient of the two-period lagged US EPU is positive and significant, highlighting that increased EPU in the US results in higher EPU for India, thereby validating the relevance condition. Furthermore, the first-stage F-statistic reported is greater than zero, elucidating that our instrument does not suffer from the problem of weak instrumentation. Finally, the Wald test of exogeneity is significant at the 1% level. Hence, we reject the null that our model is exogenous, highlighting that the use of IV-probit is appropriate in the present context.[11]

[11] The results are qualitatively similar if we instrument level EPU with the two-year lagged US EPU.

Table 9: Endogeneity Correction: EPU and GVC Participation

	(1) gvc1	(2) gvc1
Instrumented Weighted EPU $_{t-1}$	-0.007***	-0.007***
	(0.0003)	(0.0003)
Log Size $_{t-1}$	0.169***	0.199***
	(0.008)	(0.009)
Log Age $_{t-1}$	0.095***	0.060**
	(0.025)	(0.027)
Log TFP $_{t-1}$	0.038***	-0.149***
	(0.010)	(0.019)
Foreign $_{t}$	-0.072	-0.176
	(0.143)	(0.143)
Industry FE	No	Yes
First Stage		
US Weighted EPU $_{t-2}$	0.123***	0.124***
	(0.002)	(0.002)
F-Statistic	8315.44	1552.46
Wald test of exogeneity	493.87***	496.56***
Observations	53,239	53,088

Notes: Standard errors are in parentheses. The second-stage coefficients reported are marginal effects.
*** p<.01, ** p<.05, * p<.1
Source: Authors.

5. Conclusion and Policy Relevance

In this study, using detailed firm-level data on the GVC participation of Indian manufacturing firms and exploring time-series variation in EPU, we find that higher uncertainty is negatively related to the GVC participation of Indian manufacturing firms. We also find that the EPU's negative impact on the GVC participation of firms transmits via the financial constraints of the firm. Furthermore, we also note that higher uncertainty is associated with both the higher exit and lower entry of firms into GVCs. Finally, to document the robustness of our findings we employ an alternate measure of capturing economic uncertainty. Specifically, we employ the alternative measure of the World Uncertainty Index and employ the stock price variance of firms to capture economic uncertainty. For both indicators, we observe that higher uncertainty impedes the GVC participation of Indian manufacturing firms. Furthermore, we also employ a continuous measure of GVC integration and find that the findings of our model are robust.

From a policy perspective, our study highlights the importance of India trying to become a manufacturing hub of manufacturing for regional and global GVC activities. In this regard, the Indian government has been active in framing policies that promote foreign investment. For instance, initiatives such as 'Make in India' and the National Policy for advanced manufacturing, which initiates investments in infrastructure projects worth $1.4 trillion under the National Infrastructure Pipeline, are all efforts to increase Indian firms' presence in the global market. In this regard, greater EPU can have significant implications for the global strategies of firms. Our preliminary findings resonate with this as we find a significant and negative impact of EPU on the GVC participation of Indian manufacturing firms. This has important implications for policy design and industrial strategies as India shifts to higher GVC activities in the region.

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Appendix

A.1. Measurement of firm-level productivity

In this study, we estimate the firm-level revenue-based total factor productivity following Ackerberg et al. (2015). This is a semi-parametric method of estimating the production function and is a two-step estimation procedure that accounts for the simultaneity bias between firms' input choices and their idiosyncratic productivity shocks. Assuming a Cobb-Douglas production function, we estimate the productivity for a firm *i* in industry *j* at time *t* as follows:

$$y_{ijt} = \alpha + \beta_1 l_{ijt} + \beta_2 k_{ijt} + \beta_3 m_{ijt} + \epsilon_{ijt}$$

Here, *y* denotes output, *l* denotes labour, *k* denotes capital, *m* denotes expenditure on energy, and ϵ stands for the measurement error in the output. To estimate TFP following Ackerberg et al. (2015), we define output as the log of sales adjusted for changes in the inventory of the firm. Labour is measured using the wage bill of the firms deflated by the average industry wages (the average industry wage is obtained at the two-digit National Industrial Classification (NIC) level using the (Annual Survey of Industries (ASI) database). We derive the capital stock of the firm using the perpetual inventory method.[12] All variables are deflated with the relevant industry-specific deflators, and we estimate the production function using the two-digit NIC classification. ϵ_{ijt} can be decomposed into ω_{ijt}, which is observed by the firm before it makes its period t input decision, and η_{ijt} is an i.i.d. component that is unobserved at time period *t* (measurement error).

$$\omega_{ijt} = y_{ijt} - (\widehat{\beta_1} l_{ijt} + \widehat{\beta_2} k_{ijt} + \widehat{\beta_3} m_{ijt} + \epsilon_{ijt})$$

Ackerberg et al. (2015) treats labour as a state variable as it assumes the timing of plant decision about its labour allocation. It assumes that a decision regarding labour is made after capital stock k_{ijt} was determined at $t - 1$ and before intermediate inputs are chosen at time *t*.

$$m_{ijt} = f(k_{ijt}, \omega_{ijt}, l_{\text{ijt}})$$

Hence, the first stage only serves to net out the error component, as the coefficient on labour cannot be identified in the first stage, and only the composite term can be derived. The labour coefficient is identified in the second stage using either a nonlinear least squares (NLLS)

[12] The perpetual inventory method revalues the capital given at historical cost to a base year. We arrive at the value of capital at the replacement cost by multiplying the revaluation factor by the value of capital at historical cost.

or generalised methods of moments (GMM) estimation depending upon the timing assumption of labour (Van Beveren, 2012).

$$y_{ijt} = \alpha + \beta_1 l_{ijt} + \beta_2 k_{ijt} + f^{-1}(k_{ijt}, m_{ijt}, l_{\mathrm{ijt}}) + \eta_{\mathrm{ijt}}$$

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