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Firm Innovation, Financial Constraints and Exports: Evidence From Indian SMEs

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Using rich firm-level data on 4517 small and medium-sized Indian manufacturing firms, we explore the implications of financial constraints on firm innovation and further investigate the interplay between financial constraints and export participation on firm innovation. Our findings highlight a negative association between firm innovation and financial constraints and a positive association between firm innovation and export. Moreover, we find that firms participating in international trade are well-positioned to offset the challenges of financial constraints on firm innovation.

I. Introduction

The importance of innovation as a conduit for economic growth is well-established in the literature (Aghion & Howitt, 1992; Romer, 1990) with innovation playing a vital role in stimulating productivity growth and competitiveness among firms (Aghion et al., 2012). However, despite its importance, undertaking innovative activities remains a herculean task for firms. One reason for this is the scale of investment needed for introducing a new product or process to the market. Moreover, investment in a firm's research and development (R&D) is regarded as an investment in intangibles, which results in the absence of collateral value for the firm. As a result, obtaining external sources of financing becomes strenuous (Chundakkadan & Sasidharan, 2020). This concern is more prominent in a developing country like India, where financial markets and institutions remain underdeveloped. Hence, financial constraints may hinder the innovative activities of firms, especially firms from emerging economies.

In contrast to financial constraints impeding firm innovation, the literature also documents a positive relationship between trade and innovation. Firms, through trade participation, can acquire better technology, know-how, and form trade networks (Ernst & Kim, 2002; Gereffi, 2014). As a result, through export participation, firms can improve their innovative performance through scale, competition, spillover, and export learning effects (Seenaiah & Rath, 2018). In a similar vein, innovation systems have documented evidence which shows that trade participation allows firms to nurture and absorb technological capabilities from abroad and reproduce them in the domestic environment (Morrison et al., 2008).

Against this backdrop, we explore the association between firm innovation, financial constraints, and export participation of firms. Furthermore, exporting firms, given the scale and networking effects, may be well positioned to offset the negative association between financial constraints and firm innovation (Lööf & Nabavi, 2016). However, systematic evidence documenting this interplay is scanty in the literature. Our study bridges this gap by exploring this nexus for Indian small and medium-sized enterprises (SMEs). In addition, we delve deeper into various trade integration strategies and explore the heterogeneity in this nexus, differentiating between GVC (global value chains) firms, exporting firms, and importing firms. The remainder of the paper is structured as follows. Section 2 documents the data source and details the variables employed. Section 3 sheds light upon the methodology and Section 4 concludes the paper.

II. Data & Variables

A. Data

In this study, to explore the implications of financial constraints on firm innovation and further investigate the interplay between financial constraints and export participation on firm innovation, we use rich firm-level data on Indian SMEs sourced from the World Bank Enterprise Surveys (WBES) database.[1] A key feature of the WBES database is that it provides in-depth firm-level information on key aspects of finance, innovation, and exporting behavior of

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1 Available at https://www.enterprisesurveys.org/en/survey-datasets

Table 1. Descriptive statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
Innovation	=1 if a firm introduced a new product and zero otherwise	4517	0.418	0.493	0	1
Financial Constraints	=1 if a firm does not have a line of credit/loan from a financial institution and zero otherwise	4517	0.718	0.45	0	1
Exports	=1 if a firm exports and zero otherwise	4517	0.091	0.287	0	1
Log Age	Log of number of years a firm has been in operation	4517	2.821	0.685	0.693	4.595
Log Workers	Log of number of workers	4517	3.127	0.733	1.099	4.595
Log Productivity	Log of sales per workers	4517	13.948	1.16	10.532	18.669
Sole	=1 if a firm is a sole proprietor firm and zero otherwise	4517	0.526	0.499	0	1
Foreign	=1 if a firm has 50% or more foreign ownership and zero otherwise	4517	0.004	0.061	0	1

Note: This table reports descriptive statistics of all variables used in this study.

firms, and other variables assembled via face-to-face interviews with managers or owners of the firms. In this regard, we use the 2014 round of WBES data, which is the latest round of interviews undertaken for India. Our final sample consists of information on 4517 SMEs operating in the Indian manufacturing sector.

B. Variables

Our primary variable of interest is firm innovation. In this regard, a vast majority of existing literature uses firms' expenditure on R&D as a proxy for the innovative efforts of the firm (Reddy & Sasidharan, 2023). However, such measures are not free from limitation. First, the R&D activities of a firm represent the input side, which may not always translate into innovative output (Tavassoli, 2018). Second, many SMEs may not always have a formal R&D unit. As a result, SMEs may not report such expenses and thereby may be excluded from our analysis (Reddy et al., 2021). The WBES database allows us to overcome these concerns as it allows us to identify the distinct innovative output of firm. More specifically, our innovation measure is a binary variable that takes the value 1 if a firm introduces a new product, and 0 otherwise.

Financing innovative activities of a firm becomes challenging for a firm which is plagued by financial constraints. To empirically explore this in the context of Indian SMEs, we capture financial difficulties of firms using a binary variable that takes the value 1 if a firm does not have a line of credit or loan from a financial institution (i.e., a firm is financially constrained) and 0 otherwise. Furthermore, in this study, we also aim to understand the nexus between firms' export participation and firms' innovation. As a result, our export participation is a dummy variable that equals 1 if a firm exports and 0 otherwise.[2] In addition, we also control for a host of firm-specific controls– firm productivity, firm age, firm size, sole proprietorship, and foreign ownership of the firms. Our choice of control variables is driven by the existing literature which documents that more productive firms, larger firms, older firms, foreign-owned and business group affiliated firms are more likely to undertake innovative activities (Chundakkadan & Sasidharan, 2020).

Table 1 presents the summary statistics of our variables of interest and other control variables. From the table, we observe that among 4517 Indian manufacturing SMEs, nearly 42% of them have introduced a new product and hence can be classified as innovating firms. Furthermore, 72% of these SMEs do not have a line of credit from a formal institution, reinforcing the idea that SMEs find it challenging to obtain a formal source of finance. From the table, we also observe that 9% of SMEs engage in export, and 52% of these SMEs are sole proprietor firms with less than 0.1% foreign ownership, almost negligible among Indian SMEs.

III. Empirical Model & Results

A. Empirical Model

To understand the nexus between financial constraints, firm export, and their innovative output, we estimate the following parsimonious model.

Equation 1 represents our baseline probit model. To this end, we employ a probit model given the binary nature of our dependent variable. In Equation 1, β_1 and β_2 are our coefficients of interest, and λ_j represents the industry fixed effects. Additionally, to understand the interplay between financial constraints and firm export (denoted by $Exports$) and its implication on firm innovation, we estimate Equation 2 where we interact our measures of financial constraints and firm export.

2 We focus on pure exporting firms, hence, our dummy variable identifies firms as exporters based purely on whether they export [and not on imports]. We do this because the literature on international trade documents two-way trading firms as GVC firms (Gopalan et al., 2022; Reddy et al., 2023).

$$Innovation_{ij} = \Phi\big(\alpha + \beta_1 Financial\ Constraints_{ij} + \beta_2 Exports_{ij} + \beta\ Controls_{ij} + \lambda_j + \mu_{ij}\big) \quad (1)$$

$$Innovation_{ij} = \Phi\big(\alpha + \beta_1 Financial\ Constraints_{ij} + \beta_2 Exports_{ij} + \beta_3 Financial\ Constraints \times Exports_{ij} + \beta\ Controls_{ij} + \lambda_j + \mu_{ij}\big) \quad (2)$$

B. Financial Constraints & Firm Export

Table 2 presents stepwise regression estimates of Equations 1 and 2. Specifically, in Column 1, we only account for financial constraints of the firm. The coefficient reported is significant and negative, documenting an inverse association between financial condition of the firm and its innovative output. In Column 2, we also factor in exporting behavior of firms and find a significant and positive association between exporting firms and their probability of introducing a new product to the market. As the next step, we estimate the complete model as specified in Equation 1, where we incorporate various firm-specific controls and industry fixed effects. From the results reported in Column 3, we observe that similar to the results in Columns 1 and 2, financial constraints continue to have a negative association with firm innovation, whereas export reports a positive association. Furthermore, in terms of controls, we observe that experienced firms, larger firms (within SMEs), foreign-owned firms, and networked firms (sole=0) display higher probability of innovation. Finally, in Column 4, we report the probit estimates of Equation 2, where we interact our measures of financial constraints and firm export. From Table 2, similar to the results obtained in Columns 1-3, we observe a negative association between financial constraints and firm innovation. However, the coefficient of our interaction terms yields a positive and significant coefficient, underscoring that by undertaking exports, firms offset the negative impact of financial constraints on innovation. Our results are in line with prior studies, which highlight that exporting firms are better equipped to overcome financial difficulties than non-exporting firms (Lööf & Nabavi, 2016). In a similar vein, Efthyvoulou and Vahter (2016) highlight that non-exporting firms are more sensitive to financial constraints as compared to exporting firms. The results of our control variables are also in line with the literature, as we observe that older firms, larger firms, and foreign owned firms have a higher probability of innovating activities. We also observe a significant effect of firm ownership structure, with standalone firms and domestic firms having a lower probability of innovation.

C. Financial Constraints & Trading Strategies

Over the past two decades, global value chains (GVCs) have become the new paradigm of international trade, with firms integrating into GVCs producing only a particular fragment of the final product and not the product in its entirety. As a result, with a specialized focus on production, firms can participate in international trade with greater ease as compared to the traditional modes of exports or imports. Moreover, it also provides an avenue for SMEs to integrate into the global market. In this regard, it becomes important to examine how various modes of trade participation amalgamate with financial constraints and explore their combined association on firm innovation. In this regard, we interact our trade participation variable which takes the value 3 if a firm is a GVC firm (i.e., a firm that imports and exports simultaneously), 2 if a firm only exports, and 1 if a firm only imports. As a result, our base category represents firms that are purely domestic in nature. Figure 1 plots the coefficients of interaction, and we observe a positive association across all modes of trade participation, underscoring that firms participating in international trade are better positioned to offset the impact of financial constraints on their innovative output.

IV. Summary and Conclusion

In this paper, we explore how the financial constraints of a firm and its export participation correlate with its innovation probability for Indian manufacturing SMEs. We further investigate the interplay between financial constraints and export on SMEs' innovative output. To this end, we use data on 4517 Indian manufacturing SMEs for the year 2014 and employ a probit model. We find a negative association between firm innovation and financial constraints and a positive association between firm innovation and export. This is in line with existing literature, which documents that a firm operating under financial constraints finds it strenuous to undertake innovative activities. In a similar vein, evidence from trade and innovative literature lends support to our findings that exporting firms are more likely to be innovative. Furthermore, our interaction measure highlights that exporting firms are more likely to mitigate financial constraints and, as a result, have a higher likelihood of undertaking innovations. In addition, we delve deeper into various modes of trade integration to explore whether the positive association between our interaction measure and firm innovation varies. Differentiating between GVC firms, exporting firms, and importing firms, we find that all modes of trade integration help firms offset the challenges of financial constraints on firm innovation.

These findings gain importance from a policy perspective as countries push towards greater trade integration; policies fostering such participation could promote innovative behavior among SMEs. However, our study is not free from limitations as the absence of panel data restricts us from attributing any causal interpretation to our results. As a result, our study highlights robust correlation. Moreover, we are also unable to account for selection concerns given the data structure. Hence, future research could advance this present line of research by leveraging panel data models and establishing causal relations.

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Table 2. Probit estimates

Variables	(1) Innovation	(2) Innovation	(3) Innovation	(4) Innovation
Financial Constraints	-0.0541***	-0.0460***	-0.0377**	-0.0537***
	(0.0162)	(0.0162)	(0.0162)	(0.0170)
Export		0.146***	0.0907***	0.00216
		(0.0252)	(0.0258)	(0.0418)
Financial Constraints x Exports				0.145***
				(0.0518)
Log Age			0.0283***	0.0285***
			(0.0108)	(0.0108)
Log Workers			0.0696***	0.0701***
			(0.0101)	(0.0101)
Log Productivity			0.00712	0.00732
			(0.00643)	(0.00642)
Sole			-0.0255*	-0.0250*
			(0.0151)	(0.0151)
Foreign			0.227*	0.224*
			(0.122)	(0.120)
Industry FE	No	No	Yes	Yes
Observations	4,517	4,517	4,517	4,517

Notes: All columns report marginal effects. Standard errors are reported in parentheses, ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

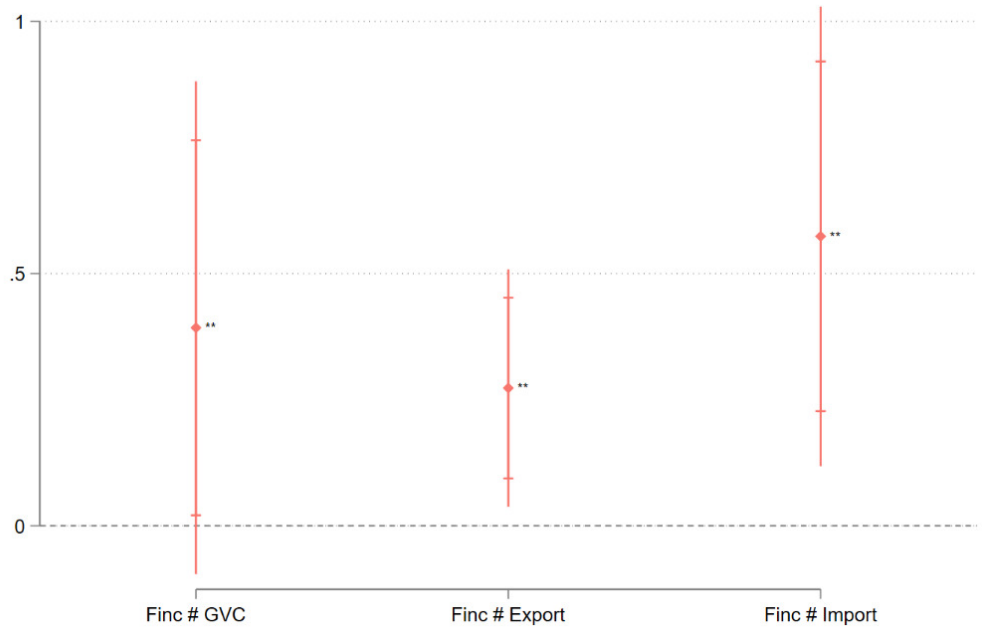

Figure 1. Modes of trade integration

Source: Coefficient Plot – Author's

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