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Innovative efforts and export market survival: Evidence from an emerging economy

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ABSTRACT

We examine the role of innovation on the export market survival of Indian manufacturing firms. To achieve this objective, we source information on 1424 firms from the CMIE-Prowess database over 2001–2018. We find that firms investing in R&D experience a lower probability of exiting from export markets. In addition, multiple sub-sample analyses indicate the significance of R&D for small and medium firms export market survival. The findings are robust to endogeneity concerns.

1. Introduction

The significance of innovation in shaping firms export behaviour is well documented in the trade literature (Azar and Ciabuschi, 2017; Barrios et al., 2003; Caldera, 2010; Roper and Love, 2002). However, the focus of the existing studies using firm-level information is mainly on examining the impact of innovation on the intensive and extensive margins of export (Azar and Ciabuschi, 2017; Barrios et al., 2003; Caldera, 2010; Kumar and Siddharthan, 1994; Roper and Love, 2002; Wakelin, 1998). Various studies have unambiguously shown that the key to the export growth in developing economies is not merely an entry into the global market, but the possibility of longer duration of exports (Besedeš and Prusa, 2010). Theoretical models of export market survival following heterogeneous firm models, predict longer duration of exports associated with sunk costs (Roberts and Tybout, 1997). Consequently, a large body of empirical literature explored the factors influencing the survival of firms in the export market (Besedeš and Prusa, 2006a; Besedeš and Prusa, 2006b). Within this frame of reference, majority of the studies have identified exit from the global market is driven by the lack of access to external finance, productivity, and ownership affiliation (Alvarez and Lo'pez, 2008; Bellone et al., 2010; Inui et al., 2017). In this regard, a key enabler of competitive advantage in the global market is innovation, which follows from the prior studies that highlights positive association between innovative efforts and firm performance.

Theoretically, it is argued that innovation enhances firm competitive advantage through various channels. Process innovation enable firms to reduce their cost of production and further establish its foothold in the global markets (Wakelin, 1998). Innovation also enables firm to upgrade and introduce new products. This form of product switching results in reallocation of resources towards higher productive products, which reduces firm's probability of failure in global markets (Zahra and George, 2002). The existing firm-level studies report innovators have higher absorptive capacity, operate closer to the global technological frontier, which reinforcing the “learning-by-exporting” mechanism (Fontana and Nesta, 2009; Deng et al., 2014). In addition, innovation also generates differentiated products leading to improved profitability (Cefis and Marsili, 2006; Tavassoli, 2018; Zhang et al., 2018).

At the same time, some studies have raised concerns regarding the possibility of innovation impeding firms export survival (Dai et al., 2020; Zhang et al., 2018). This line of reasoning emanates from the fact that innovation requires substantial investment, and the outcome is uncertain. Therefore, there exists a possibility that the underlying costs outweigh the benefits (Deng et al., 2014; Dai et al., 2020; Zhang et al., 2018). In such a scenario, higher investment in R&D activities may not improve the likelihood of survival in export market. On the contrary, it may be negative, if the risk and costs associated are extremely high. Further, Kafouros et al. (2008) highlight that intensive global competition and the imitation possibility limits the gains from innovation (Deng

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et al., 2014).

In this regard, given the limited empirical evidence and the absence of consensus on the effect of innovation on export survival of the firm, the core objective of this study is to examine the role of innovation (proxied by R&D investment) on the export survival in the context of an emerging economy, India. To this end, India provides us an ideal testing ground for examining the innovation-export exit nexus for the following reasons. First, the economic reforms implemented in the early nineties opened the Indian economy to the international markets with a myriad of trade reform measures aimed at promoting exports. Thus, analyzing the factors that shape global market participation and survival of firms becomes crucial. Further, the manufacturing sector contributes around 72 % of India's total exports (Economic Survey, 2019). However, despite its importance in total exports, the manufacturing sector's contribution to overall global trade is still small (1.64 % in 2018) compared to the other emerging economies. Indian manufacturing's minimal global presence direct us towards a possibility that perhaps Indian firms may find it difficult to survive in the global markets. In addition, the policy makers' agenda of transforming India as the next manufacturing hub makes it important to examine the factors that could aid Indian firms' survival in the export market, and boost the stagnant manufacturing sector.

As mentioned, there is limited evidence in the context of innovation and export-survival nexus. With reference to India, Dzhumashev et al. (2016) examines the effect of exporting and R&D investment on firms' survival for Indian IT firms, which highlight positive influence of both factors on IT firms' survival. However, our study contributes to the current literature in multiple ways. First, we contribute to the thin literature on international market survival of firms from an emerging economy, India. In this regard, our study is closest to the work of Dai et al. (2020) which explores the role of innovation on export survival of Chinese manufacturing firms. However, our study differs substantially from Dai et al. (2020). To begin with, even though China and India can be classified as emerging economies, the growth trajectories of both these economies are distinct. Chinese firms have extensively integrated into global value chains (GVCs), while India's GVC integration remains low. Moreover, our study also attempts to explore the channel through which innovative activities of the firms are associated with export survival. Specifically, we explore the financial constraint channel, and the rationale for exploring the financial constraints and R&D nexus stems from the existing literature which highlights that undertaking R&D and exporting involve substantial investments, making financial condition of the firm a key factor shaping firm survival in the export market. Further, unlike Dai et al. (2020), we correct for the endogeneity issue of reverse causality while exploring this nexus. In addition, we examine the role of export incentives on export market survival. In this way, our study adds to the ongoing debate on the effectiveness of export promotion incentives on export market survival (Cadot et al., 2015; Volpe Martincus and Carballo, 2010a). We also draw insights on innovation and export survival of firms by exploring various facets of firm and industry heterogeneity in terms of firm size, ownership affiliation, and technology intensity of firms, advancing export market survival literature. Second, our study focuses on the entire manufacturing sector compared to the earlier strand of research, which focus on the experience of one specific sector (Dzhumashev et al., 2016). Third, this study contributes to the literature by identifying the R&D and financial constraint linkage as a key channel influencing export survival of firms. Finally, unlike earlier studies which are based on short panels, our dataset spans longer duration (18 years; 2001–2018). This enables us to account for the changing dynamics of the Indian manufacturing sector over the past two decades.

Against this background, we use rich firm-level panel data on Indian manufacturing firms collected by the Centre for Monitoring Indian Economy (CMIE) Prowess database over 2001–2018 to examine the impact of R&D investment on firm survival in the export markets. We use random effects probit model and details of the estimation are provided in the methodology section. Our main findings suggest that firms investing in R&D experience lower hazard rate, i.e., R&D activities are associated with longer survival in export market. The rest of the paper is structured as follows. Section 2 presents a brief review of the existing literature. Section 3 sheds light on the data source and variable construction. Section 4 presents a descriptive analysis on export market survival. Section 5 explains the methodology employed. Section 6 presents the findings of our baseline model and the results of various subsample analyses, while Section 7 concludes the study.

2. Literature review

This study connects two strands of literature while exploring the innovation-export survival nexus. First, our study is related to the literature examining factors that influence survival of firms in the export market. Studies in this context has proliferated in recent years, highlighting firm productivity, age, size, differentiated product, previous export experience, size of export as the significant factors influencing export survival of firms (Alvarez and Lo'pez, 2008; Bellone et al., 2010; Inui et al., 2017). However, the role of innovation in the export market survival perspective has not received much empirical attention.

Moreover, branching out of this strand of literature are another set of empirical studies that emphasize on domestic market survival rather than export market survival. Within this context, studies have explored the link between innovation and firm survival. For instance, Hall (1987) found investment in R&D as a key factor influencing US manufacturing firm survival. Cefis and Marsili (2006) show that innovation positively impact survival of manufacturing firms in Netherlands. Esteve-Pérez et al. (2007) report that Spanish firms undertaking R&D face a 57 % lower exit risk. Zhang et al. (2018) report similar impact of innovation on survival of Chinese high-tech firms. Jung et al. (2018) find positive effect of R&D investment on the probability of Korean SMEs survival. Similarly, Inui et al. (2017) also finds a positive impact of R&D on survival of Japanese firms.

On the other hand, our study is also linked to the literature on firm innovation. In this regard, several studies in the domain of international trade have explored the innovation-export nexus. This strand originated following the development of technology gap model (Posner, 1961), product-cycle model (Vernon, 1966), and other related research (Krugman, 1980), which posit innovation as a key strategy pursued by firms to improve its export market presence. This theoretical argument is well documented in the existing empirical literature. For instance, Hirsch and Bijaoui (1985) establish the importance of innovation for Israeli firms, Kumar and Siddharthan (1994) for Indian firms, Wakelin (1998) for UK firms, Roper and Love (2002) for UK and Germany, Barrios et al. (2003) and Caldera (2010) for Spanish firms, and Azar and Ciabuschi (2017) for Swedish exporters.

The brief review of existing empirical evidence emphasizes the importance of innovation on export participation and domestic market survival of firms. However, there is dearth of studies on the association between innovation and export market survival in the context of India. Therefore, to bridge this empirical gap, we empirically examine whether firm innovation can aid firms longer duration in the export market.

3. Data and variables

3.1. Data

In this study, we draw firm-level information from the Prowess database maintained by the Center for Monitoring Indian Economy (CMIE). The CMIE-Prowess database provides detailed firm-level information for listed and unlisted firms obtained from the audited annual reports and financial statements.[1] The database contains information on

[1] PROWESS is a proprietary database. (www.cmie.com).

firm exports, sales, salaries and wages, total assets, R&D investment, business group affiliation, and foreign ownership. The companies included in the database constitute around 70 % of the organized sector's economic activity, and was previously employed by various studies (De Loecker et al., 2016; Topalova and Khandelwal, 2011). For the present purpose, we use the data pertaining to the firms belonging to two-digit Indian manufacturing industries over the period 2001–2018.

In this regard, we begin our empirical analysis by making our data suitable for the empirical analysis. As a first step, we drop all firms with missing or negative value on sales. Second, we drop firms with missing information on incorporation year of the firm, which is necessary for capturing the age of the firm. Further, with regard to defining export market exit in the sample, we follow existing literature, which identify exiters as firms that are involved in export market in year *t*, but not in the year $t+1$ (Dai et al., 2020). In this regard, one of the major empirical concerns while undertaking survival analysis is the issue of censoring i.e., the inability to observe the complete export history of the firms (Besedeš and Prusa, 2006a). Censoring in the data arise from: (i) left-censoring, and (ii) right-censoring. Left censoring in the export market survival refers to firms that are involved in export market at the beginning of our study period. In order to account for this issue, we exclude all left censored spells (Besedeš and Prusa, 2006b). Therefore, our analysis corresponds to those firms that began exporting after 2001. Unlike the difficulty posed by left censoring spells, the issue of right censoring spells can be tackled through survival analysis methods (Schwartz, 2013; Fu and Wu, 2014). Consequently, right censoring refers to firms that continue to export at the end of the study period.

In addition to the issues posed by censoring of the data, another concern is the multiple spells in the data. Table 1 highlights the spell pattern observed during the survival analysis. The table presents the issue of left and right censored spells documented in the survival analysis. It also highlights multiple spells, where firms enter, exit and re-enter the export market, which results in measurement error on the export duration front. One widely employed method to overcome the concern of multiple spells is to treat multiple spells as independent (Besedeš and Prusa, 2006b). Therefore, we consider single spell and first spell of multiple spells as the benchmark. Finally, since the objective of our study is to examine export survival, following the standard practice, we drop all those firms that never engaged in exporting activities during the study period.[2] Following our data filtering process, we are left with an unbalanced panel of 1424 firms over 2001–2018.

3.2. Variables

In this study, as mentioned earlier, the objective is to examine the role of innovation on export survival of firms. Therefore, the export status, and innovation activities of the firm are at the core of our empirical setup. In this regard, the CMIE-PROWESS database provides information on firm's exports, which allow us to identify firms export participation. Consequently, export participation is a binary variable, which takes the value 1 if the firm is an exporter, and 0 otherwise.

To capture the innovative activities of a firm, we use firms' innovation input[3] in the form of R&D expenditure to proxy innovation. In this regard, the PROWESS database provides information on R&D outlay of a firm, which is further classified based on capital and current account expenditure.[4] We sum the current and capital account expenses to arrive at the total R&D outlay of the firms during the year. This information enables us to identify firms undertaking investment in innovative activities. Consequently, our R&D measure is a binary variable, which takes the value of 1 if a firm undertakes R&D and 0 otherwise. Our decision to use a binary variable is guided by two factors. First, the literature on R&D discerns two key facets of R&D (Cohen and Levinthal, 1990; Volberda et al., 2010): (a) generation of new knowledge; and (b) fostering absorptive capability of the firm. In this regard, Coad et al. (2020) highlight that in an emerging economy like India, the core utility for a firm comes from fostering its absorptive capacity. Therefore, undertaking formal R&D becomes a crucial distinction between innovators and non-innovators, which our binary measure successfully captures. Second, earlier studies have expressed concern that R&D data sourced from CMIE-PROWESS database may be subject to measurement errors (Coad et al., 2020). Hence, following Coad et al. (2020), we overcome these concerns by converting continuous measure of R&D as a dummy variable.

In addition, we also include a host of firm specific controls. To this end, we control for firm productivity, age, size, firms' initial value of exports, and ownership of the firm. The inclusion of these covariates is based on the prior literature. To elucidate further, prior studies documents that firm productivity plays a crucial role in firm survival, since productive firms are more profitable and firms that finds it difficult to generate profits through exporting will eventually exit the international market (Roberts and Tybout, 1997; Dai et al., 2020). Therefore, we posit a positive association between firms' total factor productivity[5] (TFP) and export market survival. Second, we account for the firm size since larger firms exploit their scale advantage, which adds to their competitiveness (Fu and Wu, 2014). On the other hand, larger firms also face higher risk of exit from foreign markets due to their rigid management modes, and sheer size of operations (Dai et al., 2020). There exist ambiguity concerning the impact of firm size on survival; therefore, this remains an empirical question. In this regard, we define firm size as log of total assets of the firm.[6] Third, we also control for firms age (defined as the log of number of years since incorporation). Older firms with established track record are less likely to fail in the international market. Fourth, the literature also notes that firms with greater exports in their initial year survive longer, hence we control for firms export intensity in their initial year of exporting (Córcoles et al., 2015; Rauch and Watson, 2003). Finally, we control for ownership structure of the firm. In this regard, we control for foreign ownership and business group affiliation of the firm since such firms enjoy networking advantages, better access to technology, and foreign market information, which sustain their survival in the global markets (Fu and Wu, 2014; Padmaja and Sasidharan, 2017).

Table 2 presents an overview of the variables used in the analysis and their construction. The table also provides descriptive statistics of the data. From the table, we observe that 48 % of the firms are involved in exporting. Around 17 % of the sample firms engage in R&D activities, Further, 22 % of the sample firms operate under the umbrella of business groups, while 2.5 % are foreign owned. Moreover, the average age of a

[2] A peculiar feature of the Prowess database is that, if a firm exit the database, it does not imply that the firm ceases to exist. We cannot ascertain whether the firms have exited the market since they are under no obligation to report the information to the data collection agency, CMIE. Therefore, the PROWESS database in not suitable for studying the domestic market survival of firms. Previous studies have shown that the exit rates from the database is small since the firms in the PROWESS are relatively large firms (Goldberg et al., 2010) This however is not a concern for our analysis since we examine the export market survival.

[3] Even though Prowess is an extremely rich database, it lacks necessary information required to identify the output side of innovation. As a result, we are not able to capture product, process, and organizational innovation. Hence, our analysis pertains to innovation input i.e., R&D to proxy firm innovation,

[4] The R&D expenditure on the capital account head refers to investment in long-term fixed assets, that can be amortized over a period longer than one fiscal period. In contrast, R&D expenditure under the head of current account refers to short-term spending that pertains to the year in account.

[5] We estimate TFP for Indian firms by adopting the semi-parametric estimations of Levinsohn and Petrin (2003). For estimating TFP, we compute capital using the perpetual inventory method and all monetary variables are deflated using industry-specific deflators.

[6] Prowess does not provide information on the number of employees in a firm. According to the Companies Act 1956, Indian firms are not mandatorily required to report employee information in their annual report. Therefore, we are unable to proxy firm size by number of employees. However, our definition of firm size takes characteristics from the official definition employed by Government of India during the study period where firm size is defined based on its assets.

Table 1
Duration pattern.

No	09	10	11	12	13	14	15	16	17	Pattern	
1	✓	✓	✓	✓	✓	X	X	X	X	Left censored	Single spell
2	X	X	X	X	X	✓	✓	✓	✓	Right censored	Single spell
3	X	X	✓	✓	✓	X	X	X	X	Completed	Single spell
4	X	✓	✓	X	X	✓	✓	X	X	Completed	Multiple spell

Note: ✓ - firm is exporting in the given year; X – firm exits.

Table 2
Descriptive statistics.

Variable	Definition	Obs.	Mean	Std. dev.	Min	Max
Export	=1 if a firm export and 0 otherwise	14,325	0.480	0.499	0	1
R&D	=1 if a firm invests in R&D	14,325	0.165	0.371	0	1
Log initial export	Log of export intensity of the firm in its first exporting year	14,325	0.082	0.156	0*	0.702
Age	Number of years firm has been in operation	14,325	23.62	14.60	2	100
Log TFP	Log of TFP computed following Levinsohn and Petrin (2003)	14,325	4.501	1.552	0.071	11.97
Group	=1 if a firm is affiliated to a business group	14,325	0.227	0.419	0	1
Foreign	=1 if a firm is foreign ownership is >10 %	14,325	0.025	0.157	0	1
Log size	Log of total assets	14,325	6.931	1.586	1.80	12.82

Note: (i) *0 minimum value of initial export intensity is an approximation for descriptive statistics purpose. These observations correspond to 18 firms which has initial export value <0.01 %.

sample firm is 23 years, and average firm productivity is 4.5.

4. Stylized facts

In this section, we present some stylized facts concerning survival of the sample firms. We begin by examining the pattern of firm's involvement in export markets. Table 3 present the export order sequence of the sample firms. In the table, each sequence is representative of the number of times a firm participate in the export market, and its pattern of involvement. In the table, the value zero indicates when a firm participates in export market, while 1 indicates exit. From the Table 3, we observe that out of 1424 firms in our export survival sample, 180 firms have single spell, where an exporting firms exit the market never re-enter. Further, we have 191 firms that survived in the export market throughout the study period. The table also show that 73 % of the remaining firms recorded multiple spells.

In addition to the pattern of exporting participation documented in Table 3. In the Table 4, we also present the export duration. From the table, we observe that almost 54 % of the firms exit within the first 3 years of exporting. This is in line with previous evidence where most firms mostly do not survive beyond 3 years. For instance, Cui and Liu (2018) document that 65.48 % of Chinese exporters survive only for 1 year. Volpe-Martincus and Carballo (2008) find the median export duration to be 1 year for Peruvian firms, while Esteve-Pérez et al. (2007) note this to be 2 years for Spanish firms. Further, similar to our study where almost 20 % of firms exit after the 1 year, Esteve-Pérez et al. (2007) report this to be 25 % for Spanish firms, and Volpe-Martincus and Carballo (2008) report 54.5 %.

In addition, we plot the Kaplan-Meier (KM) survival estimates, a non-parametric estimation, to examine the difference in survival probabilities of exporting firm that invest in R&D, vis-à-vis non-R&D firms. Fig. 1 presents the KM survival estimates. From the figure, we see that survival probabilities experience a huge fall in the first four years highlighting that firms find it difficult to survive initially in the export market. This corroborates the findings from the Table 4, which shows that almost 54

Table 3
Export sequence order.

Sequence-order	No. of firms	Percent	Cum	R&D (% total assets)
0	191	13.41 %	13.41 %	0.71 %
01	180	12.64 %	26.05 %	1.15 %
010	457	32.09 %	58.15 %	1.09 %
0101	367	25.77 %	83.92 %	1.00 %
010101	110	7.72 %	91.64 %	0.30 %
01010	82	5.76 %	97.40 %	1.34 %
0101010	19	1.33 %	98.74 %	2.70 %
01010101	14	0.98 %	99.72 %	2.02 %
0101010101	2	0.14 %	99.86 %	–
010101010	1	0.07 %	99.93 %	–
010101010101	1	0.07 %	100 %	–

Note: (i) “0” refers to firm exporting and “1” depicts firm exit from the market. (ii) For brevity we report the grouped sequence order. The sequences are considered similar based on order similarity, i.e., sequences are similar where the elements appear in the same order. The sequence A-B-B-A is treated identical to A-B-A-A, because the elements A and B appear in the same order in both sequences (first A, then B, and then A again). For example: 001, 00001, 0000001, 000000001, 011111111111111 are all treated as similar since once a firm exits it does not re-enter in again.

Table 4
Export spell.

Export duration (years)	No. of firms	Percent	Cum	R&D %
1	275	19.31 %	19.31 %	1.03 %
2	274	19.24 %	38.55 %	1.00 %
3	214	15.03 %	53.58 %	1.80 %
4	150	10.53 %	64.12 %	0.66 %
5	83	5.83 %	69.94 %	0.81 %
6	57	4.00 %	73.95 %	0.41 %
7	50	3.51 %	77.46 %	1.08 %
8	52	3.65 %	81.11 %	1.59 %
9	40	2.81 %	83.92 %	1.09 %
10	36	2.53 %	86.45 %	1.16 %
11	37	2.60 %	89.04 %	1.01 %
12	36	2.53 %	91.57 %	0.07 %
13	35	2.46 %	94.03 %	1.10 %
14	29	2.04 %	96.07 %	1.29 %
15	28	1.97 %	98.03 %	0.37 %
16	19	1.33 %	99.37 %	1.19 %
17	9	0.63 %	100.00 %	0.05 %

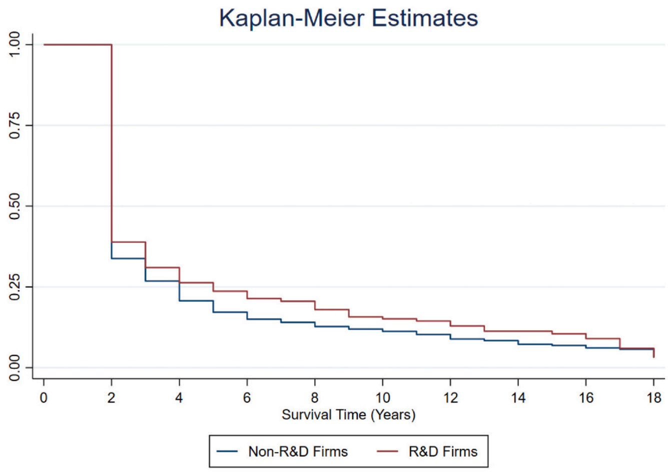

Fig. 1. Kaplan-Meier Estimation based on R&D activities of the firm. Source: Authors' computation using CMIE-PROWESS database.

% of the firms exit in the first three years. Further, the KM estimates provides indicative evidence that R&D firms have higher survival probability in export markets. This is evident from the Fig. 1 that KM estimates pertaining to R&D firms lie above non-R&D firms.

5. Methodology

Following initial work of Besedeš and Prusa (2006b), subsequent studies used the Cox proportional hazard model. The advantage of Cox model was that it could be estimated without specifying a functional form for the baseline hazard model (Hess and Persson, 2012). However, recent literature points out certain limitation associated with the Cox model (Hess and Persson, 2012; Inui et al., 2017; Zhang et al., 2018; Dai et al., 2020). First, Cox model is a continuous time proportional hazard model. However, duration of trade is usually observed in terms of discrete units. Therefore, Cox model is not well suited to tackle the discrete nature of trade data, and its application leads to biased results. Second, the Cox model fail to control for unobserved heterogeneity which induces bias in the model. Third, the proportional hazard assumptions are unlikely to hold for trade duration data since the assumption implies that the effects of specified explanatory variables on the hazard rate are constant over time (Hess and Persson, 2012; Fu and Wu, 2014; Inui et al., 2017).

Given that Cox models are inappropriate for trade data, Hess and Persson (2012) recommends discrete-time models to overcome the concerns associated with Cox models. The advantage of discrete-time models is that it can overcome the problem of multiple ties observed in trade data, account for unobserved heterogeneity, and is free from restrictive proportional hazard assumption. Therefore, existing research largely uses complementary log-log (cloglog) model (Dai et al., 2020; Hess and Persson, 2012; Inui et al., 2017; Zhang et al., 2018). However, Hess & Persson (2012, pp. 1097) suggests "*that applying conventional binary response panel data models with normal random effects is a sensible approach when estimating discrete-time duration models*".[7] Moreover, by estimating a random effects model, the binary choice models can account for the unobserved heterogeneity as well. Therefore, we estimate random effects probit model, following Rossi et al. (2021), given by the Eq. (1).

$$Export\ Exit_{it} = \Phi\left(\alpha + \beta\ R\&D_{it} + \mathbf{Z} + \gamma_t + \lambda_j + \mu_{it}\right) \tag{1}$$

In Eq. (1), export exit is a binary variable indicating exit of the firm from export market as 1 and 0 otherwise. Our main variable of interest is the coefficient of the R&D variable. *Z* denote vector of control variables including TFP, size, age, export intensity, foreign ownership and business group affiliation. In this regard, we use lagged values of export intensity, firm productivity and firm size to overcome any endogeneity bias in the model. Moreover, the model also considers the industry (λ_j) and year (γ_t) fixed effects to control for industry heterogeneity, and changes over time in the firm's export survival. As mentioned earlier, we estimate Eq. (1) using random effects panel probit model. Further, to explore the channels through which R&D influence export survival, specifically, to explore the role of financial constraints, we interact R&D with financial constraints (see Section 6.2 for a more detailed discussion).

6. Results

6.1. Baseline estimates

Table 5 presents the findings of the random effects probit model.[8] From the table, we observe that our main variable of interest, R&D has a negative and significant coefficient across all specifications, which highlights the negative association between R&D investment and export market exit. This implies that the hazard rate of exiting from the export markets fall substantially for firms that are engaged in innovative activities. In terms of the economic significance of this result, it should be noted that exporting firms undertaking R&D have 3.5 % to 4.3 % lower hazard rate of exit[9] compared to the non-R&D firms. The results are qualitatively similar and significant while using the complementary log-log model, which highlights that undertaking R&D reduces the hazard rate of exit by 4.3 % to 5.3 %.[10] The findings of our empirical analysis are in line with Dai et al. (2020), which report positive impact of innovation in reducing the export market exit hazard of Chinese firms. In a similar vein, Rossi et al. (2021) report that innovation lowers the probability of export market exit of European SMEs by around 4 %.

Table 5
R&D & export survival: Probit model.

Variables	(1)	(2)	(3)
	Marginal effects	Marginal effects	Marginal effects
R&D	−0.0423***	−0.0361**	−0.0444***
	(0.0152)	(0.0154)	(0.0156)
Log Initial Export $_{t-1}$	−0.169***	−0.186***	−0.164***
	(0.0447)	(0.0449)	(0.0452)
Log Age $_{t-1}$	−0.0493***	−0.0480***	−0.0249**
	(0.0117)	(0.0117)	(0.0125)
Log TFP $_{t-1}$	−0.00854	−0.0395***	−0.0323***
	(0.00538)	(0.00877)	(0.00883)
Group	0.101***	0.0846***	0.0511**
	(0.0202)	(0.0203)	(0.0210)
Foreign	−0.0196	−0.0188	−0.0433
	(0.0379)	(0.0378)	(0.0383)
Log Size $_{t-1}$	−0.0598***	−0.0466***	−0.0316***
	(0.00483)	(0.00622)	(0.00665)*
Industry Fe	–	Yes	Yes
Year FE	–	–	Yes
Observations	12,741	12,741	12,741

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[7] While estimating a binary choice response model, the underlying assumption on the hazard rate is that it follows a Gaussian distribution (Hess and Persson, 2012).

[8] Alternative to probit model, the recent empirical literature employs a complementary log-log model to estimate the survival function.

[9] The hazard ratio is measured as e $^{(-0.0361)}$ = 0.965 Following which the hazard rate is computed as (1-hazard ratio) * 100.

[10] For brevity, the results are not reported in the text and are available upon request to the authors.

Turning to our controls, we find that firms with higher initial value of exports, more productive firms, older, and large firms[11] are more likely to survive in export market. Similar findings are documented in Córcoles et al. (2015); Dai et al. (2020); Inui et al. (2017); Zhang et al. (2018). In terms of the ownership variables, we observe that the coefficient on foreign ownership is insignificant. This can be attributed to the fact that <3 % of our sample firms are foreign owned. Previously, studies on trade integration in India have also documented an insignificant impact of foreign ownership (Reddy and Sasidharan, 2021). Further, we also observe that the coefficient on group is positive and significant highlighting that business group affiliates are more likely to exit the export market. This finding is in line previous research on India, which documents that that business group affiliates are more inclined towards operating in the domestic market compared to exploring markets abroad (Chakrabarti and Mondal, 2017; Padmaja and Sasidharan, 2021).

6.2. Role of financial constraints

Participating in international markets require substantial costs, making the financial condition of firm an important factor in shaping its decision as well as survival (Musso and Schiavo, 2008; Minetti et al., 2019). Moreover, financial constraints could hinder its investment in innovative activities, thereby affecting firm performance and increasing its likelihood of exiting the international market. In order to account for this channel of operation, we proxy for financial condition of the firm using leverage ratio[12] and identify firms as financially constrained if firms leverage value if greater than the industry leverage and 0 otherwise (Greenaway et al., 2007; Stiebale, 2011). We interact leverage dummy with firm's decision to invest in R&D activities. Table 6 reports the result of the random effects probit estimation. First, similar to the baseline estimates, we observe a significant and negative coefficient on R&D highlighting that innovation aids firm survival in export market. Second, we find that firms with higher leverage have 4.7 % to 5.3 % lower probability of survival in the export market. Our results confirm prior findings that financially distressed firms face higher probability of exit from the export market (Rossi et al., 2021). Further, we observe that the coefficient of the interaction measure comes up with a negative and significant (column 3) in the presence of industry and time fixed effects. This results show that leveraged firms that invest in R&D experience lower hazard rate in the export market, i.e., higher survival probability. In terms of the marginal effects, the results indicate firms undertaking R&D have a 5.6 % lower probability of export exit.[13]

Table 6
R&D, financial constraints & export survival.

Variables	(1)	(2)	(3)
	Export-Exit	Export-Exit	Export-Exit
R&D	−0.0371**	−0.0306*	−0.0326**
	(0.0161)	(0.0164)	(0.0165)
Leverage	0.0539***	0.0472***	0.0493***
	(0.0120)	(0.0120)	(0.0121)
R&D × Leverage	−0.0116	−0.0165	−0.0564*
	(0.0335)	(0.0335)	(0.0341)
Log Initial Export $_{t-1}$	−0.167***	−0.183***	−0.161***
	(0.0446)	(0.0449)	(0.0451)
Log Age $_{t-1}$	−0.0502***	−0.0491***	−0.0253**
	(0.0117)	(0.0117)	(0.0125)
Log TFP $_{t-1}$	−0.00694	−0.0363***	−0.0293***
	(0.00538)	(0.00880)	(0.00887)
Group	0.0998***	0.0842***	0.0494**
	(0.0202)	(0.0202)	(0.0209)
Foreign	−0.0209	−0.0196	−0.0462
	(0.0378)	(0.0378)	(0.0383)
Log Size $_{t-1}$	−0.0560***	−0.0441***	−0.0285***
	(0.00489)	(0.00624)	(0.00669)
Industry Fe	–	Yes	Yes
Year FE	–	–	Yes
Observations	12,741	12,741	12,741

Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

6.3. Firm size

To capture the heterogeneity of our sample, we classify our sample firms into small & medium firms (SMEs), and large firms based on total assets. To this end, we classify SMEs as those with assets below the median industry assets and those above the industry median are treated as large firms. Panel A and B in Table 7 presents the results of the size classification on export market survival. From the table, we observe that the coefficient on R&D is negative for both SMEs and large firms. However, it is significant only for SMEs. This result indicates that R&D enables SMEs to survive longer in the export markets. In terms of the magnitude of the impact, from the table, we observe that R&D is associated with lower hazard rate by 6.1 %–7.4 %. Our results are consistent with the findings of Rossi et al. (2021), who document a positive association between innovation and export survival of European SMEs. Further, our results are also qualitatively similar while using a complementary log-log model (results are available upon request).

6.4. Technology classification

In the empirical analysis, we examined the role of R&D on firm survival for all manufacturing firms. However, the technology underlying the production is not homogenous for all firms. To factor this in our

Table 7
R&D & export survival: Heterogeneous effects of firm size.

Variables	SMEs		Large firms	
	(1)	(2)	(3)	(4)
	Export-Exit	Export-Exit	Export-Exit	Export-Exit
R&D	−0.0639**	−0.0774***	−0.0334*	−0.0314
	(0.0255)	(0.0257)	(0.0195)	(0.0193)
Log Initial Export $_{t-1}$	−0.255***	−0.171***	−0.139**	−0.143**
	(0.0573)	(0.0572)	(0.0683)	(0.0677)
Log Age $_{t-1}$	−0.0906***	−0.0330**	−0.0228	−0.0275
	(0.0158)	(0.0166)	(0.0170)	(0.0178)
Log TFP $_{t-1}$	−0.0903***	−0.0451***	−0.0846***	−0.0666***
	(0.00983)	(0.0107)	(0.00885)	(0.0101)
Group	0.0344	−0.00554	0.0436*	0.0397
	(0.0319)	(0.0317)	(0.0249)	(0.0251)
Foreign	0.0718	0.0599	−0.0673	−0.0763*
	(0.0714)	(0.0706)	(0.0441)	(0.0443)
Industry Fe	Yes	Yes	Yes	Yes
Year FE	–	Yes	–	Yes
Observations	6250	6250	6491	6491

Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

[11] The results remain qualitatively similar while employing lag of sales (log) as an alternate measure for firm size.

[12] The leverage ratio is measured as the ratio of firm's debts to total assets of the firm. A higher ratio indicates higher financial constraint of the firm

[13] The findings are quantitively and qualitatively similar while employing the complementary log-log model. The results are available upon request to the authors.

empirical analysis, we divide the sample into two sub-groups: high-tech and low-tech industries[14,15] (Parameswaran, 2009). Table 8 presents the findings of this sub-sample analysis. From the table, we observe that the investment in R&D increases the probability of export survival for low-tech firms. The coefficient though negative, turns insignificant for high-tech industries. The results highlight the gains in terms of firm survival as an outcome of investment in R&D activities, especially in the case of for low-technology intensive industries.[16]

6.5. *Export incentives and export survival*

The role of fiscal stimuli can play an important role for export survival of the firm, given the financial needs associated with undertaking exports. In this regard, the existing literature highlights that export-promotion programs aid firms' entry into export markets (Volpe Martincus and Carballo, 2010b; Van Biesebroeck et al., 2016). Interestingly, PROWESS database has information on the export incentives (subsidies, drawback incentives) received by firms. We use this information to identify firms that have received support vis-à-vis other firms using an indicator variable. The interaction of the export incentive variable and R&D yields a negative and statistically significant coefficient, suggesting that innovative activities of the firm reduce the likelihood of export market exit, even more so for firms that received support for their exporting activities (Table 9). This result is consistent with the findings of the prior studies demonstrating that export incentives have positive impact on firms' export duration (Anwar et al., 2019; Heiland and Yalcin, 2021).

6.6. *Endogeneity correction*

While examining the role of firm innovation on its export survival, a major econometric concern is the potential endogeneity. This stems for

Table 8
R&D & export survival: Heterogeneous effects based on technology intensity.

Variables	High-tech		Low-tech	
	(1)	(2)	(3)	(4)
	Export-Exit	Export-Exit	Export-Exit	Export-Exit
R&D	−0.0260	−0.0295	−0.0496**	−0.0615**
	(0.0201)	(0.0203)	(0.0239)	(0.0243)
Log Initial Export $_{t-1}$	−0.218***	−0.195***	−0.166***	−0.149**
	(0.0720)	(0.0721)	(0.0573)	(0.0579)
Log Age $_{t-1}$	−0.0528***	−0.0189	−0.0457***	−0.0313*
	(0.0176)	(0.0187)	(0.0157)	(0.0167)
Log TFP $_{t-1}$	−0.0337**	−0.0202	−0.043[3]***	−0.0400***
	(0.0150)	(0.0152)	(0.0109)	(0.0109)
Group	0.0626**	0.0188	0.103***	0.0783***
	(0.0307)	(0.0316)	(0.0268)	(0.0280)
Foreign	−0.116*	−0.138**	0.0477	0.0217
	(0.0596)	(0.0604)	(0.0490)	(0.0495)
Log Size $_{t-1}$	−0.0436***	−0.0299***	−0.0501***	−0.0358***
	(0.0107)	(0.0113)	(0.00767)	(0.00834)
Industry Fe	Yes	Yes	Yes	Yes
Year FE	–	Yes	–	Yes
Observations	5231	5231	7510	7510

Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 9
R&D & export survival: Role of export incentives.

Variables	(1)	(2)	(3)
	Export-Exit	Export-Exit	Export-Exit
R&D	−0.223***	−0.199***	−0.227***
	(0.0548)	(0.0554)	(0.0566)
Export Incentive	−0.842***	−0.834***	−0.840***
	(0.0447)	(0.0447)	(0.0455)
R&D # Export Incentive	−0.627***	−0.584***	−0.589***
	(0.0903)	(0.0906)	(0.0919)
Log Initial Export $_{t-1}$	−0.292***	−0.369**	−0.321**
	(0.147)	(0.148)	(0.151)
Log Age $_{t-1}$	−0.120***	−0.118***	−0.0656
	(0.0388)	(0.0389)	(0.0416)
Log TFP $_{t-1}$	−0.0258	−0.114***	−0.0933***
	(0.0177)	(0.0295)	(0.0299)
Group	0.282***	0.238***	0.153**
	(0.0665)	(0.0665)	(0.0696)
Foreign	−0.133	−0.126	−0.198
	(0.126)	(0.126)	(0.129)
Log Size $_{t-1}$	−0.170***	−0.133***	−0.0946***
	(0.0167)	(0.0210)	(0.0225)
Industry Fe	–	Yes	Yes
Year FE	–	–	Yes
Observations	12,741	12,741	12,741

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the possibility of reverse causality, where instead of innovation aiding export survival of firms, it is the exporting activities that pushes firms towards more innovative efforts. The existing literature on innovation and export also express these concerns that the two variables may not be truly exogenous (See, among other, Coe and Helpman, 1995; Van Beveren and Vandenbussche, 2010; Rossi et al., 2021). Hence, it becomes essential to account for this endogeneity concern to capture the true impact of innovative efforts of firm on their export market survival. Therefore, to reduce the effect of the potential endogeneity, we also make use of an instrument variable (IV) estimation technique.

Given the binary nature of both the dependent and the endogenous R&D variable, the use of two-stage IV is inept (Bauernschuster et al., 2009). Hence, we estimate a bivariate probit model. Further, we identify sectoral R&D intensity (R&D expenditure at industry level as a percentage of industry total assets) as a suitable instrument. This instrument is well suited to solve the endogeneity concerns, since firms from more R&D intensive industries are more likely to invest in R&D. However, at the same time, firm survival in the export market is conditional upon its own innovative efforts and not that of the industry as a whole. We follow this empirical strategy followingRossi et al. (2021) to tackle endogeneity issue.

Table 10 presents[17] the results of the bivariate probit model. We observe that that coefficient of the R&D variable is negative and significant at 1 % significance level. Based on the marginal effects reported, we can discern that firms undertaking R&D have a 2 % to 4 % higher probability of surviving the export market. The findings are similar to the baseline estimates and the existing literature (Dai et al., 2020; Rossi et al., 2021). Alternatively, we employ Lewbel (2012, 2018) approach to correct for endogeneity in our model and further showcase robustness of our findings.[18] The results of Lewbel approach provides similar results, underscoring the significance of R&D in export survival of firms.[19]

[14] High-tech industries are: NIC 20, 21, 26, 27, 28, 29, 30, and 32; and low-tech industries include firms from NIC 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, and 31.

[15] A caveat of this classification is that it is industry specific and does not translate into firm-specific measure.

[16] Similar results are obtained with a complementary log-log model. The results are available upon request.

[17] Since the instrument used is constructed at an industry level, we do not include industry fixed effects in the empirical analysis.

[18] Lewbel (2012, 2018) proposed an estimator for identifying parameters in regression models with endogenous regressor. This approach is useful in situations in the absence of an external instrument. In this approach, identification is achieved by having regressors that are uncorrelated with the product of heteroskedastic errors. We thank an anonymous reviewer for this valuable suggestion.

[19] For brevity, we do not report the results. The results are available upon request to the authors.

Table 10
R&D & export survival: Endogeneity correction.

Variables	(1)	(2)
	Export-Exit	Export-Exit
R&D	−0.0210**	−0.0237**
	(0.00964)	(0.00991)
Log Initial Export $_{t-1}$	−0.0826***	−0.0700***
	(0.0135)	(0.0134)
Log Age $_{t-1}$	0.0202***	0.0244***
	(0.00369)	(0.00393)
Log TFP $_{t-1}$	0.00284**	0.00310**
	(0.00129)	(0.00127)
Group	0.0605***	0.0480***
	(0.00563)	(0.00524)
Foreign	0.0207*	0.00839
	(0.0108)	(0.0108)
Log Size $_{t-1}$	0.00630***	0.0116***
	(0.00161)	(0.00198)
First stage		
Industry R&D	2.079***	2.199***
	(0.203)	(0.200)
Year FE	No	Yes
Observations	12,668	12,668

Note: We do not incorporate industry fixed effects since the instrument is constructed at industry level. Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

6.7. Robustness

To posit the robustness of our findings, we begin by estimating R&D stock of the firm.[20] In this regard, we compute R&D stock of the firm using perpetual inventory method (PIM) using Eq. (2).

$$R\&D_{it} = (1-\delta)R\&D_{i,t-1} + RD_{i,t-1} \quad (2)$$

In the above equation, *RD* represents the real R&D expenditure of the firm in *t-1* and δ represents the rate of depreciation, which is assumed at 15 % (in line with the literature and the reviewer's suggestion). A key requirement for the application of PIM is the availability of data on the initial year value of $R\&D_{it}$. However, since we do not have data on firms' investment in the pre-sample years, the initial investment in approximated by assuming that firms which do not report any R&D expenses during the first three years of the sample, did not undertake R&D investments in the pre-sample years (Parameswaran, 2009). The underlying rationale for this assumption is that the probability of a firm having previous R&D investments is low if a firm has not undertaken R&D expenditure consequently for three years. On the other hand, firms that report R&D in any of the first three years of the sample, the initial year R&D stock is measured as

$$R\&D_{it} = RD_{i,t-1}\sum_{i=0}^{n}\left(\frac{1-\delta}{1+g}\right)^{a}$$

g represents the growth rate of real R&D expenditure of firms, and *n* represents the number of pre-sample years of R&D investment. Further $RD_{i,\,t-1}$ is proxied by the average R&D expenditure of firms during the first three years (Kathuria, 2001). Moreover, we arrive at the real values of R&D expenditure by using an R&D deflator which is weighted average of capital and wage deflator.

Using the R&D stock measure, we create a dummy variable that takes the value 1 if the firm undertakes R&D and 0 otherwise. Columns 1–2 in Table 11 documents the results of this analysis. Furthermore, we also make use of R&D in the intensive form (R&D expenditure relative to total assets of the firm). The results are reported in Columns 3–4. From the table, we observe that R&D both in intensive and extensive form is a key factor in export survival of firms.

Further, as a second robustness check, we incorporate duration analysis model to provide robustness of our findings. To this end, we employ the complementary log-log (cloglog) model employed in the literature to model survival analysis (Dai et al., 2020; Hess and Persson, 2012; Inui et al., 2017; Zhang et al., 2018). Table 12 documents the results of our Clog-log model. From the table, we observe that the coefficient on R&D dummy is negative and significant, in line with our baseline results. The findings highlight that a firm by undertaking R&D is less likely to exit (4.9 %–5.5 %) export market. These results also show that our findings are robust to alternative survival analysis technique.

Table 11
R&D & export survival: R&D stock.

Variables	(1)	(2)	(3)	(4)
	Export-Exit	Export-Exit	Export-Exit	Export-Exit
R&D Dummy	−0.0251	−0.0366**		
	(0.0154)	(0.0155)		
R&D Intensity $_{t-1}$			−0.790**	−1.069***
			(0.328)	(0.327)
Log Initial Export $_{t-1}$	−0.185***	−0.164***	−0.125	−0.139
	(0.0449)	(0.0452)	(0.0953)	(0.0940)
Log Age $_{t-1}$	−0.0476***	−0.0244*	0.00197	−0.00320
	(0.0118)	(0.0125)	(0.0255)	(0.0262)
Log TFP $_{t-1}$	−0.0396***	−0.0325***	−0.0210	−0.00757
	(0.00878)	(0.00883)	(0.0201)	(0.0198)
Group	0.0832***	0.0506**	0.0731**	0.0692**
	(0.0203)	(0.0210)	(0.0344)	(0.0348)
Foreign	−0.0193	−0.0438	−0.00615	−0.0102
	(0.0378)	(0.0383)	(0.0597)	(0.0586)
Log Size $_{t-1}$	−0.0467***	−0.0316***	−0.0485***	−0.0501***
	(0.00624)	(0.00666)	(0.0143)	(0.0148)
Industry Fe	Yes	Yes	Yes	Yes
Year FE	–	Yes	–	Yes
Observations	12,741	12,741	3076	3076

R&D dummy and intensity are measured using R&D stock. Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 12
R&D & export survival: Complementary log-log model.

Variables	(1)	(2)	(3)
	Export-Exit	Export-Exit	Export-Exit
R&D	−0.0499***	−0.0447***	−0.0550***
	(0.0153)	(0.0155)	(0.0157)
Log Initial Export$_{t-1}$	−0.173***	−0.190***	−0.167***
	(0.0450)	(0.0452)	(0.0454)
Log Age $_{t-1}$	−0.0486***	−0.0472***	−0.0213*
	(0.0114)	(0.0114)	(0.0122)
Log TFP $_{t-1}$	−0.00667	−0.0348***	−0.0288***
	(0.00530)	(0.00855)	(0.00864)
Group	0.0996***	0.0843***	0.0510**
	(0.0198)	(0.0198)	(0.0205)
Foreign	−0.00754	−0.00465	−0.0263
	(0.0382)	(0.0382)	(0.0383)
Log Size $_{t-1}$	−0.0608***	−0.0491***	−0.0348***
	(0.00481)	(0.00613)	(0.00653)
Industry Fe	–	Yes	Yes
Year FE	–	–	Yes
Observations	12,741	12,741	12,741

Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

[20] We thank one of the reviewers for this suggestion.

7. Conclusion

There exist two contrasting views about the impact of innovation on the export market survival. On the one hand, innovation results in improved productivity and profitability of firms along with learning by exporting effect, which reduce exit rates from export market (Bernard et al., 2011; Fontana and Nesta, 2009; Zhang et al., 2018). On the other hand, innovation itself requires large investments, and involves high risk and uncertainty (Dai et al., 2020; Zhang et al., 2018). Therefore, failure of such risky investments to translate into successful output may result in higher exit rates from the export market due to the financial burden, which is imperative for R&D firms.

In this regard, there is a dearth of rigorous empirical studies on the role of innovation and export market survival in the context of emerging markets and developing economies. In this context, our study aims to fill this gap using rich firm level data using an unbalanced panel of 1424 exporting firms from Indian manufacturing over 2001–2018. To test this relationship, we rely on random effects probit model. We find that firm's decision to invest in R&D is a significant factor in aiding export survival of firms. Further, we find the importance of financial health of a firm in its survival in the export market. The outcome of the empirical analysis also reveals positive association of R&D investment on survival of SMEs in export market. Our results suggest that recepient firms of export incentives have higher export market survival. Moreover, the empirical analysis undertaken also highlights the robustness of our results to possible endogeneity concerns.

Although our study focusses on India, the empirical results have wide-scale policy implications for India and other emerging economies. First, our study provides evidence for the role of R&D on firm survival in the export market. The results highlight that innovative activities provide competitive advantage for firms and therefore is a crucial factor with respect to firm survival. Therefore, the findings call for policies that promote innovative efforts among firms that participate in global markets. Second, the study also highlights the importance of financial resources on firm survival. In this context, the results showcase that financially constraint firms undertaking R&D investments experience lower probability of exit, i.e., they survive longer. This highlights the importance of financial support needed to undertake innovative activities. Given that participation in international market itself is associated with significant fixed costs, undertaking investment in R&D becomes more strenuous for firms. Hence, policies providing financial support for firms could promote their endeavours in R&D activities which in turn could help their longevity in the global market. The importance of policy measures in terms of financial support gain more prominence during unprecedented crisis created by Covid-19 outbreak.

Third, the size sub-sample analysis carried out in the study highlights significant impact of R&D on firm survival of SMEs. The finding of this analysis has important policy implication, especially for an emerging economy like India, where SMEs contribute significantly to output, employment and exports. Hence, policies fostering R&D investment among SMEs could aid their survival in export markets. Fourth, we also document that firms receiving subsidies in the form of export incentives survive longer, and also promote domestic innovation. This finding provides evidence of effectiveness of incentive schemes that enable firms to foster innovative capabilities and improve their internationalization.[21] Further, even though our study focuses on the experience of Indian firms, we believe that these policy recommendations are relevant for other emerging and developing economies. Moreover, our study highlights the significance of innovative efforts from international trade perspective, which provides cues for firms from emerging and developing countries markets devote resources to enhance innovative capabilities since it improves their global competitiveness. This becomes even more crucial in a GVC dominated trade system, where firms can increase their trade presence by creating competitiveness in a specific task.

Despite robust empirical analysis, our analysis is not free from limitation. A limitation of our database is that it does not provide information on the export destination, prices, export product information, and quantities. Therefore, we are unable to account for export market destination and export product characteristics. Hence, with the availability of such data, future studies can advance this strand of literature by examining the destination and product characteristics on export survival in the context of emerging and developing countries.

[21] The Production Linked Incentive (PLI) scheme launched by the Indian government aims to blend domestic and exporting capabilities to create a competitive manufacturing base in the country.

Declaration of competing interest

The authors declare no conflict of interest.

Data availability

The data is a proprietary database and is available at https://prowessiq.cmie.com/.

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