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Productivity and Learning-by-exporting: A Firm-level Analysis of Indian Manufacturing

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1. INTRODUCTION

EXPORTING has often been understood as a means to achieve higher productivity, where exporting firms tend to experience higher productivity growth than non-exporting ones. Several theoretical models also indicate that exporting causes improvement in productivity (Krugman, 1979; Jovanovic and Lach, 1991). These studies illustrate that exporting firms have opportunities to interact with international clients and overseas competitors and gain knowledge and technology from their buyers. They interact and acquire information from foreign clients on improving product designs, on upgrading product quality and on how to decrease production cost (Evenson and Westphal, 1995; Blalock and Gertler, 2004). Some part of the efficiency of export-led development must therefore be attributed to positive externalities derived from exporting (Evenson and Westphal, 1995), and this is often referred to as export-by-learning effects.

It is often asked whether more efficient or productive firms self-select into export markets, or whether exporting serves to ensure ongoing productivity benefits compared with domestically oriented producers that only produce for the domestic market (Clerides et al., 1998; Bernard and Jensen, 1999). This paper contributes to the literature by examining the exporting behaviour of Indian manufacturing firms in the context of India's recent liberalisation policy. India had high trade restrictions, offering huge potential gains from liberalising and opening up the economy. Exporting offers the potential for increasing efficiency from competition and also increases contact with overseas customers that provide them with maximum scope for learning opportunities.

At present, there is a substantial competitiveness and productivity gap between domestic and export-oriented firms, which could gradually be reduced through increased productivity from international trade. There is also the possibility of greater scope for learning-by-exporting effects due to the efficiency gap between domestic and foreign firms. In this paper, we attempt to show that, while self-selection matters, feedback from exporting to productivity is an important factor for enhancing efficiency and competitiveness of domestic firms.

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In this paper, we use firm-level data of the Indian manufacturing sector to study the export behaviour of firms in terms of productivity improvements from undertaking exporting activities. The study covers nearly 600 firms from 1991 to 2001, the key reform period of the new Indian economic liberalisation policy. To our knowledge, this is the first paper to study 'learning-by-exporting' behaviour of Indian manufacturing firms.

There are several policy implications for countries pursuing export-led economic strategy. If there are gains from exporting in terms of productivity improvements, then government initiatives to promote exports will have a positive impact on economic growth. In this case, government policy to incentivise domestic firms to enter foreign markets and reduce trade barriers will have direct benefits in terms of improvements in productivity. On the other hand, if there is self-selection, then government policy to encourage entry into the export market may not have much impact on productivity improvements of domestic firms. However, there might still be gains from entering export markets if there is feedback from export market entry to productivity if persistence in export market further increases the productivity of domestic firms.

The remainder of the paper is organised as follows. Section 2 presents a literature review on exporting and firm productivity. Section 3 contains a description of Indian manufacturing and export policies. Section 4 discusses data and hypotheses. Sections 5 and 6 present econometric method and results, respectively. Section 7 concludes.

2. EXPORTING AND FIRM PRODUCTIVITY

There are two prominent lines of theoretical explanations for the relationship between productivity and exporting at the firm level. First, there is evidence in support of the self-selection hypothesis implying that more productive firms self-select into exporting. In contrast, there is also some empirical evidence for learning-by-exporting. Seminal work by Bernard and Jensen (1999) attempts to explain the relationship between exporting and productivity. Their study offers conclusive evidence for self-selection for US manufacturing industries between 1976 and 1987. The phenomenon has subsequently been confirmed by Aw and Hwang (1995) and Aw et al. (2000) for Taiwan and Korea; Roberts and Tybout (1997) for Colombia; Clerides et al. (1998) for Colombia, Morocco and Mexico; Bernard and Jensen (1999) for US; Bernard and Wagner (1997) on German data; Girma et al. (2003, 2004) for UK firms; Damijan and Kostevc (2006) for Slovenia and Alvarez; Haidar (2012) for Indian firms; and Lopez (2009) for Chil- ean plants. None of the above studies have provided conclusive evidence for learning- by-exporting. Efficient performers are likely to be ones that are able to cope with sunk costs associated for entry into a foreign market, and reap positive net profits. Also, given that com- petition is more intense outside the domestic market, only the most productive firms do well abroad. This explanation is very much in consonance with the assumption made in the theoretical literature with heterogeneous firms that efficient firms self-select themselves into foreign markets.

An alternative theoretical explanation for the firm level focuses attention on learning effects. Access to useful technological and managerial inputs from international contacts is often referred to in this context as the possibility of exploitation of economies of scale by operating in various overseas markets. As far as the technological argument is concerned, we would expect the learning hypothesis to have more explanatory power for countries facing significant

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technological gaps vis-a-vis the overseas markets, while the economies of scale argument may be of particular relevance for firms from small domestic markets. Although the

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two explanations are not mutually exclusive, the latter shifts the burden of the arguments onto the causal relationship from exporting to productivity, whereas the former emphasises the causal link from productivity to exporting. An empirical analysis of causality is hence a means to assess the performance of the two approaches in the data.

We can find some evidence for learning-by-exporting from several studies. Greenaway and Kneller (2004), on a large sample of UK manufacturing firms, found learning effects to be quite significant only in the initial periods after entry. They also found that the learning effect was consistently lower in industries in which existing exposure to foreign firms was greater. Further, the paper highlights that industry differences are important determining factors whether learning effects boost productivity after export market entry.

Blalock and Gertler (2004) and Van Biesbroeck (2005) found evidence for less developed countries like Indonesia and sub-Saharan African countries. Blalock and Gertler (2004) also found the scope for learning through exporting is greater for domestic firms than from multi- national firms. Evidence of learning-by-exporting can also be found in the studies by Baldwin and Gu (2003) for Canada and Isgut (2001) for Colombia. Castellani (2002) finds that Italian firms with exposure to foreign markets experience learning effects but only within a threshold export intensity.

3. INDIAN MANUFACTURING AND EXPORT POLICIES

Over the last few years, various policy initiatives and economic reforms have made India one of the fastest growing economies in the world. However, at just over 15 per cent of GDP, the manufacturing sector in India is not representative of its potential. With the objective of developing the manufacturing sector, the Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, has been creating a policy environment suitable to sup- port manufacturing. A robust and growing manufacturing sector has the potential to generate employment. By providing the necessary infrastructure, easier clearance and approval mechanisms, flexible yet secure labour rules, focus on clusters and skill development facilities, the proposed national manufacturing and investment zones are potentially ideal locations for Indian manufacturing to emerge as globally competitive entities. Not being based on a model of tax concessions, the proposed manufacturing policy tries to deal with the issues that have historically come in the way of India emerging as a strong base for manufacturing.

We think the Indian manufacturing sector is an appropriate setting for research on learning-by-exporting for several reasons. First, the country has abundant labour, both unskilled and skilled, and natural resources to support a large number of manufacturing facilities in a wide variety of industries. Second, India gradually shifted its policy from import substitution to export promotion in the early 1980s, and subsequently the New Industrial Policy (NIP) in 1991.

The new export-import policy ushers in a series of reforms that will undoubtedly provide greater impetus to India's export efforts. Exporters, for example, are allowed to import intermediate products and capital goods duty free. They were given generous tax holidays and assured appropriate physical infrastructure, often through the provision of land, power, security and transport to ports, within specially created industrial parks. India too has experimented with special zones, mainly export processing zones (EPZs), but unfortunately India's approach to export zones has been one of relative neglect rather than support. While China's five main special economic zones (Shenzen, Zhuhai, Santou, Xiamen and Hainan) exported

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$26 billion in 1994, roughly 22 per cent of the national total, India's main EPZs (Kandla, Santacruz, Noida, Madras, Cochin and Falta), managed a tiny fraction of that.

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To summarise, the new export policies in conjunction with the NIP of 1991 represent a major paradigm shift in Indian's economic liberalisation policy and aim to enhance productivity and efficiency in Indian industries by increasing competition, creating level playing field among public, private and foreign businesses and generating an environment which is conducive for technological growth.

4. DATA AND HYPOTHESES

The data used in the study are collected from several sources including Capitaline, various issues of the Annual Survey of Industries (ASI), National Accounts Statistics and some publications of the Ministry of Industry. Capitaline is a data package which maintains a corporate database of more than 4,000 companies classified under 335 Indian industries. The financial and non-financial details of these companies enable users to analyse in detail the financial structure of any company or industry. The information on relevant firm characteristics such as size (number of employees), value of inputs, net profits and sales, value of output, total exports and imports was obtained from Capitaline. The data constitute an unbalanced panel covering 1991–2001. The sample consists of 583 firms (Table 1). We matched Capitaline data to ASI to construct the data on number of employees. All variables used in our estimation are measured at 1995 prices (Table 2). The variables used are as follows.

Output: The Capitaline package provides data on total sales and finished goods inventory. Total value of output is the sum of the two. We use wholesale price indices as deflators for output.

Material inputs: The total raw materials consumed are deflated by the weighted input price index. The material price index is a weighted index of wholesale prices of major input groups, where the weights have been calculated from the matrix of input–output transactions published by Central Statistical Organization (CSO). The value of the output and material input is taken from various issues of ASI. The input–output transaction matrix (1978–79 and 1983–84) is used to construct the price deflators.

Labour: The series on labour is constructed using data from ASI. Data on total employee cost of the firms are collected from the Capitaline package and the series on number of

TABLE 1
Number of Firms Exporting and not Exporting, by Year

Year	Number of Firms	
	Exporting	Non-exporting
1991	340	242
1992	376	206
1993	384	198
1994	411	171
1995	422	160
1996	433	149
1997	435	147
1998	436	146
1999	443	139

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2000	451	131
2001	462	120

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TABLE 2
Descriptive Statistics of Key Variables

	Observations	Mean	SD	Minimum	Maximum
Log (output)	6,402	19.413	1.508	11.949	24.843
Log (labour)	6,402	6.966	1.637	0.445	12.926
Log (capital)	6,402	19.57	1.664	11.299	25.868
Log (materials)	6,402	19.788	1.664	11.295	26.444
Share.exp.	6,402	0.0020	0.0048	6.37e 07	0.0597

employees is constructed using the wage rate in corresponding industries estimated from ASI (total emoluments/number of employees).
Capital: The capital stock is proxied by the value of net fixed assets and is deflated using the capital stock deflator.
Exports: We define exports as total exports earnings from goods sold to the world markets. The values are deflated by a unit value index which can be obtained from Economic Survey of India.

a. Hypotheses

We set out to test the following:

1: To test whether productivity gains occur after firms enter the world market.

If this holds, we would expect learning-by-exporting effects to take place after entry of firms into the export market.

2: To test whether firms self-select, in other words only highly productive firms enter export markets.

Self-selection suggests that firms incur sunk costs to enter export markets, and therefore, only more productive firms are able to export. Productivity increases in advance of exporting, and hence, exporting is a result of productivity increase rather than a cause.

5. ESTIMATION STRATEGY

We assume the production technology is Cobb-Douglas and specify the production function as:

$$y_{it} = b_0 + b_1 Export_{it} + b_2 k_{it} + b_3 l_{it} + b_4 m_{it} + a_i + x_{it} + e_{it}; \quad (1)$$

where $Export_{it}$ is a dummy indicating whether firm i exported in year t; y_{it} is the logarithm of the firm's output, often measured as gross revenue or value added; k_{it}, l_{it} and m_{it} are logarithms of capital, output and material inputs for firm i and time t; a_i is a fixed effect for firm i; x_{it} is an idiosyncratic productivity shock; and e_{it} is i.i.d error term. Here, we have labour and material as freely available inputs and capital is the state variable. The key difference between x_{it} and e_{it} is that the former is a state variable, and hence, it impacts the firm's decision rules. Since it is not

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observed, and can influence choices of inputs, it leads to a simultaneity problem in estimation of the production function. Estimators ignoring this correlation between inputs and unobservable factors like ordinary least squares (OLS) will yield inconsistent results. Again, the managers of

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the firm can observe x_{it} and adjust the inputs in response, whereas they cannot respond to the latter. A positive coefficient on $Export_{it}$ implies that exports are associated with higher productivity. We have mentioned earlier that the production function cannot be estimated consistently by least squares. Input levels and exports might be correlated with unobserved heterogeneity in productivity captured in the error term, and it is important to trace a causal relationship between exporting and productivity (Blalock and Gertler, 2004).

Blalock and Gertler (2004) also mention that more productive firms are more likely to export, and if the unobserved heterogeneity between exporters and non-exporters is not accounted for, a correlation between exporting and productivity could simply be attributed to selection. To this end, we have estimated the production function using the following approaches. First, firm fixed effects are included to control for idiosyncratic time-varying shocks with proxy estimators and also control for time-invariant productivity differences and other stationary attributes. We have also used Olley and Pakes (1996) and Levinshon and Pe- trin (2003) approaches which take into account idiosyncratic productivity shocks, x_{it}. Blalock and Gertler (2004) point out that a firm may find a better production process or hire a talented manager, which improves productivity and increases the probability that the firm chooses to export. To control for the problem, the above approaches generate proxies for x_{it}. While Olley and Pakes (1996) use investment as a proxy, Levinshon and Petrin (2003) use material inputs. Both make two important assumptions about the firm's production technology. The first is that the shock proxy must be monotonically increasing with respect to the true shock. Second, while inputs such as labour and material inputs must respond immediately to a shock, a variable like capital must respond only after an adjustment lag (Blalock and Gertler, 2004). Since the state variables do not respond to contemporaneous noise, the contribution of an idiosyncratic shock can be represented as a function of both the proxy and state variables. The

TABLE 3
Estimation of Cobb-Douglas Production Function on a Sample of Indian Manufacturing Firms From 1991 to 2001

Dependent Variable Log (Output)	Ordinary Least Squares	Fixed Effect	Olley–Pakes	Levinshon–Petrin
Export dummy1	0.049*	0.045*	0.096*	0.159*
	(3.190)	(2.730)	(6.230)	(8.610)
Log (capital)	0.292*	0.290*	0.301*	0.710*
	(25.530)	(21.490)	(68.640)	(1.980)
Log (labour)	0.422*	0.370*	0.492*	0.495*
	(21.101)	(13.380)	(66.160)	(64.590)
Log (materials)	0.204*	0.226*	0.148*	0.010*
	(10.700)	(9.060)	(18.470)	(98.960)
Constant	6.668*	0.335*	13.521	94.463
	(26.93)	(19.78)	(0.240)	(0.830)
Observations	6,402	6,402	6,402	6,402
R-squared	0.887	0.882	0.894	0.895
No. of firms	583	583	583	583

Notes:

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(i) Absolute value of t statistics in parentheses.
(ii) *Coefficients are significant at 1 per cent level of significance.
(iii) Export dummy1: A firm exporting or not in current year. It takes value 1 = exporting and 0 = not exporting.

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practical interpretation is that an increase in investment or intermediate input use, contingent on a given level of capitalisation, implies a positive idiosyncratic shock. Self-selection is also important in this context. It explains the relative timing of the exporting and productivity gains. Many authors (Clerides et al., 1998; Bernard and Jensen, 1999) have argued that firms incur sunk costs to enter world markets. Entry happens only after a sufficient increase in pro- ductivity for exporting profits to justify the expense (Blalock and Gertler, 2004). These authors conclude that exporting is the result of efficiency, not its cause. We have also tested self-selection by examining productivity gains in the year prior to exporting. We have also examined whether the productivity trend persists even after the firm stops exporting.

6. ESTIMATION RESULTS

We report the main results in Table 3. The first two columns report pooled OLS and firm fixed-effect estimations. Olley–Pakes (OP) and Levinshon–Petrin (LP) estimations are reported in subsequent columns. The export coefficients are positive and significant at 1 per cent level of significance. The results suggest that exporting increases productivity by about 5 per cent.

If exporting generates efficiency gains, firms that began to export should thereafter exhibit a change in the stochastic process that governs their productivity growth (Clerides et al.,

TABLE 4
Fixed-effect Estimation Using Differing Definitions of Exporting Behaviour

Dependent Variable	(1)	(2)	(3)	(4)
Export dummy1	0.045*	0.022	0.252*	
	(2.73)	(1.09)	(11.28)	
Export dummy2		0.049*		
		(2.13)		
Export dummy3			0.353*	
			(13.60)	
Export dummy4				0.277*
				(12.37)
Log (capital)	0.290*	0.290*	0.262*	0.268*
	(21.49)	(21.56)	(19.56)	(20.06)
Log (labour)	0.370*	0.370*	0.382*	0.373*
	(13.38)	(13.35)	(13.89)	(13.66)
Log (mat-inputs)	0.226*	0.227*	0.219*	0.217*
	(9.06)	(9.07)	(8.97)	(8.90)
Constant	6.629*	6.633*	7.062*	7.041*
	(19.78)	(19.82)	(21.41)	(21.30)
Observations	6,402	6,402	6,402	6,402
R-squared	0.882	0.882	0.883	0.883

Notes:
(i) Absolute value of t statistics in parentheses.
(ii) *Coefficients are significant at 1 per cent level of significance.
(iii) Export dummy1: A firm exporting or not in current year. It takes value 1 if exporting and 0 otherwise.
(iv) Export dummy2: Dummy variable to indicate a firm exported in prior years, but not in this year. It takes a value of 1, during years when previously exporting firm did not export, and it takes a value of 0 otherwise.

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(v) Export dummy3: Dummy variable to indicate a year prior to exporting. It takes a value of 1 if a firm is exporting in prior year and 0 otherwise.
(vi) Export dummy4: Dummy variable indicating a firm exported current year or in the past. It takes a value of 1 if a firm has exporting experience and 0 otherwise.

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1998). As a result, there is an improvement in productivity after they enter into the foreign markets. The methodology to determine the learning effects is based on a simple idea similar to Blalock and Gertler (2004). We therefore examine whether productivity was higher in the year before firms initiated exporting. The selection hypothesis also argues that firms export only in good years and stop with a decline in productivity.

On the other hand, the productivity gain is expected to be more permanent and persistent if firms actually learned from exporting even after exporting is ceased. In Table 4, column 1 again reports the fixed-effect analysis. Column 3 includes a dummy variable indicating a firm initiated exporting the year before. The coefficient on the indicator is positive and significant, suggesting that there is a productivity rise prior to exporting. Column 2 reports the results for a model in which we include a dummy variable to indicate the years after the firm ceases to export. We assign a value of 1 to the variable during years when a previously exporting firm did not export and 0 otherwise. The selection hypothesis suggests that the coefficient of this variable would be negative, implying that a reduction in productivity coincided with cessation of export. The estimated coefficient is negative and significant, which is consistent with the learning hypothesis. Finally, we have introduced another variation of exports dummy that is exporting current year or in the past. This takes the value 1 if the firm has exporting experiences and 0 otherwise. The result suggests that the benefits of exporting appear to be

TABLE 5
Olley–Pakes Estimation Using Differing Definitions of Exporting Behaviour

Dependent Variable	(1)	(2)	(3)	(4)
Export dummy1	0.096*	0.084*	0.143*	
	(6.223)	(4.970)	(7.570)	
Export dummy2		0.058*		
		(1.990)		
Export dummy3			0.141*	
			(5.190)	
Export dummy4				0.142*
				(7.460)
Log (capital)	0.301*	0.293*	0.293*	0.293*
	(68.640)	(67.570)	(67.540)	(67.580)
Log (labour)	0.492*	0.494*	0.491*	0.491*
	(66.160)	(66.560)	(66.090)	(66.050)
Log (mat-inputs)	0.148*	0.148*	0.149*	0.150*
	(18.470)	(18.510)	(18.580)	(18.750)
Constant	13.521	16.570	11.042	10.710*
	(0.240)	(0.291)	(0.200)	(0.190)
Observations	6,402	6,402	6,402	6,402
R-squared	0.894	0.895	0.883	0.890

Notes:
(i) Absolute value of t statistics in parentheses.
(ii) *Coefficients are significant at 1 per cent level of significance.
(iii) Export dummy1: A firm exporting or not in current year. It takes value 1 if exporting and 0 otherwise.
(iv) Export dummy2: Dummy variable to indicate a firm exported in prior years, but not in this year. It takes a value of 1, during years when previously exporting firm did not export, and it takes a value of 0 otherwise.

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(v) Export dummy3: Dummy variable to indicate a year prior to exporting. It takes a value of 1 if a firm is exporting in prior year and 0 otherwise.
(vi) Export dummy4: Dummy variable indicating a firm exported current year or in the past. It takes a value of 1 if a firm has exporting experience and 0 otherwise.

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TABLE 6
Levinshon–Petrin Estimation Using Differing Definitions of Exporting Behaviour

Dependent Variable	(1)	(2)	(3)	(4)
Export dummy1	0.159*	0.091*	0.159*	
	(8.610)	(5.480)	(8.610)	
Export dummy2		0.053**		
		(1.830)		
Export dummy3			0.168*	
			(6.250)	
Export dummy4				0.160*
				(8.630)
Log (capital)	0.710*	0.710*	0.700*	0.700*
	(1.980)	(2.730)	(2.090)	(5.440)
Log (labour)	0.495*	0.497*	0.494*	0.490*
	(64.590)	(64.940)	(64.550)	(64.670)
Log (mat-inputs)	0.010*	0.010*	0.011*	0.010*
	(98.960)	(90.980)	(89.760)	(65.900)
Constant	94.463	80.653*	94.462*	93.720*
	(0.830)	(0.680)	(0.830)	(0.830)
Observations	6,402	6,402	6,402	6,402
R-squared	0.897	0.896	0.897	0.890

Notes:
(i) Absolute value of t statistics in parentheses.
(ii) *Coefficients are significant at 1 per cent level of significance.
(iii) Export dummy1: A firm exporting or not in current year. It takes value 1 if exporting and 0 otherwise.
(iv) Export dummy2: Dummy variable to indicate a firm exported in prior years, but not in this year. It takes a value of 1, during years when previously exporting firm did not export, and it takes a value of 0 otherwise.
(v) Export dummy3: Dummy variable to indicate a year prior to exporting. It takes a value of 1 if a firm is exporting in prior year and 0 otherwise.
(vi) Export dummy4: Dummy variable indicating a firm exported current year or in the past. It takes a value of 1 if a firm has exporting experience and 0 otherwise.

permanent and persistent even if the firm ceases to export. The above results were also verified by OP and LP estimations in Tables 5 and 6. In column 2, the dummy that captures the cessation of export is negative, indicating declining productivity upon the exit of the export market. This supports self-selection. Column 4 indicates the dummy for entry into the export market any period in the past. This is again positive, indicating learning effects from entry into the export market even if the firm currently exits the export market.

7. CONCLUSION

Over the past years, a growing body of literature based on firm-level analysis has shown that exporting firms are more competitive and more productive than their domestic counterparts. For this reason, governments in many developing countries (including India) have tried to push domestic firms to operate internationally using export promotion policies.

In this paper, we examined the hypothesis of learning from exporting at the firm level, using a sample of Indian manufacturing firms that covers a key period of the economic

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reform. We find strong evidence that Indian manufacturing firms experience a rise in productivity on entering export markets, showing the evidence of learning effect. We also find that

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there is a productivity rise prior to exporting. Our results support the selection mechanism assumed in the recent theoretical models of international trade with heterogeneous firms (Bernard et al., 2003; Melitz and Ottaviano 2008). Our result also suggests that the benefit of exporting appears to be permanent and persistent even if the firm ceases to export.

The above results have some important policy implications. Policies oriented to improve information and access to foreign markets by providing exporting infrastructures could reduce sunk costs of entry. Hence, more and more firms can enter export markets. As seen in Table 1, the number of exporting firms has increased over the years. We may also say that policies directed at increasing productivity or stimulating R&D investments would have a positive impact on the spell length in export markets.

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