Economic Liberalization in India: Productivity and Learning-by-Export

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Abstract

In this paper, we examine whether firms become productive by learning through exporting. To this end, we estimate the production function by using micro data of Indian manufacturing firms operating in the period 1991-2001. In contrast to previous studies which focused more towards developed countries, we find strong evidence that Indian manufacturing firms are experiencing a rise in productivity in entering export markets, and thus the evidence of the learning effect. We also find that there is a productivity rise prior to exporting, which reinforces the evidence of learning effect. Our results also support the self-selection mechanism.

JEL Classification:
Keywords*:* Learning-by-exporting, Productivity gains, Olley-Pakes and Levinshon-Petrin

1. Introduction

Exporting has often been highlighted by economists as a means to achieve higher productivity level. We can also find more interesting and relevant cases of export-led growth from the experience of East Asian economies. These countries by adopting export-oriented strategies provide the case for economic development through export promotion. Lucas (1993) attributes the East Asian miracles to careful adoption of export oriented strategy by these countries. There are several theoretical models indicate that exporting causes improvement in productivity. Krugman (1979); Jovanovic and Lach (1991) are among the most prominent models that support the above hypothesis. They have shown that the exporting firms get opportunity to interact with international clients and competitors abroad and gain knowledge and technology from their buyers. They interact and acquire information from foreign clients on improving product designs, upgrading product quality and on how to decrease production cost (Blalock and Gertler, 2004, Evenson and Westphal, 1995). Some part of the efficiency of export-led development must, therefore, be attributed to externalities derived from exporting (Evenson and Westphal 1995). This is often referred to in the literature as export-by-learning effects.

The most prevailing and often asked question is that whether more efficient or productive firms self select into export markets, and whether exporting serves to ensure ongoing productivity benefits compared with domestically oriented producers that exclusively produce for the local market (Clerides et al. 1998, Bernard and Jensen, 1999, Wagner, 2002). This paper contributes to the existing literature by examining the exporting behaviour of the India manufacturing firms in the context of India's recent

liberalization policy. India had high trade restrictions and in such economies there is huge potential gain from exporting. Exporting offers the potential for increasing efficiency from competition and also increases contact with foreign customers that provide maximum scope for learning opportunities. From a policy perspective, it is important for firms to learn from exporting in terms of increasing its global competitiveness and improving its productivity. India's domestic market for manufacturing though not small, if India have to industrialize and progress technologically, it will have to develop its export markets. At present there is substantial competitiveness gap between domestic and export-oriented industries, and such gap can be reduced endogenously through increased productivity from international trade. There is also possibility of greater scope for the learning-by-exporting effects due to the existence of efficiency gap between a developing economy like India and developed economies like USA and Europe. In this paper we attempt to show that, while self-selection matters, feedback from exporting to productivity is an important factor for efficiency and competitiveness of domestic firms. In other words, whether there is any evidence that the Indian firms learn to become more productive by becoming exporters.

The rest of the paper is organized as follows. Section 2 presents literature review on exporting and firm productivity. Section 3 contains a description of the Indian manufacturing and its export policies. Section 4 discusses the data and hypotheses. Section 5 and 6 presents econometric method and the results respectively. Section 7 concludes with some policy implications.

2. Literature on Exporting and firm productivity

There are two prominent strands of theoretical explanations for the relationship of productivity and exporting at the firm level, each of which emphasizes on direction of causal relationship. On the one hand, there is some 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 of learning-by-exporting.

Seminal work by Bernard and Jensen (1995) is one of the earliest attempts to explain the relationship between exporting and productivity. Their study offers conclusive evidence of self-selection hypothesis for the US manufacturing industries between 1976 and 1987. The phenomenon of self-selection has subsequently been confirmed by Aw and Hwang (1995) for Taiwan; 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. (2005) for UK firms; Damijan et al. (2004) for Slovania and Alvarez and Lopez (2005) for Chilean plants. However, most studies that pay attention to causal links have concluded that correlation between exporting and productivity largely reflects the self-selection of most productive firms into foreign markets. In contrast none, of the above studies have provided conclusive evidence of learning-by-exporting. The fact is that the firm faces difficulties selling in foreign market are due to the existence of sunk costs and fierce competition in these markets. According to this approach, above average performers are likely to be the ones that are able to cope with sunk costs associated to the entry into a foreign market, and thus reap positive net profits. Also, given that competition could be fiercer outside the home market, which only allows the most productive firms to do well

abroad. This explanation is in conformity with the assumption made in theoretical literature of international trade with heterogeneous firms that efficient firms self-select themselves into foreign markets.

An alternative theoretical explanation for the firm level link between exporting and productivity is given by the learning effects associated to exporting, implying that exporting makes firms more productive. The possibility of useful technological and managerial inputs from international contacts is often mentioned in this context, as is the possibility of exploitation of economies of scale by operating in several markets. As far as the technological argument is concerned, one might expect the learning hypothesis to have more explanatory power for countries facing significant technological gaps vis-à-vis the foreign markets, while the economies of scale argument may be of particular relevance for firms from small domestic markets. Although the two explanations are not mutually exclusive in general, the latter one shifts the burden of the arguments onto the causal relationship from exporting to productivity, whereas the former emphasizes 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 of learning- by-exporting from several studies. Greenaway and Kneller (2003), on a large sample of UK manufacturing firms, found the learning effects to be quite significant only in the initial periods after entry. Blalock and Gertler (2004) and Van Biesbroeck (2005) in their studies have found the evidence of export-by-learning for less developed countries like Indonesia and sub-Saharan African countries. Blalock and Gertler (2004) in their study for Indonesia have found that the scope for learning through exporting is more for domestic firms than from multinational

firms. Evidence of learning-by-exporting can also be found in the studies by Baldwin and Gu (2003) for Canada and Isgut (2005) for Colombia. Karry (1999) and Bigsten et al. (2002) find evidence for learning effects for China and several Sub-Saharan African countries respectively. Castellani (2001) finds that Italian firms with exposure to foreign markets experience learning effects but only within a threshold export intensity.

3. Indian Manufacturing and Export Policy

Indian manufacturing sector is an appropriate setting for research on learning-by-exporting for several reasons. First, India being the second largest population in the world, 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 from import substitution policy to export promotion in the early 1980s and subsequently the New Industrial Policy (NIP) of 1991 has been a key element of India’s objective of integrating with the world economy and hence enhancing efficiency and growth rate.

The new Export Import policy announced by government of India ushers in a series of reforms that will undoubtedly provide great impetus to India's export efforts. Exporters, for example, were allowed to import intermediate products and capital goods duty free. They were given generous tax holidays. The exporters were assured decent physical infrastructure, often through the provision of land, power, physical security, and transport to the ports, within specially created industrial parks. India too has experimented with special zones, mainly export processing zones or 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, Hainan) exported $26 billion in 1994, roughly 22 per cent of the national total, India's main export processing zones, or EPZs (Kandla, Santacruz, Noida, Madras, Cochin and Falta), managed a tiny fraction of that, both in absolute levels and as a proportion of total Indian exports.

To summarize, the new export policies in conjunction with the New Industrial Policy (NIP) of 1991, represents a major paradigm shift in Indian's economic liberalization policy. The key elements of NIP are (1) the abolition of licensing of capital goods, (2) reduced list of industries to be reserved for the public sector, (3) increasing foreign equity ownerships in domestic industries, (4) private investment in infrastructure, (5) freer import of capital goods, (6) reduced tariff for consumer goods, (7) deregulation in small scale industrial units, and (8) allowing greater inflow as well as outflow of foreign investments. These elements aim to enhance productivity and efficiency in Indian industries by increasing competition, creating level playing field among public, private and foreign businesses, and generating environment which is conducive for technological growth.

4. Data and Empirical Model

The data used in the study is from several sources including Capitaline, various issues of Annual of Survey of Industries (ASI), various issues of National Accounts Statistics and some publications of Ministry of Industry. Capitaline is a data package which maintains a corporate database of more than 4000 companies classified under 335 Indian industries. The financial and non-financial details of these companies have been compiled quite carefully enabling the users to analyze in detail the financial structure of

any company or industry. The information on some relevant firm characteristics such as size (number of employees), value of inputs, net profits, and sales, value of output, total exports, and imports were obtained from Capitaline data source. The firm level data constitute an unbalanced panel covering period 1991-2001. The sample consists of 583 firms. The data on number of employee is not available in the Captialine source. We matched Capitaline data to ASI in order to construct the data on number of employees. All the variables used for estimation are measured at 1995 prices. The variables used in the present study are as follows.

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

Material inputs: The total raw materials consumed by the firms 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 Annual Survey of Industry (ASI), various issues. 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. The data on total employee cost of the firms is collected from the Capitaline package and the series on number of 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 it 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 unit value of index which can be found from Economic Survey of India.

4.1 Hypotheses

Based on both theoretical and empirical literature, we derive the following hypotheses regarding the 'Learning-by-Exporting' effects in Indian manufacturing industries.

Hypothesis 1: *To test whether productivity gains occur after the firms enter the world market. In other words productivity of the firms does not rise prior to their entry into export markets.*

If hypothesis 1 holds, we would expect that learning-by-exporting effects to take place after the entry of the firms into the export market. India's liberal export-import policies are expected to improve information and access to foreign markets and this would ultimately help reduce the sunk cost of entry. As a result more and more firms would be able to enter the export markets. 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.

Hypothesis 2: *To test if the firms self select, in other words only highly productive firms enter export markets.*

Self selection hypothesis suggests that firms incur sunk cost 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. This is an important hypothesis to test as many studies have shown strong and significant results in favour of this hypothesis. If this hypothesis holds, we expect the firm productivity to be permanent for learning-by-exporting and it will not recede as the firms cease to export. If entry into export markets is characterized by economically significant sunk costs, Indian firms that are productive enough would have the capability of participating in the export markets. It is also possible that the strong positive association between productivity and participation in export markets reflects the self selection of the better firms into to export markets. The procedure to test these hypotheses has been discussed in details in the next section.

5. Estimation strategy

The objective of this paper is to identify and estimate the effect of exporting on productivity. For this purpose the production technology is assumed to be Cobb-Douglas and we specify the production function as

$$y_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 k_{it} + \beta_3 l_{it} + \beta_4 m_{it} + \alpha_i + \omega_{it} + \varepsilon_{it} \qquad (1)$$

where $Export_{it}$ is a dummy indicating whether a 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 the logarithm of capital, output and material inputs for firm i and time t. Again, α_i is a fixed effect for firm i, ω_{it} is an idiosyncratic productivity shock and ε_{it} is i.i.d error term. Here we have labor and material inputs as freely available inputs and

capital is the state variable. The key difference between ω_{it} and ε_{it} is that former is a state variable and hence it impacts the firm's decision rules. Since it is not observed by the econometrician, and it can influence the choices of inputs, which leads to the well known simultaneity problem in production function estimation. Estimators ignoring this correlation between inputs and unobservable factors like the ordinary least squares (OLS) will yield inconsistent results. Again, the managers of the firm can observe ω_{it} and adjust the inputs in response whereas they cannot respond to the latter. A positive coefficient on $\boldsymbol{Export}_{it}$ indicates that export is associated with higher productivity. We have mentioned earlier that the production function cannot be estimated consistently by least squares. It is also due the fact that the 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 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. Firstly, 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 Petrin (2003) approaches which take into account the idiosyncratic productivity shocks, ω_{it}, which is contemporaneous with the export decision. Blalock and Gertler (2004) points out that firm may find a better production process or hire a talented manager which improve productivity and increase the

probability that the firm chooses to export. To control for the problem the above approaches generate proxies for ω_{it}. While Olley and Pakes (1996) use investment as a proxy, Levinshon and Petrin (2003) use material inputs as a proxy. Both the approaches make two important assumptions about the firm's production technology. First, the shock proxy must be monotonically increasing with respect to the true shock. Second, so called freely variable inputs, such as labor and material inputs must respond immediately to a shock, while state variable like capital, must respond only after an adjustment lag. The fact is that because state variables do not respond to contemporaneous noise, the contribution of idiosyncratic shock can be represented as a function of the proxy variable and state variables. In practice, the interpretation is that an increase in investment or intermediate input use, conditional on a given level of capitalization, indicates a positive idiosyncratic shock. Issue of self-selection is also important in this context. It explains the relative timing of the exporting activity and productivity gains. Many authors (Clerides et al. 1998; Bernard and Jensen 1999) have argued for the fact that firms incur fixed cost (sunk cost) to enter in the overseas market. And this happens only after productivity rises sufficiently for exporting profits to justify the expense (Blalock and Gertler, 2004). These authors have found out that exporting is the result of rather than the cause of efficiency. We have also tested self-selection hypothesis by examining the productivity gains in the year prior to the initiation of exporting. We have also examined whether the productivity trend persists even after the firm stops exporting.

6. Results

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

Empirical studies often find that exporting firms are more efficient than their domestic counterparts or non-exporting firms. Very few studies have probed into the question of efficiency gains due to exporting. In this paper we have made an attempt to determine whether there is any evidence that the firms learn to be more efficient by exporting. If exporting generates efficiency gains, then firms that began to export should thereafter exhibit a change in the stochastic process that governs their productivity growth (Clerides et al. 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. Further to this the selection hypothesis argues that firms would export only in relatively good years. It is thus expected that the firms would cease to export with 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 stopped. Table 4 reports the results of these hypotheses. Column 1 again reports the base line fixed effect analysis. Column 2 adds a dummy variable to indicate the year before a firm initiated exporting. The coefficient on the indicator is positive and significant, suggesting that there is a

productivity rise prior to exporting. Column 3 reports the results for a model in which we added a dummy variable to indicate the years after the firm cease 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 indicating 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. The variable takes the value 1 if the firm has exporting experiences and 0 otherwise. The result suggests that the benefit of exporting appear to be permanent and persistent even if the firm ceases to export.

We have also tested for the survival bias hypothesis. It is argued that exporting may be correlated with the firm's exit due to the problem of liquidity and change in ownership (Blalock and Gertler, 2004). We have addressed this problem by estimating a hazard model. A hazard model determines the effect of exporting behaviour on firm's survival in the export market. Our result rules out the possibility of survival bias.

7. Conclusion and policy implications

In this paper, we have examined the hypothesis of learning from exporting at the firm level, using a representative sample of Indian manufacturing firms. We find strong evidence that Indian manufacturing firms are experiencing a rise in productivity on entering export markets, which in other words, can be treated as an evidence of learning effect. We also find that 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 (Melitz 2004, Melitz and Ottaviano 2003, Bernard et al

2002). In these models, intra-sectoral differences in export behaviour are explained by exogenously different productivity levels of firms with high productive firms serving the foreign markets. According to the results of our analysis, this assumption seems appropriate for the Indian manufacturing. Our result also suggests that the benefit of exporting appear 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 the sunk costs of entry. Hence more and more firms can enter the export markets. It is noticed from the Table 1 that number of exporting firms is increasing over the years, in other words the number of non-exporting firms is decreasing 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.

The vast proportion of new technologies in the world inevitably had to be imported. There was no way for any single country, especially a developing country, to rely on its own activities for technological advance. Autarkic strategies inevitably cut the economy off from technological progress in the rest of the world. Second, even a large domestic market is not large enough to spur strong internal competition in the absence of vigorous competition from abroad. Protected home markets turned monopolistic or oligopolistic because the minimum efficient scale of production often represented a large proportion of the home market. Domestic enterprises, unchallenged by foreign competition, turned lazy and relied on state largess rather than their own efforts to survive.

References

Ahluwalia, I. J., 1985. Industrial Growth in India, Oxford University Press, Delhi.

Bhagawati, J. N., (1998). The Design of Indian Development, India's Economic Reforms and Development: Essay for Manmohan Singh, Isher Judge Ahluwalia and I.M.D. Little, (Eds.), Oxford University Press, Delhi, 23-39.

Bhagwati, J. N., and Desai, P., 1970. India, Planning for Industrialization, Industrialization and Trade Policies since 1951. Oxford Univ. Press, London.

Bhagwati, J. N., and Srinivasan T.N., (1975). Foreign Trade Regimes and Economic Development: India, A Special Conference Series on Foreign Trade Regimes and Economic Development, New York: NBER.

Jha, L.K., (1976). Shortages and High Prices- the Way Out. Indian Book Company, New Delhi.

Aw, Bee Yan, Amy R. Hwang, 1995. Productivity and Export Market: A Firm Level Analysis. Journal of Development Economics, xlvii.

Aw, Bee Yan, Chung, Sukkyum, Roberts, Mark J., 2000. Productivity and turnover in the export market: micro level evidence from the Republic of Korea and Taiwan (China). The World Bank Economic Review 14 (1), 65-90.

Bernard, Andrew B., Jensen, J. Bradford, 1999. Exceptional export performance: cause, effect, or both? Journal of International Economics 47 (1), 1-25.

Bernard, Andrew B., Jensen, 2001. Why some firms export. NBER working paper 8349.

Bernard, Andrew B., Jensen, 2001a. Exporting and productivity: The importance of reallocation. Mimeo, Dartmouth College.

Bernard, Andrew B., Wagner, J. 1997. Exports and success in German manufacturing. Weltwirtschaftliches Archiv 133, 134-57.

Bernard, Andrew B., Wagner, J. 2001. Export entry and exit by German firms. Weltwirtschaftliches Archiv 137, 105-23.

Bernard, Andrew B., Eaton, J., Jensen, B. and Kortum, S. 2003. Plants and productivity in international trade. American Economic Review. 93, 1268-90.

Castellani, Davide 2001. Export behaviour and productivity growth: Evidence from Italian manufacturing firms. Mimeo, ISE-Universita di Urbino.

Clerides, Sofronis K., Lauch, Saul, Tybout, James R., 1998. Is learning by exporting important? Micro-dynamic evidence from Columbia Mexico, and Morocco. Quarterly Journal of Economics 113 (3), 903-947.

Delgado, M., Farinas, J. C., and Ruano, S. 2002. Firm productivity and export markets. A Nonparametric approach. Journal of International Economics 57, 397-422.

Grima, S., Greenaway, D. and Kneller, R. 2004. Does exporting lead to better performance? A microeconometric analysis of matched firms. Forthcoming in Review of International Economics.

Haddad, Mona, 1993. How Trade Liberalization Affected Productivity in Morocco. World Bank, Policy Research Working Paper No. 1096.

Handoussa, Heba, Mieko Nishimizu, and John Page, 1986. Productivity Change in Egyptian Public Sector Industries after the opening. Journal of Development Economics, xx, 53-74.

Hallward-Driemeier, M., Iarossi, G. and Sokoloff, K.L. 2002. Exports and manufacturing productivity in East Asia: A comparative analysis with firm level data. NBER working paper 8894.

Levinshon, James, Petrin, Amil, 2003. Estimating production functions using inputs to control for unobservables. Review of economic studies 70 (2) 317-341.

Olley, Steven G., Pakes, Ariel, 1996. The dynamics of productivity in the telecommunications equipment industry. Econometrica 64 (6), 1263-1297.

Roberts, Mark, Theresa Sullivan, and James Tybout, 1995. Micro-Foundations of Export Booms, World Bank mimeo.

Tybout, James, and M. Daniel Westbrook, 1995. Trade Liberalization and Dimensions of Efficiency Change in Mexican Manufacturing Industries, Journal of International Economics, xxxi, 53-78.

Van Biesebroeck, Johannes, 2003. Exporting raises productivity in Sub-Saharan African Manufacturing, Working paper 10020, National Bureau of Economic Research, Cambridge, MA.

World Bank, 1997. World Development Report: The State in a Changing World. Oxford University Press, New York.

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
2000	451	131
2001	462	120

Table 2
Descriptive statistics of key variables

	Obs	Mean	Std. Dev.	Min	Max
Log (output)	6402	19.413	1.508	11.949	24.843
Log (labor)	6402	6.966	1.637	0.445	12.926
Log (capital)	6402	19.57	1.664	11.299	25.868
Log (materials)	6402	19.788	1.664	11.295	26.444
Share.exp.	6402	0.0020	0.0048	6.37e-07	0.0597

Table 3
Estimation of Cobb Douglas production function on a sample of Indian manufacturing firms from 1991 to 2001

Dependent Variable log (output)	OLS	Fixed effect	Olley-Pakes	Levinshon-Petrin
Export dummy1	0.049*	0.045*	0.125*	0.102*
	(3.19)	(2.73)	(7.93)	(6.77)
Log (capital)	0.292*	0.290*	0.112*	0.044*
	(25.53)	(21.49)	(5.71)	(2.45)
Log (labor)	0.422*	0.370*	0.542*	0.507*
	(21.10)	(13.38)	(96.44)	(92.68)
Log (materials)	0.204*	0.226*	0.254*	0.243*
	(10.70)	(9.06)	(8.06)	(7.677)
Constant	6.668*	0.335*	0.856*	1.577*
	(26.93)	(19.78)	(18.76)	(13.87)
Observations	6402	6402	6402	6402
R-squared	0.887	0.882	0.881	0.895
No. of firms	583	583	583	583

1. Absolute value of t statistics in parentheses.
2. Coefficients are significant at 1% level of significance.
3. Export dummy1: A firm exporting or not in current year. It takes value 1=exporting and 0=not exporting

Table 4
Fixed-effect estimation using differing definitions of exporting behaviour

Dependent variable	(1)	(2)	(3)	(4)	(5)
Export Dummy1	0.045*	0.022	0.252*		0.047*
	(2.73)	(1.09)	(11.28)		(3.01)
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*	0.254*
	(21.49)	(21.56)	(19.56)	(20.06)	(18.78)
Log (labor)	0.370*	0.370*	0.382*	0.373*	0.372*
	(13.38)	(13.35)	(13.89)	(13.66)	(13.78)
Log (mat-inputs)	0.226*	0.227*	0.219*	0.217*	0.201*
	(9.06)	(9.07)	(8.97)	(8.90)	(8.23)
Export share					81.199*
					(10.59)
Constant	6.629*	6.633*	7.062*	7.041*	7.654*
	(19.78)	(19.82)	(21.41)	(21.30)	(22.18)
Observations	6402	6402	6402	6402	6402
R-squared	0.882	0.882	0.883	0.883	0.860

1. Absolute value of t statistics in parentheses.
2. Coefficients are significant at 1% level of significance.
3. Export dummy1: A firm exporting or not in current year. It takes value 1if exporting and 0 otherwise.
4. 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.
5. 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.
6. 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.

Appendix

Olley-Pakes estimation

A brief sketch of estimation strategy of Olley and Pakes (1996) estimation is given here. This approach has two key innovations: First, it allows us to control for the simultaneity bias when estimating production functions without having to rely on instruments. This is important as it is often hard or impossible to find good instruments. The second innovation of this approach is that it controls for potential selection bias in estimating production functions. This is especially relevant in the context of transition as selection is likely going to be an intrinsic part of the transition process, where unproductive firms leave the industry and are being replaced by more productive ones. Ignoring this selection mechanism may bias estimates of aggregate TFP. We may note here that the Olley-Pakes procedure rests on the assumption of factors fully adjusting to shocks in each period and markets being perfectly competitive. Levinsohn and Petrin (2003) (henceforth Levinsohn-Petrin) argues that investment as used by Olley-Pakes does not fully control for simultaneity problem and suggested the advantages of using materials inputs to identify the unobservable productivity. They highlight that intermediate inputs respond to the entire productivity term, whereas investment may only partially respond to the "news" in the unobserved term. In addition, they also show a stronger linkage to economic theory and estimation with material inputs as valid proxy as compared to investment. We have extended the Olley and Pakes (1996) framework by allowing market structure (factor markets, demand conditions) to be different for exporting firms by introducing export into the underlying structural model.

$$y_{it} = \beta_0 + \beta_1 Export_{it} + \beta_2 k_{it} + \beta_3 l_{it} + \beta_4 m_{it} + \alpha_i + \omega_{it} + \eta_{it} \qquad (1A)$$

where i and t are subscripts denoting firm and time and va is value added i.e., (output minus material inputs), l is for labour, k is for capital, and respectively. All of the above variables are in logs. Capital is treated as a fixed input while labor and materials are assumed to be freely variable inputs. Additionally, the error term ε_{it} is assumed to be additively separable in two components, a transmitted component, ω_{it}, and an i.i.d component, η_{it}. The key difference between ω_{it} and η_{it} is that the former is a state variable, and hence impacts the firm's decision rules, while latter has no impact on the firm's decision. In other words, η_{it} represents the error term capturing the unpredictable shocks, while ω_{it} represents a productivity shock which is unobserved by the econometrician but known to the firm. Firms adjust their variable inputs based on their anticipation or knowledge of the productivity shock ω_{it} [3].

Since there exists a correlation between the error term ε_{it} i.e., $(\omega_{it} + \eta_{it})$ and explanatory variables, a simple OLS will lead to inconsistent estimate of the regression model. In a perfectly competitive environment where input and output prices are common across firms, the capital investment can be written as just a function of two state variables, k_{it} and ω_{it} or we can express it as

$$\boldsymbol{i_{tt} = i_{tt}(\omega_{tt}, k_{tt})} \qquad \text{(1B)}$$

where $\boldsymbol{i_{it} > 0}$. Olley-Pakes shows that under certain conditions that optimizing firms choosing to invest tend to have investment functions that are strictly increasing in the

[3] The major innovation of Olley-Pakes is to bring a new equation, the invest equation, as a proxy for ω, the unobserved transmitted component of ε. Trying to proxy for the unobserved ω has several advantages over the usual within estimators or the more general Chamberlin and GMM type estimators. It does not assume that ω reduces to a "fixed" (over time) effect and it leaves more identifying variance in x and k. Hence it is a less costly solution to the omitted variable and/or simultaneity problem and it should also be substantively more informative (Griliches and Mairesse, 1998).

unobserved productivity shock. In our model, this assumption might be appropriate as the removal of foreign ownership and imports tariffs by the Indian government is expected to increase the investment in new technologies in capital goods such as plants, equipments and buildings.

By inverting equation (1B), we can express unobserved productivity ω_{it} as a function of observable investment and capital and thus we can control for ω_{it} in estimation. We can express the equation as follows.

$$\omega_{it} = h_{it}(i_{tt}, k_{tt}) \tag{1C}$$

Given this monotonicity condition, we can rewrite equation (1A) as:

$$y_{it} = \beta_0 + \beta_1 Export_{it} + \beta_3 l_{it} + \beta_4 m_{it} + \phi_{it}(i_{it,} k_{it}) + \eta_{it} \tag{1D}$$

where $\phi_{it}(i_{it}, k_{it}) = \beta_0 + \beta_k k_{it} + h_{it}(i_{it}, k_{it})$

Since the error term η_{it} is uncorrelated with the inputs, estimation of equation 1D provides unbiased estimate of β_1, β_l and β_m. We have used a third order polynomial expansion in l_{it} , k_{it} and ϕ_{it}.

Our variable of interest in this paper is the return to exporting. It is estimated in the first of three estimation stages. So we do not implement the second and third stage subsequently.