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Exceptional exporter performance: cause, effect, or both?

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Abstract

A growing body of empirical work has documented the superior performance characteristics of exporting plants and firms relative to non-exporters. Employment, shipments, wages, productivity and capital intensity are all higher at exporters at any given moment. This paper asks whether good firms become exporters or whether exporting improves firm performance. The evidence is quite clear on one point: good firms become exporters, both growth rates and levels of success measures are higher ex-ante for exporters. The benefits of exporting for the firm are less clear. Employment growth and the probability of survival are both higher for exporters; however, productivity and wage growth is not superior, particularly over longer horizons.

Keywords: Trade; Productivity; Plant survival; Export-led growth

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1. Introduction

Exporters are better than non-exporters. A growing body of empirical work has documented the superior characteristics of exporting plants and firms relative to

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those producing solely for the domestic market.[1] Exporters are larger, more productive, more capital-intensive, more technology-intensive, and pay higher wages. While the cross-sectional differences are large, they do not indicate the direction of causality between exporting and excellent performance. Exporters may be exceptional because good firms become exporters, or because exporting is good for firms, or both. Disentangling these effects is crucial for understanding firm level responses to aggregate shocks and for designing appropriate policy.

In this paper, we analyze the interaction between exporting and firm performance. Our analysis is centered on two key questions: do good firms become exporters and do exporters outperform non-exporters? To address these questions, we consider the structure and performance of the firm before, during, and after exporting, taking extreme care to avoid confusing correlated outcomes, e.g. exporters are more productive, with causal relationships, e.g. exporting increases productivity. In order to evaluate the widest range of performance characteristics, we look at measures important to the firm, such as the value of shipments and productivity, as well as those important to the workers, such as employment, wages, and composition of the workforce.

The benefits attributed to exporting are varied.[2] They include gains for workers in the form of higher pay and better future employment prospects as well as advantages for firms such as faster growth of shipments and productivity, diversification of risk, increased innovation, and improved survival chances. In addition, exporting has been promoted for its macroeconomic benefits. In a 1993 report, the World Bank considers export-oriented growth to be the hallmark of a successful development strategy for less industrialized nations in East Asia (World Bank, 1993). More recently, proponents of NAFTA and GATT have argued that reduced trade barriers will promote domestic growth through the rise in exports. In a letter to Congress accompanying the National Export Strategy report (TPCC, 1995), the U.S. Secretary of Commerce argued ''Simply put, U.S. exports equal U.S. jobs.''

Yet how much do we know about the behavior of individual exporters or how much exports contributes to overall economic growth? Previous research provides little evidence on the performance of plants prior to and after they enter export markets.[3] These are important empirical questions, not only for understanding the role of trade in the economy, but also for informing policies that seek to promote growth through exporting. To set appropriate policy goals, we need to understand how plants become exporters. To set reasonable expectations about the effects of export promotion policies, we need to understand what happens to plants after they

[1] See Bernard and Jensen (1995), (1997a), (1997b), (1997c) and Richardson and Rindal (1995) for evidence on U.S. plants and firms, Bernard and Wagner (1997) and Bernard et al. (1997) on German plants, Aw and Hwang (1995) for Taiwanese firms.

[2] See Richardson and Rindal (1995) for a detailed discussion of the potential benefits.

[3] An exception is the contemporaneous study by Clerides et al. (1996) on the performance of exporters in developing countries.

enter the export market. Without empirical evidence of how plants perform prior and subsequent to exporting, we are at risk of selecting inappropriate policies.

As an example, if good firms become exporters but there are no subsequent benefits, then a policy that tries to pick future winners by aiding current exporters will target exactly the wrong firms, as it would be the firms yet to become exporters who are tomorrow's winners. However, if firms increase innovative and productive activity in order to enter foreign markets, i.e., become good to export, then rewarding exporting ex-post may increase such activity at current non-exporters and successfully increase economic growth.

If there are no post-entry rewards from exporting, then policies designed to increase the numbers of exporters may also be wasting resources, as those firms and their workers will not receive any extra benefits. In fact, they may be exposed to considerable downside risk if they are not 'export-ready', their stay in the export market is short, and there are negative consequences of stopping exporting.

On the other hand, if gains do accrue to firms once they become exporters, then the appropriate policy interventions would be those that reduced barriers to entering foreign markets. These might include macroeconomic trade policies designed to increase openness to trade and microeconomic policies to reduce entry costs, such as export assistance, information programs, joint marketing efforts, and trade credits.[4] In this paper, we examine the implicit assumptions about the benefits of exporting that run through all these arguments.

The results from our analysis are quite clear. Good firms do become exporters. Future exporters already have most of the desirable performance characteristics several years before they enter the export market. In addition, firms that become exporters grow faster, in terms of shipments and employment, than future non-exporters in the few years before they start exporting. Considering a model of the decision to export, we find that ex-ante success, i.e., firm size and wages, increases the probability of exporting.

The benefits of exporting to the firm exist but are harder to locate. The major benefit for exporting plants is the increased probability of survival. Among surviving plants, short run performance of today's exporters is relatively good. Exporters will grow faster over the next year than today's non-exporters. On the other hand, their productivity performance will be poorer, or at least no better.

Export status today is a poor predictor of future performance especially over longer intervals. Only employment growth is significantly higher for today's exporters over medium and long horizons. Shipments, productivity, and wages grow more slowly at exporters.

In attempting to understand the performance of today's exporters we find that there is a large amount of entry into and exit from the export market. More than 15% of exporters this year will stop by next year, while 10% of non-exporters will

[4]This is precisely what the recent proliferation of export assistance centers claim as their goal. ''The U.S. Export Assistance Center in Boston opened with the promise of helping New England businesses market their products overseas.'' (Boston Globe 11/27/95).

enter the foreign market. We find further that the critical junctures for the firm are the points at which they begin or cease exporting. Switchers, both in and out, undergo dramatic transformations.

The paper is organized as answers to a series of questions. First, in Section 2, we review the evidence on how much better exporters are at any point in time. We then discuss how exporting might interact with firm structure and performance in Section 3. In Section 4, we take up the issue of ex-ante performance and ask whether good firms become exporters. We evaluate ex-post outcomes over various time horizons in Section 5 and assess any performance improvements from exporting. In addition, we examine whether exporters have a higher probability of surviving. Section 6 concludes.

2. How exceptional are they?

Before we discuss the sources of the differences between exporters and non-exporters, we provide evidence on the magnitude of the performance gap for a variety of plant attributes. Some of these differences have been discussed elsewhere for exporting plants. Here we present new results on the differences at both plants and firms over a number of years.

The data for this paper come from the Longitudinal Research Database (LRD) of the Bureau of the Census. Since we are interested in behavior before and after exporting, we choose our sample to contain the longest period of continuous coverage on exports, 1984–1992, and include all plants in both the Census of Manufactures (CM) for 1987 and 1992 and the Annual Survey of Manufactures (ASM) for inter-census years. For comparisons involving more than one year we are limited to plants included in the ASMs.[5] This results in an unbalanced panel with 50 000–60 000 plants in each year.

We report the differences between exporters and non-exporters in Table 1 for three groups (all plants, small plants, and all firms)[6,7] for three years (1984, 1987 and 1992). Columns (a)–(c) report the export premia estimated from a regression of the form

[5]The design of the ASM imposes some structure on our analysis. Some plants are included with certainty in each ASM 5 year wave. These 'certainty' cases include all plants with more than 250 employees. Other, generally smaller plants, are included with some probability (<1) in each wave. However, if a non-certainty plant is included in one 5 year wave it will not be included in the next. See Census (1987) for more information. To avoid considering only large plants, we perform most of our year-to-year analyses within ASM waves, i.e., for 1984–1988 and 1989–1992. This happens to nicely coincide with two distinct episodes of aggregate export behavior, slow growth until 1987 and very rapid growth thereafter.

[6]We construct firms as the agglomeration of all manufacturing plants with the same corporate ownership.

[7]For more detailed comparisons of exporting and non-exporting plants up through 1987, see Bernard and Jensen (1995).

Table 1
Exporter premia

1984[a]	(a) All plants (%)	(b) Small plants (%)	(c) All firms (%)	(d) All plants (%)	(e) Small plants (%)	(f) All firms (%)
Total employment	77.6	50.7	102.3	–	–	–
Shipments	104.3	74.8	123.9	21.7	20.6	21.4
Value-added per worker	23.8	21.5	21.9	22.3	21.7	22.6
TFP	18.1	15.8	5.5	16.8	16.1	12.4
Non-production/total workers	5.1	5.2	4.6	4.7	4.9	5.3
Average wage	17.9	15.9	17.7	14.8	14.5	17.3
Production wage	18.8	16.2	19.0	16.0	15.3	18.3
Non-production wage	8.8	7.6	8.1	3.6	3.7	6.1
Capital per worker	19.0	11.8	21.8	17.5	13.5	19.2
Number of plants/firms	56 257	43 102	28 952	56 257	43 102	28 952
1987						
Total employment	95.2	64.7	100.4	–	–	–
Shipments	113.9	80.3	115.2	15.7	14.6	12.5
Value-added per worker	16.1	13.0	11.8	16.2	14.7	12.8
TFP	12.2	10.8	3.5	12.5	11.8	7.1
Non-production/total workers	3.0	3.3	3.3	3.2	3.4	3.5
Average wage	11.2	8.9	9.2	9.3	8.5	9.0
Production wage	9.2	6.2	6.2	7.2	6.0	6.3
Non-production wage	9.9	8.4	9.6	5.2	5.2	5.5
Capital per worker	12.8	6.8	6.7	10.1	7.2	4.9
Number of Plants/Firms	199 258	186 441	150 568	199 258	186 441	150 568
1992						
Total employment	88.1	66.3	92.5	–	–	–
Shipments	112.6	88.4	115.0	18.8	18.3	17.3
Value-added per worker	18.9	16.4	16.7	18.0	17.3	16.9
TFP	13.0	12.0	8.6	13.5	13.3	12.4
Non-production/total workers	3.3	3.8	3.6	3.5	3.8	3.6
Average wage	11.9	10.7	11.0	9.3	9.3	9.6
Production wage	9.0	7.2	7.0	6.6	6.2	16.9
Non-production wage	11.4	10.5	12.4	4.6	5.1	5.8
Capital per worker	20.2	14.4	13.5	13.6	11.9	8.8
Number of Plants/Firms	224 009	211 555	175 400	224 009	211 555	175 400

[a] For 1984, ASM plants are weighted by the inverse of their sampling probabilities. The resulting premia are comparable to those from the Census years.

Numbers in columns (a)–(c) are coefficients on an export dummy in a regression of the form:

$$\ln X(i) = a + b^{*}\text{EXPORT}(i) + c^{*}\text{INDUSTRY} + d^{*}\text{STATE} + e(i)$$

and the numbers in columns (d)–(f) are coefficients on an export dummy in a regression of the form:

$$\ln X(i) = a + b^{*}\text{EXPORT}(i) + c^{*}\text{INDUSTRY} + d^{*}\text{STATE} + f^{*}\,\text{Log(EMPLOYMENT)} + e(i)$$

where i indicates the plant/firm, EXPORT(i)=1 if the plant/firm is an exporter, INDUSTRY is a vector of four digit (SIC) industry dummies, STATE is a vector of U.S. state dummies, and EMPLOYMENT is the number of employees at the firm/plant. All firm regressions exclude state and industry dummies. Small plants have fewer than 250 employees. All differences are significant at the 1% level.

$$\ln X_i = \alpha + \beta \text{Export}_i + \gamma \text{Industry}_i + \theta \text{State}_i + \varepsilon_i \quad (1)$$

where Export_i is a dummy for current export status, and Industry_i and State_i are dummies for four digit (SIC) industry and state respectively. The export premium, β, shows the average percentage difference between exporters and non-exporters in the same state and industry. Columns (d)–(f) report export premia after adding an additional control for size, measured by total employment at the plant or firm.

The export premia are positive and significant for every characteristic for every group in all years. By far the largest differences are found in the size of exporters. For all plants and firms, total employment and total shipments are twice as large at exporters. Even within the sample of small plants, exporters are 50%–66% larger than non-exporters[8]

Export premia for other characteristics are significant and stable across groups and years. We find that labor productivity is 12%–24% higher at exporters while the difference in capital intensity ranges from 7%–22%. Capital intensity does not explain all of the labor productivity differentials as a measure of relative TFP levels yields premia of 4%–18% for exporters.[9] The composition of the workforce differs across the two types of plants, exporters have a 3% larger share of non-production workers in total employment and pay higher wages to both production and non-production workers. Interestingly, the export premia are relatively unchanged when we group plants into firms. Size premia are higher and TFP premia are lower for exporting firms.[10]

Comparing the two census years, 1987 and 1992, we see little change in the export premia. The difference in size, average wages and composition of the workforce are essentially unchanged. The productivity differentials, capital intensity, and the white collar wage premium actually rose during the export boom.

The results presented here, in conjunction with a growing number of other studies on exporting, confirm that there are substantial differences between exporters and non-exporters. All measures of performance, productivity, size and wages, are greater at exporting plants and firms. The remainder of the paper examines the sources of these large differentials.

[8]Many of the differentials are substantially larger than reported in the table as the log approximation does poorly when the differences are large.

[9]To calculate TFP, we first estimate the coefficients of a Cobb–Douglas specification of value added on capital and labor separately for each four digit SIC industry for each year. We then calculate the plant level residual using these four digit level SIC coefficients. The residual is our plant level measure of TFP.

[10]We acknowledge that there are important reasons for conducting analyses at the level of the firm rather than the plant. However, these results provide some encouraging news for research on exports conducted with plant-level data.

3. Why might exporting matter?

The previous section documented that exporters have relatively desirable performance characteristics. However, the exact relationship between exporting and good firm outcomes is not revealed by the cross-section analysis. In this section, we present several different, but not necessarily mutually exclusive, discussions of how exporting and success might be related at the firm.[11]

3.1. Success begets exporting

For most academic economists, the statement that ''good firms become exporters'' is almost a waste of breath, producing knowing nods of agreement. The reasoning behind the statement and the sentiment is that there exist additional costs of selling goods in foreign markets. These might include transport costs, expenses related to establishing a distribution channel, or production costs to modify domestic models for foreign tastes. Although many of these extra costs have declined over time, and particularly rapidly in recent years, they still exist to a greater or lesser extent and provide an entry barrier that less successful firms cannot overcome. The end result is that in a sample of non-exporting firms within the same industry, the larger, more productive firms should be more likely to become exporters.

3.2. Exporting begets success (or failure)

Perhaps the most frequently heard explanation of exporting and firm success, particularly among business leaders, is that exporting itself is good for the firm. The act of selling in a foreign market makes or breaks a firm. The underlying premise of this perspective is that competition is fiercer in international markets than domestic ones, and once they begin to sell abroad, firms must improve their performance to remain exporters. What is usually not spelled out in this story is why profit-maximizing firms would not already choose to improve their productivity. Potential explanations are beyond the scope of this paper but might include issues of technological or knowledge spillovers and learning. This perspective is captured at some length in the McKinsey report (1993).[12] The empirical predictions of this view focus on post-entry performance. Firms that enter and stay in the export market should outperform their purely domestic counterparts in terms of sales, employment and especially productivity. An

[11]For reasons that will become obvious, we forgo formal models and, instead, take special care to identify the testable implications of the competing explanations.

[12]The McKinsey view considers not just export markets but domestic markets contested by foreign producers.

additional implication is that exiting the export market will signal failure and be associated with negative outcomes for all measures.

There exists another variation of the 'exporting leads to success' story, one based on products. Suppose that, within an industry, there are a number of equally productive firms producing goods differentiated by some set of attributes. Given sufficient foreign demand for its product, any firm could overcome the costs of selling abroad. However, suppose also that only one collection of attributes is demanded by foreign consumers and thus only one firm begins to sell abroad. From this vantage point, we should expect to see relative increases in output and employment at exporting firms, but not necessarily increases in productivity.

3.3. Succeeding to export

The discussion thus far has concentrated on the causal relationship between firm exporting and firm success. There is yet another version of the argument that exporting causes better firm performance. In this scenario, the focus is on the forward looking nature of firms. Some firms realize that a potential avenue of continued growth for their products is through foreign sales. However, to begin exporting these same firms must first improve their performance to cover the additional costs and increased competition. Again, this story is nominally at odds with the behavior of a profit-maximizing firm which would be expected to improve performance with or without the incentive of exporting. This line of reasoning implies that there may not be large initial differences between firms, i.e., before they consider exporting, but that after the decision is reached to try to enter the foreign market, the firms undergo substantial performance improvements. The empirical implications of this story are difficult to extract. There is no implication that after beginning to export that exporters will outperform non-exporters, largely because their improvements will occur before exporting begins. Similarly, several years before exporting there may be no differences between future exporters and future non-exporters. During the time leading up to the first foreign sale, however, future exporters should be improving their performance relative to firms that will not export. We will provide evidence on the relative growth in the years before exporting, but warn that this cannot be interpreted as causality from exporting to success.

4. Do good firms become exporters?

In asking whether good firms become exporters the answer is almost less important than the question. It would be a major surprise if we discovered that, before selling abroad, exporters had similar performance characteristics to non-

exporters.[13] However, in light of the increasing share of exports in total manufacturing and the growth of government policies to promote exports, we ask and answer the question to emphasize the importance of separating correlation and causality in this area. We provide evidence on ex-ante characteristics as well as a formal analysis of the decision to export.

4.1. Performance before entry

We start by comparing ex-ante plant characteristics and growth rates for exporters and non-exporters. In light of the dramatic surge in exporting in the late 1980s and early 1990s we divide our sample into two sub-periods, 1984–1988 and 1989–1992.[14] We select all plants that did not export in any of the first years and compare initial levels and growth rates of our measures of plant success for exporters and non-exporters in the final year.

In Table 2, we present results on the differences in initial levels between future exporters and non-exporters.[15] The differences are substantial. Firms that become exporters are 20%–45% larger in terms of employment, 27%–54% larger in terms of shipments, have higher labor productivity (7%–8%), and pay higher wages (2%–4%). The point estimates for TFP levels are positive but not significant. In other words, most of the desirable attributes found in exporters relative to non-exporters are also found in those plants 2–3 years before they begin exporting.

While future exporters already have the desirable characteristics, we also want to learn how they perform in the run up to entering the foreign market. We

[13] Although unlikely, it is not impossible. If there were no additional costs to selling in the foreign market then exports at the industry and firm level could be determined by unsystematic variation in product attributes and comparative advantage. Exporters and non-exporters would make different goods but could have similar productivity, size and wage levels and growth rates. For evidence on sunk costs associating with exporting at the plant level, see Bernard and Jensen (1997b).

[14] These subperiods are chosen to match waves of plants in the ASM. We use two waves that run from 1984–1988 and 1989–1992. A detailed analysis of the export boom in the U.S. is given in Bernard and Jensen (1997c).

[15] In other words, we form a subsample by selecting only those plants that did not export in 1984–1987 (1989–1991) inclusive. We categorize as exporters, those plants in the subsample who exported in the final year, 1988 (or 1992). We consider systematic differences in the pre-export levels of plant characteristics by running

$$\ln X_{i0} = \alpha + \beta \text{EXPORT}_{iT} + \gamma \ln \text{Size}_{i0} + \delta D_i + \varepsilon_i.$$

where X_{it} is the plant characteristic in year t, EXPORT_{iT} is an export dummy for the last year of the period, Size_{i0} is employment in the first year of the period and D_i is a vector of state and four digit industry dummies. The coefficient on the export dummy in the last year, β, measures the premium for future exporters T years before beginning to export. It must be emphasized that this is not a test for a causal relationship.

Table 2
Ex-ante advantage in levels for future exporters 1984–1988, 1989–1992

	1984 Premia		1989 Premia	
	(a)	(b)	(c)	(d)
Total employment	20.74%		45.06%	
	(5.01)		(10.78)	
Shipments	27.21%	8.59%	54.59%	9.41%
	(5.94)	(3.20)	(11.51)	(4.21)
Value-added per worker	7.16%	8.42%	8.66%	8.72%
	(2.32)	(2.73)	(3.55)	(3.55)
TFP	6.01%	6.42%		
	(1.44)	(1.53)		
Average wage	3.36%	2.92%	4.41%	2.60%
	(2.68)	(2.33)	(4.10)	(2.44)
Non-production/total employment	0.67%	0.38%	0.73%	0.47%
	(1.04)	(0.60)	(1.34)	(0.86)
Production worker wage	2.49%	1.86%	2.79%	0.73%
	(1.75)	(1.31)	(2.43)	(0.64)
Non-production worker wage	2.32%	1.87%	5.07%	2.69%
	(1.08)	(0.87)	(3.36)	(1.79)

Plants are included if they did not export in any of the initial years (1984–1987, 1989–1991). Plants may or may not have exported in the final year. The numbers represent the premia for future exporters (1988, 1992) in the initial year, controlling for four digit (SIC) industry and state. Numbers in parentheses are *t*-statistics. Columns (b) and (d) also control for plant size.

document the annual growth rate premia of future exporters in Table 3.[16] From 1984–1987, measures of plant size, shipments and total employment, are growing significantly faster at firms that become exporters in 1988. The magnitude of the growth rate premia are substantial, 1.4% per year for employment and 2.4% per year for shipments. In the later period, both are again positive but only shipments is significantly different. Productivity growth rates are comparably higher but generally not statistically significant. Average wage growth for all types of workers is slightly higher at future exporters but not significant.

These results, while not determining the causal relationship from success to exporting, provide important evidence confirming that future exporters already

[16]To evaluate the changes in plant performance leading up to exporting, we run a regression of the following form

$$\%\Delta X_{T-1} = \frac{\ln X_{iT-1} - \ln X_{i0}}{T-1} = \alpha + \beta \text{EXPORT}_{iT} + \gamma \ln \text{Size}_{i0} + \delta D_i + \varepsilon_i.$$

The coefficient on the export dummy in the last year, β, measures how much faster future exporters were growing per year over the preceding $T-1$ years, controlling for initial size, state and industry. Again, it must be emphasized that this is not a test for a causal relationship.

Table 3
Ex-ante advantage in growth rates for future exporters 1984–1988, 1989–1992

	1984–1987 Growth rates	1984–1987 Growth rates	1989–1991 Growth rates	1989–1991 Growth rates
Total employment	1.40%	2.14%	0.04%	3.06%
	(2.32)	(3.64)	(0.05)	(3.80)
Shipments	2.39%	2.68%	2.93%	5.27%
	(3.08)	(3.48)	(3.00)	(5.50)
Value-added per worker	1.80%	1.52%	2.40%	1.68%
	(1.57)	(1.32)	(2.03)	(1.42)
TFP	2.12%	2.18%		
	(1.40)	(1.44)		
Average wage	0.17%	0.00%	0.89	0.38
	(0.49)	(0.02)	(1.92)	(0.82)
Non-production/total employment	−0.30%	−0.27%	0.30%	0.19%
	(1.74)	(1.63)	(1.29)	(0.82)
Production worker wage	0.35%	0.25%	0.59%	0.23%
	(0.85)	(0.49)	(1.11)	(0.43)
Non-production worker wage	0.92%	0.86%	1.06%	0.65%
	(1.25)	(1.17)	(1.36)	(0.84)

Plants are included if they did not export in any of the initial years (1984–1987, 1989–1991). Plants may or may not have exported in the final year. The numbers represent the extra annual growth rates in plant characteristics for future exporters (1988, 1992) over future non-exporters, controlling for four digit (SIC) industry and state. Numbers in parentheses are *t*-statistics. Columns (b) and (d) also control for plant size.

have many of the desirable performance characteristics found in the cross-section comparisons. In addition, growth of employment, and shipments is higher at these plants in the years just before they enter the export market. To test the causal relationship we next estimate a model of the decision to export.

4.2. The decision to export

Several recent papers have explored factors that influence the decision to export by the firm.[17] Here we briefly summarize the dynamic model and empirical framework used in those papers and provide estimates for plants in our sample.

A firm exports, $Y_{it}=1$, if current and expected revenues are greater than costs,

$$Y_{it}=\begin{cases}1 & \text{if } \hat{R}_{it} > c_{it} + N\cdot(1-Y_{it-1}) \\ 0 & \text{otherwise}\end{cases} \tag{2}$$

where c_{it} is the variable cost of production today, N is a sunk cost that the firm

[17] See Bernard and Jensen (1997b) and Roberts and Tybout (1997).

must pay if it did not export last period, $Y_{it-1}=0$, and $\hat{R}_{it}$ is revenues of export sales today and any discounted increase in the value of the firm in the future from exporting today,

$$\hat{R}_{it} \equiv p_t q_{it}^{*} + \delta(E_t[V_{it+1}(\cdot)|Y_{it}=1] - E_t[V_{it+1}(\cdot)|Y_{it}=0]) \tag{3}$$

We estimate this model using a binary choice non-structural approach of the form

$$Y_{it} = \begin{cases} 1 & \text{if } \beta X_{it} - N\cdot(1-Y_{it-1}) + \varepsilon_{it} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

Plant characteristics, such as size and productivity, are included in the vector X_{it}, as are other exogenous factors that might affect the probability of exporting.[18]

To facilitate computation and avoid problems with unobserved plant heterogeneity, we employ a linear probability specification with fixed effects.

$$Y_{it} = \alpha_i + \beta X_{it-1} + NY_{it-1} + \kappa_i + \eta_{it} \tag{5}$$

All regressors are lagged one year to reduce possible simultaneity problems.[19] Since the specification with fixed effects and a lagged endogenous variable is likely biased and inconsistent, we estimate the linear probability models in first differences, using as instruments, X_{it-2}, X_{it-3}, Y_{it-2}, and Y_{it-3},

$$\Delta Y_{it} = \beta \Delta X_{it-1} + N\Delta Y_{it-1} + \Delta\eta_{it} \tag{6}$$

Table 4 contains the estimates for the entire period 1987–1992. The results confirm the hypothesis that prior success, as measured by total employment, productivity, and the level of wages, increases the probability that a firm will export. A 10% increase in employment increases the probability of exporting by 1%. In addition, the product change dummies for recent years are positive and significant lending support to the theory that product attributes contribute to the decision to export.[20]

The picture painted by the preceding results is quite vivid. Plants that become

[18] X_{it} includes total employment, productivity, average plant wages, the ratio of non-production to total employment, and dummies for recent product changes by the plant.

[19] This specification is not without problems. It is well known that parameter estimates in dynamic systems with fixed effects are downward biased, see Nickell (1981). Alternative estimation strategies for a binary choice model with substantial unobserved hetereogeneity and a lagged dependent variable include probit with random effects (Roberts and Tybout, 1997) and conditional logit and an instrumental variables estimator of the first differences of the linear probability model. Given the large number of plants in our sample and the large variation in unobserved plant effects, even controlling for industry and location, estimating a linear probability model provides substantial computation advantages. In addition, estimates of the coefficients on plant characteristics with the alternative frameworks are qualitatively similar. See Bernard and Jensen (1997b) for a more detailed discussion of the relative merits and disadvantages of these empirical methodologies.

[20] This specification allows us to control for unobserved persistent plant heterogeneity. In a simple framework assuming homogeneity, labor productivity does not significantly Granger-cause exporting.

Table 4
The decision to export[a]

	First differences
Plant-level Variables[b]	
Total employment	0.104[d]
	(0.046)
Wage	0.029[d]
	(0.026)
Non-production/total Employment	−0.024
	(0.037)
Productivity	0.012[e]
	(0.007)
Changed product since last year	0.048[c]
	(0.009)
Last changed product two years ago	0.014[d]
	(0.007)
Exported last year	0.420[c]
	(0.012)
Last exported two years ago	0.093[c]
	(0.005)
Year dummies	
Industry dummies	
State dummies	
N	81 636

[a] The results are for all plants from 1984–1992.
[b] All plant characteristics are lagged one year.
[c] Significant at the 1% level.
[d] Significant at the 5% level.
[e] Significant at the 10% level.

exporters are successful before they start exporting. Several years prior to entry, exporters are larger, more productive and pay higher wages. Compounding their advantages, they also grow faster in the years leading up to exporting. These results confirm that success leads to exporting.

5. Does exporting improve performance?

The results from the previous sections leave little doubt that good firms become exporters and that at any point in time exporters have preferable performance characteristics. However, arguably the most interesting direction of causality runs from exporting to firm performance. In this section, we provide evidence on the relationship between export status of the firm today and subsequent performance. We start by examining exporter and non-exporter growth rates over short, medium and longer intervals for measures of employment, wages, and productivity. Next,

we consider whether the performance outcomes are driven by the extent of entry into, and exit from, the export market. We then document the changes at the plant upon beginning and ending exporting and ask whether plants that export continuously outperform those that move in and out of foreign markets. Finally, we consider whether exporting is positively related to plant survival.

5.1. Ex-ante exporter performance – various horizons

Perhaps the cleanest test of the effects of exporting on plant outcomes can be found by running a regression of the change in a performance measure, X_{it}, on initial export status and controls for initial employment levels and other initial plant characteristics,

$$\%\Delta X_{iT} = \frac{1}{T}(\ln X_{iT} - \ln X_{i0}) = \alpha + \beta \text{Export}_{i0} + \gamma \text{Size}_{i0} + \delta \text{Char.}s_{i0} + \varepsilon_{iT} \quad (7)$$

Additional plant characteristics for the initial year include average wage, the ratio of non-production to total employment, as well as state and four digit industry dummies. The coefficient, β, gives the increase in the average annual growth rate of the performance measure of exporters relative to non-exporters in the same state and industry for an interval of length T. Table 5 presents results for annual changes in performance while Table 6 shows outcomes for intermediate and longer intervals. All results are given for specifications with and without the additional plant controls. Over annual horizons, exporters show significantly faster grow than non-exporters in shipments and, particularly, in employment. On the other hand, productivity grows no faster, or more slowly, at exporters. The results for labor productivity growth are mixed, significantly slower for exporters in the early period and faster, but not significant, in the later period. Wages show mixed results, without controlling for plant characteristics, we find that exporters have lower wage growth for all types of workers. With the additional controls, annual increases are higher for initial exporters, especially during the boom. Interestingly, the faster overall wage growth is due to increasing white collar employment shares and faster blue collar wage growth.[21] Over longer intervals, the advantages from initial exporting are more limited. Considering growth from 1984–1988, 1989–1992, and 1984–1992 in Table 6, we still see significantly higher growth rates of employment for initial exporters, although the annual increase is smaller, 0.4%–1.1% per year. The extra growth in shipments is no longer apparent, estimates with plant controls range from −0.01% to 0.3% but none are significantly different

[21] Results from Granger-causality tests confirm annual regressions presented above. Exporting does not Granger-cause productivity but does Granger-cause employment, shipments and wages. Results are available from the authors.

Table 5
Short run performance of exporters versus non-exporters (Annual Growth Rates)

	1984–92		1984–88		1989–92	
	without controls	with controls	without controls	with controls	without controls	with controls
Total employment	0.41%	2.33%	1.20%	2.07%	−0.91	2.52%
	(2.88)	(15.76)	(6.44)	(10.92)	(3.77)	(10.04)
Shipments	0.13%	1.49%	0.20%	0.98%	−0.54%	1.79%
	(0.75)	(8.04)	(1.20)	(4.02)	(1.86)	(5.81)
Value-added per worker	0.24%	−0.28%	−1.10%	−0.80%	0.74%	0.37%
	(1.00)	(1.15)	(3.51)	(2.30)	(2.03)	(0.95)
TFP			−2.35%	−0.97%		
			(4.97)	(1.95)		
Average wage	−0.47%	0.56%	−1.10%	0.11%	0.19%	0.79%
	(5.20)	(6.36)	(8.91)	(0.98)	(1.31)	(5.44)
Non-production/total employment	−0.19%	0.25%	−0.30%	0.21%	−0.03%	0.34%
	(4.22)	(5.47)	(5.92)	(3.42)	(0.45)	(4.61)
Production worker wage	−0.36%	0.73%	−1.20%	0.13%	0.55%	1.22%
	(3.48)	(6.93)	(8.21)	(0.91)	(3.40)	(7.37)
Non-production worker wage	−0.31%	0.08%	−0.20%	0.26%	−0.40%	−0.51%
	(1.99)	(0.55)	(1.19)	(1.16)	(1.67)	(2.06)

The numbers represent the extra annual growth rates in plant characteristics for exporters in the first year, controlling for four digit (SIC) industry and state. Specification with controls also includes employment, average wage, non-production/total employment in the initial year. Numbers in parentheses are *t*-statistics.

Table 6
Performance of exporters versus non-exporters over medium and long horizons (Average Annual Growth Rates)

	Medium run				Long run	
	1984–88		1989–92		1984–92	
	without controls	with controls	without controls	with controls	without controls	with controls
Total employment	0.18%	1.07%	−1.33%	1.04%	−0.36%	0.40%
	(1.19)	(6.95)	(6.47)	(4.90)	(2.95)	(3.31)
Shipments	−1.01%	−0.01%	−1.46%	0.34%	−0.96%	0.22%
	(5.54)	(0.06)	(5.68)	(1.26)	(6.61)	(1.50)
Value−added per worker	−1.00%	−0.81%	0.21%	−0.13%	−0.84%	−0.50%
	(4.69)	(3.65)	(0.76)	(0.47)	(3.72)	(3.13)
TFP	−1.92%	−1.09%			−0.84%	−0.50%
	(6.01)	(3.25)			(3.72)	(2.15)
Average wage	−1.46%	−0.41%	−0.07%	0.33%	−0.59%	−0.04%
	(16.62)	(5.15)	(0.66)	(3.36)	(10.84)	(0.87)
Non-production/total employment	−0.44%	−0.05%	−0.04%	0.11%	−0.16%	0.02%
	(9.80)	(1.36)	(0.71)	(1.94)	(5.41)	(0.70)
Production worker wage	−1.94%	−0.78%	0.13%	0.47%	−0.72%	−0.19%
	(18.38)	(7.74)	(1.08)	(3.82)	(11.03)	(2.99)
Non-production worker wage	−0.13%	0.31%	−0.59%	−0.31%	0.16%	0.16%
	(0.84)	(2.01)	(3.03)	(1.60)	(1.58)	(1.60)

The numbers represent the extra annual growth rates in plant characteristics over rest of the period for exporters in the first year, controlling for four digit (SIC) industry and state. Specification with controls also includes employment, average wage, non-production/total employment in the initial year. Numbers in parentheses are *t*-statistics.

from zero even during the export boom from 1989–1992. Productivity growth is lower for initial exporters, but the point estimates are significant for the first panel and the long run.

These direct tests of the benefits of exporting provide evidence that at one year horizons exporters see significant performance improvements. However, even though shipments and employment are both higher, productivity growth is usually no higher for exporters. Over longer intervals, the benefits of exporting are hard to locate, and are limited to employment increases. Shipments show no performance improvements while productivity and wage growth is actually lower for initial exporters.

On balance, these results do not suggest that at the firm level exporting leads to faster productivity growth. The news for workers and the overall economy is mixed. Workers benefit because employment growth is higher over all intervals but wages actually grow more slowly. To understand the source of the mixed performance results, we look more closely at the patterns of export behavior by plants in the sample and then consider changes as plants enter and exit the export market.

5.2. Evidence on switching

One apparent puzzle from the prior results is that the benefits of exporting accrue only over very short intervals. To understand more about the nature of the export market, we examine the transitions in and out of exporting for our samples of plants.

Table 7 gives the fractions of plants that switch status in each year. The degree of switching is substantial with 10% of non-exporters entering the foreign market and 17% of exporters leaving on average in each year. The boom in U.S. exports is also evident as exits drop sharply in the later years while entry rates increase.[22] In addition to high annual entry and exit rates, we find that a large fraction of plants participate in the export market at least once over the period.

The data on transitions at least partly explain the results from the previous section. The large number of plants moving in and out of exporting mean that initial export status is poorly correlated with subsequent exporting, especially at longer horizons. The coefficient on initial export status in the growth rate regressions confounds the effect for plants that stop exporting and those that continue to export. Conversely, the pool of initial non-exporters contains a sizable percentage of plants that begin exporting by the end of the interval.

[22]Bernard and Jensen (1997b) discuss transitions in more detail for a sample of larger, continuously operating plants.

Table 7
Switching in and out of exporting

	1984–85	1985–86	1986–87	1987–88	1988–89	1989–90	1990–91	1991–92
% of all plants that stop exporting	8.5	5.4	7.1	5.9	6.7	4.8	4.7	5.3
% of all plants that start exporting	4.6	5.9	6.7	7.0	6.6	7.1	5.9	7.7
Total switchers	13.1	11.3	13.8	12.9	13.3	11.9	10.6	13.0

5.3. The big changes – entry and exit

To better understand the transformations that occur at plants when they start and stop exporting, and to better identify any potential benefits from exporting, we estimate growth rate regressions of the following form

$$\%\Delta X_{iT} = \alpha + \beta_1 \text{Start}_{iT} + \beta_2 \text{Both}_{iT} + \beta_3 \text{Stop}_{iT} + \gamma \text{Size}_{i0} + \delta \text{Char}_{i0} + \varepsilon_{iT} \tag{8}$$

where

$$\text{Start}_{iT} = 1 \text{ if } (\text{Export}_{i0} = 0)^*(\text{Export}_{iT} = 1)$$

$$\text{Both}_{iT} = 1 \text{ if } (\text{Export}_{i0} = 1)^*(\text{Export}_{iT} = 1)$$

$$\text{Stop}_{iT} = 1 \text{ if } (\text{Export}_{i0} = 1)^*(\text{Export}_{iT} = 0)$$

The coefficients, β_1, β_2, and β_3, give the differential in growth rates for entrants, exporters in both years, and exits relative to non-exporters in both years.[23]

Annual results for are presented in Table 8. The conclusions are clear.

Table 8
Short run changes at starters stoppers, both, neither (Average Annual Growth Rates)

	Annual		
	Stop	Both	Start
Total employment	−1.03%	4.68%	5.64%
	(4.11)	(27.99)	(23.39)
Shipments	−3.25%	4.96%	9.11%
	(10.10)	(23.90)	(29.70)
Value-added per worker	−1.53%	0.79%	3.14%
	(3.56)	(2.89)	(7.67)
TFP	−2.18%	0.05%	2.78%
	(2.63)	(0.09)	(3.26)
Average wage	−0.30%	1.27%	2.07%
	(2.00)	(12.62)	(14.28)
Non-production/total employment	0.29%	0.37%	0.60%
	(3.79)	(7.34)	(8.06)
Production worker wage	0.07%	1.07%	0.72%
	(0.40)	(8.96)	(4.19)
Non-production worker wage	−0.75%	0.96%	2.85%
	(2.78)	(5.38)	(11.03)

The numbers represent the extra annual growth rates in plant characteristics over rest of the period for exporters in the first year, controlling for four digit (SIC) industry and state. Specification with controls also includes employment, average wage, non-production/total employment in the initial year. Numbers in parentheses are *t*-statistics.

[23] It should be noted that $\text{Both}_{i,T} = 1$ if the plant exports in the first and last years of the interval. If the interval is longer than 2 years, the plant may or may not export in every year.

Movements in and out of exporting are times of substantial change for the plant. Exiting the export market is associated with bad outcomes for plants, all performance measures show significantly slower growth rates than continuing non-exporters.[24] The year of entry into the export market is a time of substantial improvement in firm performance. Compared to non-exporters, employment grows 5.6% faster, shipments 9.1% faster, labor productivity 3.1% faster, and even TFP grows 2.8% more rapidly. Average wages rise at the plant, mostly because of an increase in non-production workers and non-production wages.[25] Exporters in back to back years significantly out-perform non-exporters in every performance measure except TFP, although they do not do as well as new entrants.

The medium and long-run results in Table 9 and Table 10 confirm that entrants into the export market grow rapidly and plants that stop exporting fare the worst. Exporters in the first and last years also increase employment and shipments faster than non-exporters but they no longer show any relative productivity advantage.

As a final measure of the benefits of exporting on growth rates, we look at the performance of continuous exporters relative to plants that move in and out.

Table 9
Medium-run changes at starters, stoppers, both, neither (Average Annual Growth Rates)

	1984–1988			1989–1992		
	Stop	Both	Start	Stop	Both	Start
Total employment	0.04%	2.72%	2.98%	−1.19%	3.23%	3.82%
	(0.20)	(14.73)	(12.98)	(3.60)	(13.88)	(14.81)
Shipments	−1.59%	2.41%	4.21%	−2.28%	3.53%	5.63%
	(5.89)	(10.64)	(15.01)	(5.69)	(12.24)	(17.65)
Value-added per worker	−1.54%	−0.09%	0.92%	−1.17%	0.60%	1.93%
	(4.79)	(0.33)	(2.76)	(2.46)	(1.79)	(5.20)
TFP	−1.67%	−0.70%	0.71%			
	(3.45)	(1.74)	(1.42)			
Average wage	−0.81%	−0.01%	0.61%	−0.00%	0.76%	1.02%
	(7.18)	(0.06)	(5.16)	(0.16)	(6.68)	(8.03)
Non-production/total employment	−0.09%	0.02%	0.13%	−0.00%	0.27%	0.28%
	(1.43)	(0.40)	(2.01)	(0.04)	(4.13)	(3.92)
Production worker wage	−1.22%	−0.42%	0.49%	0.02%	0.72%	0.63%
	(8.35)	(3.46)	(3.22)	(0.08)	(5.13)	(4.04)
Non-production worker wage	−0.17%	0.93%	1.12%	0.18%	−0.31%	0.58%
	(0.74)	(4.93)	(4.78)	(0.55)	(1.36)	(2.28)

The numbers represent the extra annual growth rates in plant characteristics over rest of the period for exporters in the first year, controlling for four digit (SIC) industry and state. Specification with controls also includes employment, average wage, non-production/total employment in the initial year. Numbers in parentheses are *t*-statistics.

[24]The relative fall in wages for production workers is not statistically significant.

[25]Bernard and Jensen (1997a) document the important role of exporting plants in the rise of wage inequality during the 1980s.

Table 10
Long-run changes at starters, stoppers, both, neither (Average Annual Growth Rates)

	Annual		
	Stop	Both	Start
Total employment	−0.583%	2.08%	2.34%
	(3.24)	(14.26)	(14.97)
Shipments	−1.40%	2.08%	3.24%
	(6.31)	(11.50)	(16.77)
Value-added per worker	−0.63%	0.06%	0.87%
	(2.52)	(0.28)	(4.06)
TFP	−0.29%	−0.42%	0.62%
	(0.81)	(1.46)	(2.00)
Average wage	−0.21%	0.27%	0.49%
	(3.04)	(4.71)	(8.08)
Non-production/total employment	0.00%	0.13%	0.13%
	(0.03)	(3.68)	(3.39)
Production worker wage	−0.35%	0.07%	0.40%
	(3.76)	(0.95)	(4.87)
Non-production worker wage	0.14%	0.28%	0.32%
	(0.91)	(2.24)	(2.41)

The numbers represent the extra annual growth rates in plant characteristics over rest of the period for exporters in the first year, controlling for four digit (SIC) industry and state. Specification with controls also includes employment, average wage, non-production/total employment in the initial year. Numbers in parentheses are *t*-statistics.

Selecting the plants that are exporters in the first and last years, i.e. those where $\text{Both}_{iT}=1$, we run the growth rate regression with a dummy for continuous exporters,

$$\%\Delta X_{iT} = \alpha + \beta \text{Continuous}_{iT} + \gamma \text{Size}_{i0} + \delta \text{Char.}s_{i0} + \varepsilon_{iT} \tag{10}$$

where

$$\text{Continuous}_{iT} = 1 \text{ if } \text{Export}_{it} = 1 \ \forall t \in [0,T] \tag{11}$$

Continuous exporters outperform firms that exit and reenter the export market in terms of employment, shipments, and production worker wages (see Table 11). Productivity growth and non-production wages are slightly higher but not significantly different from zero.

The results of the preceding sections give a mixed story about the future gains from exporting today. Employment growth is significantly higher over all intervals for today's exporters. Shipments and wages increase faster for exporters over short horizons but show varied results over longer periods. Productivity growth gains are negligible. Returning to the variety of explanations presented in Section 3, we find scant support for the story that exporting leads to increased productivity growth once firms enter the international market. However, the relative increases

Table 11
Gains from continuous exporting

	1984–88	1989–92
Total employment	0.83%	1.52%
	(3.18)	(4.11)
Shipments	1.02%	1.12%
	(3.45)	(2.45)
Value-added per worker	0.61%	0.71%
	(1.42)	(1.00)
TFP	0.11%	
	(0.17)	
Average wage	0.47%	0.30%
	(3.97)	(1.62)
Non-production/total employment	0.01%	0.05%
	(0.13)	(0.47)
Production worker wage	0.50%	0.80%
	(3.06)	(2.98)
Non-production worker wage	0.15%	−0.65%
	(0.64)	(1.63)

The sample includes only those plants that export in both the first and last year. Continuous plants export in all years.

in employment and shipments growth suggest that there are gains from exporting, perhaps due to expanded markets.

5.4. Survival

All the results from the preceding sections are conditional on the plants having survived. Here we provide evidence on arguably the most important potential benefit from exporting, plant survival. Given the large costs associated with firm failure and the resulting dislocation of workers, any benefits from exporting through increased plant survival would be significant.

To determine if exporting has any effect on plant survival, we estimate a probit of the form

$$S_{it} = \begin{cases} 1 & \text{if } \beta X_{it-1} + \gamma Y_{it-1} + \varepsilon_{it} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{12}$$

where S_{it} equals 1 if the plant survives from year $t-1$ to year t, X_{it-1} is a vector of plant characteristics in the initial year, including total employment, average wages, non-production/total employment, and Y_{it-1} is the export status of the plant in year $t-1$. The results for 1985–1992 are in Table 12 and strongly support the claim that exporting reduces the probability of plant failure. An exporting plant is 10% more likely to survive than a non-exporter with similar characteristics.

Table 12
Exporting and plant survival

	Coefficient	Change in Probability[a]
Intercept	−1.674[a]	
	(0.195)	
Export dummy	0.256[a]	10.16%
	(0.011)	
Total employment	0.207[a]	11.88%
	(0.003)	
Average wage	0.291[a]	4.88%
	(0.009)	
Non-production/Total employment	−0.559[a]	−4.68%
	(0.018)	
Year dummies		
State dummies		
Industry dummies		

Numbers present the increase in the probability of plant survival from a one standard deviation increase in the variable (or a switch from 0–1 for the export dummy) evaluated at the means of the regressors for the year 1992.
[a]Significant at the 5% level.

6. Conclusions

In this paper, we consider the sources of the substantial performance advantages at exporting plants and firms. Those advantages are substantial: at any point in time exporters produce more than twice as much output and are 12%–19% more productive. In addition, exporters pay higher wages to all types of workers. We look at both the characteristics of plants before they export and the performance of plants once they enter the foreign market.

One result is clear. Good plants become exporters. Several years before they actually ship any goods abroad, future exporters have many of the same, desirable performance characteristics. In addition, in the years just prior to the start of exporting, these plants are growing faster than their non-exporting counterparts.

As for the performance of plants once they become exporters, the results are mixed. Exporting does have its rewards, most importantly the increased probability of plant survival. Exporters have significantly lower failure rates than non-exporters with similar characteristics. In addition, among surviving plants, employment growth is higher at exporters over all horizons. However, there is substantial evidence that exporting does not confer the Midas touch. Most plant attributes, especially productivity, grow no faster, and even slower, at today's exporters. This is particularly true over longer horizons where even the growth rate of shipments is not significantly higher. The source of the poor longer term performance is easy to spot. The export market is one of substantial dynamism, more than 10% of manufacturing plants enter or exit every year. Entry and exit are

associated with large changes for the plant. Entry is a time of growth and improved performance, while plants that stop exporting perform poorly. Knowing the export status of a plant today is not sufficient to identify faster growth in the future. Surprisingly these results on U.S. plants are quite similar to those found by Clerides et al. (1996) on firms in Morocco, Mexico, and Columbia using a substantially different empirical strategy.[26]

In choosing among the competing explanations for the excellent performance characteristics of exporters at any point in time, we conclude that there is substantial evidence that success and new products lead to exporting, and that exporting is associated with growth in plant size. However, the lack of productivity gains suggest that firms entering the export market are unlikely to substantially raise their productivity, even if they export continuously.

These results contain caveats for those who would anoint exporting as the cure for the ills of an economy. Exporting shows little evidence of boosting firm productivity. However, exporting does provide expanded market opportunities for the most productive firms in a sector. As these plants expand the overall economy may grow as resources are reallocated from less productive to more productive activities. Potential benefits may be located in terms of the number of jobs and, through higher plant survival rates, the stability of those jobs.

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