This is a preprint of an article published in *Journal of Development Studies,* Vol. 37, No. 5, June 2001, pp. 57-82.

What's Different about Exporters? Evidence from Colombian Manufacturing[1]

Alberto E. Isgut[*]

Department of Economics, Wesleyan University, Middletown, CT 06459, USA

Abstract: Using a large panel of Colombian manufacturing plants, this paper finds that exporters are significantly larger, more capital intensive, have higher labour productivity, and pay higher wages than nonexporters three years before exporting for the first time. The differential in performance increases in the years leading to entry in the export market. After entry, sales, employment, and the proportion of skilled workers in the labour force keep growing significantly faster for exporters, but the growth of labour productivity and capital intensity is indistinguishable for exporters and nonexporters.

Key Words: trade, productivity growth, export-led growth

JEL Classification: D21, F10, L60

August 2000

[1] I thank Andrew Bernard, Albert Berry, Gerry Helleiner, Joyce Jacobsen, Jim McGuire, seminar participants at Wesleyan University and Universidad T. Di Tella (Buenos Aires), and an anonymous referee for helpful comments. Financial support from the Centre for International Studies at the University of Toronto is gratefully acknowledged. I am responsible for any remaining errors.
[*] Tel. (860) 685-3958; Fax (860) 685-2781; Email. aisgut@wesleyan.edu.

I. INTRODUCTION

The relationship between open trade policies and productivity growth has been examined in a large number of research papers since the 1980s.[1] As Nishimizu and Robinson [1984] and Rodrik [1992] pointed out, the presumption that open trade policies leads to productivity growth relies on three main arguments: increasing returns to scale, alleviation of foreign exchange constraints, and cuts of X-inefficiency. If some domestic firms are characterised by increasing returns to scale, they will be able to increase production and lower average costs by accessing the larger export market. Additionally, a fast rate of export growth can alleviate the severity of foreign exchange constraints and the tendency towards recurrent balance of payments crises often experienced by developing countries, facilitating a regular and increasing volume of imports. Capital and intermediate goods imports embodying new technologies will bring new knowledge that will ultimately enhance the country's productivity [*Helleiner*, 1994, p. 27]. Finally, exposure to international competition can create an incentive for domestic firms to reduce costs and adopt new, more efficient technologies—in other words, to cut X-inefficiency. Although this argument has been most usually applied to import-competing firms, it is also true for firms entering the export market.

There is now a large body of empirical evidence showing a strong positive association between the openness of the trade regime and economic growth. However, this evidence has been criticised on several grounds. For one thing, no single measure of openness can summarise the complexity of a trade regime, and the usual measures have been found to be uncorrelated among themselves [*Pritchett*, 1996]. More importantly, as Rodriguez and Rodrik [1999] have pointed out, many popular measures of trade distortions are poorly related to trade policies or are strongly correlated with other sources of bad economic performance. Finally, even if a negative association between trade restrictions and growth could be firmly established, the causality need not go from trade to growth. The imposition of import restrictions, for example, may be a response to recurrent balance of payments crises caused by the combination of an overvalued exchange rate and expansionary fiscal and monetary policies. If this is the case, both the trade regime and the country's growth performance will depend on the implementation of macroeconomic policies that ensure a stable supply of imports.

In order to disentangle the relationship between the trade regime and growth from the complexities of measuring the trade regime and the influence of macroeconomic policies, researchers have looked for evidence in microeconomic data.[2] After all, two of the three arguments that support the claim that trade openness has a positive effect on growth—scales economies and X-efficiency—are about the technology and behaviour of individual firms. They suggest that the exposure to international trade make *some* individual firms grow. Therefore, one way to proceed is to identify individual firms that are exposed to trade and to assess their performance.

Much recent work has focused on the performance of manufacturing exporters. Exporters are, by definition, exposed to international trade. They are able to sell their products in a market that is both larger and presumably more competitive than the domestic market. Therefore, if the arguments about scale economies and X-efficiency are correct, we should observe that these firms are more productive than nonexporters.

The existence of a positive relationship between participation in the export market and labour productivity has been verified for many developing and developed countries. In addition, exporters have been found to be larger, more capital-intensive, and to pay better wages than nonexporters.[3] But how are these characteristics related to their export activities? Is the act of exporting a cause or a consequence of these characteristics?

The arguments about increasing returns to scale and X-efficiency imply a causal link from the act of exporting to firm performance. Firms must start exporting before they can exploit scale economies. Only then they will increase their levels of production and productivity. Additionally, firms that enter the export market will face higher competitive pressures, for example to deliver shipments at the dates promised or to ensure the quality of their products. If the argument about X-inefficiency is correct, these firms will have greater incentives to improve their management and adopt state-of-the-art technologies once they enter the export market (learning-by-exporting). Both arguments suggest that several indicators of firm performance, such as employment, sales, labour productivity, capital intensity, and wages, are likely to increase faster for firms that enter the export market than for firms that never export.

However, the link between exporting and firm performance may obey to a different reason. It is possible that entering the export market requires some managerial and technical skills that are not available to all the firms producing for the domestic market. If this is the case, only a handful of firms will have the option to start exporting. Moreover, if these managerial and technical skills are positively correlated to the size and productivity of the firm, we will observe in the data that new exporters are larger and more productive than nonexporters *before* entering the export market for the first time. In other words, the remarkable performance of exporters compared to nonexporters may be a consequence of the self-selection of the best firms into the export market.

Recent evidence from both developed and developing countries has tended to favour the self-selection hypothesis. Bernard and Wagner [1997] find that German manufacturing exporters are already significantly larger and more productive than nonexporters three years before entering the export market—and these differences widen in the years prior to entry. Yet, the exporters do not keep improving their performance compared to nonexporters after they start exporting. They conclude that 'exporting itself does not provide a performance edge to firms; (…) firms must [first] succeed in order to begin exporting' [*Bernard and Wagner*, 1997, pp. 136 and 155]. Bernard and Jensen [1999a] corroborate this result for the United States, while Clerides, Lach, and Tybout [1998], using a more sophisticated econometric framework, find no evidence that exporting leads to lower average variable costs in several industries of Colombia, Mexico, and Morocco.[4]

This paper examines in depth the relationship between manufacturing exports and firm performance in Colombia during 1981-1991. The methodology employed, which is based on the work of Bernard and Jensen [1995, 1999a] and Bernard and Wagner [1997], consists on comparing several indicators of plant performance for exporters and nonexporters at various time intervals. For example, the self-selection and learning-by-exporting hypotheses are studied, respectively, by comparing the performance of new exporters *vis-à-vis* nonexporters in the years before and after their entry into the export market. This methodology has advantages and disadvantages compared to the econometric methods used by Clerides et. al [1998]. One advantage lies in its computational simplicity, which allows the examination of a broad range of plant performance variables. Another advantage is that it facilitates the comparison of results between Colombia and two industrialised countries, Germany and the U.S., which have been studied with the same methodology. An important disadvantage is that it does not account for unobserved plant effects that may be correlated both with the decision to participate in export markets and with performance indicators. For example, in the model studied by Clerides et al. [1998] the lagged export participation variable is endogenous in the average variable cost equation, making it more difficult to assess the direction of causality between exporting and average variable costs. However, the endogeneity problem may not be as important in practice.[5]

II. BACKGROUND AND DATA OVERVIEW

Like many other Latin American countries, Colombia engaged in an import substitution industrialisation (ISI) strategy as a response to the collapse of the international trading system during the Great Depression. During the 1930s and 1940s industrial growth was led by a few industries: beverages, oil derivatives, nonmetallic minerals, and textiles. Starting in the 1950s, a second phase of import substitution included paper and printing, chemicals and rubber, basic metals, and metal products [*Ocampo*, 1994, p. 133]. An important characteristic that has distinguished Colombia from other Latin American countries pursuing ISI strategies has been the attempt to neutralise the adverse impact of high import tariffs and quantitative restrictions on manufacturing exports. Since the mid-1950s, the government introduced a set of policies to promote the diversification of exports, including preferential exchange rates, tariffs exceptions for imports used in the production of nontraditional exports, tax incentives, and special credit facilities [*Ocampo*, 1994, p. 135]. A major reform in 1967 rationalised these export promotion mechanisms and introduced a crawling peg exchange rate system.

The real exchange rate played an important role as a determinant of Colombian manufacturing exports in the 1970s and 1980s. In the second half of the 1970s, the Colombian economy faced a large and persistent boom in coffee prices that led to substantial current account surpluses. As a result, the real exchange rate appreciated and the annual growth of manufacturing exports slowed down to 9% during 1974-79 (down from 16% during 1967-74). Towards the end of the coffee boom, in 1979, a combination of expansionary fiscal policy with contractionary monetary policy led to large fiscal deficits and a fast accumulation of external debt. This combination of policies contributed to the continued real appreciation of the peso and a negative annual growth rate of manufacturing exports of almost -10% during 1979-83 [*Ocampo and Villar*, 1995].

While the main focus of its trade policies were on the area of export promotion, Colombia had also initiated a very gradual liberalisation of import restrictions in the early 1970s, reducing tariff rates and the number of items requiring prior licensing. This liberalisation accelerated in 1979-81, but it was reversed by the end of 1982, as the international debt crisis tarnished Colombia's ability to finance its current account deficit in the international financial market. By 1984, most import items were subject to quantitative restrictions. The return of protectionism led to a reduction in the current account deficit and helped in the recovery of industrial production [*Ocampo*, 1994, p. 143]. But as the balance of payments difficulties eased, by 1985, the government restarted import liberalisation. The main difference with the seventies was that now the real exchange rate depreciated substantially. As Ocampo [1994, pp. 144-45] put it: '[The] exchange rate policy was extremely effective in generating a devaluation of the effective exchange rate for both exports and imports. By 1986, both rates had amply surpassed their historical peaks.' In this context, manufacturing exports boomed, growing at annual rates of 12% for 1983-89 and 29% for 1989-91.

Only towards the end of our sample period, in 1990, did Colombia radically reform its trade policy, virtually eliminating quantitative restrictions, reducing tariffs, and cutting direct export incentives. As a result, import-competing firms were shielded from international competition during most of the sample period (1981-1991). It is, therefore, appropriate to focus only on export firms in order to assess the link between trade and economic growth in Colombia during this period, since only these firms were exposed to the pressures of international competition.

The data set used for the analysis comes from the Colombian annual manufacturing survey (AMS). This survey covers all the plants with 10 or more employees and provides information on each plant's geographic location, industry, ownership structure, capital stocks, investment flows, expenditure on labour and materials, value of output sold in the domestic market, and value of output exported.[6] It should be noticed that the statistical unit of this data set is, like in other countries' manufacturing surveys, the plant rather than the firm. However, unlike the manufacturing surveys for the U.S. and Germany, information about which plants belong to a multi-plant firm is not available in the Colombian AMS. Nevertheless, an advantage of the Colombian AMS is that it has a more complete breakdown of labour categories than the breakdowns reported for Germany and the U.S.

The AMS asks plants to report the value of sales for the export market in pesos. This information is likely to differ from the export data collected by the Customs for several reasons. First, many establishments may sell their product to wholesalers, without knowing whether it will be ultimately exported. Second, the valuation of exports at the plant may not include transportation and other costs required to carrying the products to an international port. Third, the Customs data is reported in U.S. dollars. Finally, the AMS classifies the industry to which the plant belongs according to the value of the main product manufactured by the plant. While the first two factors may bias downward the value of exports reported to the AMS, the last factor may create the opposite bias for some manufacturing sectors. Table 1 shows the average annual value of exports for 1981-1991 by industry, according to the AMS and the Customs data. Overall, the Colombian AMS covers 88% of the country's manufacturing exports, which exceeds the export coverage of the U.S. AMS [see *Bernard and Jensen*, 1995, p. 74]. The export coverage differs across industries, and only in three of them (food, beverages, and plastic) are exports significantly higher in the AMS than in the Customs data.

As Table 2 shows, the proportion of exporters over the total number of plants has been very stable (around 11%-12%) until the last two years, when it jumped to 15% in 1990 and close to 20% in 1991. The percentage of exports over sales for the average exporter has also increased from an average of 15.7% during 1981-85 to 19.6% during 1986-91.[7] As in the U.S. and Germany, most exporters sell a relatively small proportion of their output abroad. During 1981-91, 55% of Colombian exporters exported less than 10% of their output, while only 14% exported more than 50% of their output (see Figure 1). Table 3 shows that the six largest export industries (food, petroleum, chemicals, textiles, primary metals, and leather) represented around 80% of total exports during the sample period. These industries also accounted for a large share of total manufacturing sales.

III. PLANT PERFORMANCE OF EXPORTERS AND NONEXPORTERS

The most notable difference between exporters and nonexporters reported in Tables 2 and 3 is in their plant size. On average, exporters employed 213 employees, and nonexporters employed 53 employees during 1981-91. These figures are remarkably similar to those of the U.S. (253 and 58 in 1987) and Germany (257 and 66 in 1992), despite the substantial differences in the degree of economic development.[8] Although average plant sizes vary from industry to industry, in each of them exporters are significantly larger than nonexporters (Table 3). The predominance of large plants among the group of exporters is confirmed in the first line of Table 4. For the data set as a whole, 51% of the observations come from small plants that employ between 10 and 30 employees on average, and only 16% come from plants of more than 100 employees. For the subgroup of exporters, only 14% of the observations come from small plants of 10 to 30 employees, and 49% come from plants of more than 100 employees.

The differences in the level of employment between exporters and nonexporters are confirmed for each employment category and size group (see Table 4). In addition to size advantages, exporters pay on average significantly higher wages than nonexporters, a fact also documented for the U.S. and Germany.[9] Controlling for plant size, the wage differentials in favour of exporters are highest for managers (between 40% and 50%) and lowest for blue-collar workers (between 9% and 16%). Exporters also have higher levels of labour productivity than nonexporters, measured both as sales per worker and value added per worker. These differences are most remarkable for plants of up to 100 employees (between 80% and 110%), though they are still important for plants of more than 100 employees (between 27% and 32%).

Exporters tend to invest more heavily, and as a result are more capital intensive than nonexporters. As with the productivity figures, the differences are higher for the smaller plants (100%

to 150% for plants with 10 to 30 employees and 46% to 69% for plants with 30 to 100 employees), but they are still significant for plants with more than 100 employees (between 32% and 42%). As for the composition of the labour force, exporters tend to employ a higher proportion of white collar workers, technicians, and managers than nonexporters in plants of up to 100 employees, but they tend to employ more blue collar workers in plants of more than 100 employees. Finally, it should be noted that not all plants hire workers in each category and invest every single year. In all size categories, exporters are more likely to hire technicians and managers and to invest in machinery or other type of physical capital. In contrast, nonexporters are more likely to report owners working in the plant.

In order to measure the exporter premia in a more systematic way, I estimate a series of equations, along the lines of Bernard and Wagner [1997], of the following form:

$$\begin{aligned} \ln X_{it} &= \alpha + \beta_0\, exporter_{it} + \theta\,(exports/sales)_{it} + \lambda \ln size_{it} \\ &\quad + \gamma_1 industry_{it} + \gamma_2 region_i + \gamma_3 year_t + \varepsilon_{it}, \end{aligned} \tag{1}$$

where X_{it} is the plant characteristic under analysis, $exporter_{it}$ is a dummy variable that takes a value of one if the plant exports in the current year, $(export/sales)_{it}$ is the ratio of exports to sales of the plant (in percentage), $size_{it}$ is the number of employees of the plant, $industry_{it}$ is a vector of 94 industry dummies, $region_i$ is a vector of 8 metropolitan region dummies, and $year_t$ is a vector of 10 year dummies. The export premium, β_0, measures the average percentage difference between exporters and nonexporters for each characteristic under study.

The results are reported in Table 5. The first two columns report a restricted specification of Equation (1) that does not include $(export/sales)_{it}$. All the estimated premia are significantly greater than zero, confirming the basic message of Table 4. Blue collar and manager wages are estimated to be, respectively, 11% and 25% higher for exporters than for nonexporters. The estimated premia for different measures of labour productivity and capital intensity are between 43% and 48%. The share of nonproduction to total workers is around 4% higher for exporters. Finally, after controlling for industry, region and year, the average number of employees is estimated to be 123% higher for exporters.

The last columns of Table 5 report the results of the unrestricted version of Equation (1), that includes $(export/sales)_{it}$. Somewhat surprisingly and in contrast to what was found for Germany, the exporter premia are less for plants that export a higher proportion of their output. Still, the premia remain positive for most plant characteristics. For example, plants that export more than 70% of their output are estimated to employ between 75% and 94% more employees, have between 27% and 35% more capital per worker, and pay their managers between 12% and 17% more than nonexporters. The most notorious differences are for blue collar wages and the proportion of nonproduction to total workers, whose premia turn negative for plants that export more than 70% of their output. In sum, these plants are still significantly larger, more capital intensive, and more productive compared to nonexporters, but they pay lower wages to blue collar workers and tend to employ a smaller proportion of skilled workers.[10]

A possible explanation of the negative correlation between plant size and export intensity is that during the export boom of the late 1980s many new firms, which are typically smaller than established firms, seem to have been founded with the express purpose of exporting [*Berry and Escandón*, 1999, p. 175]. As for the higher proportion of low skilled workers and lower blue collar wages of firms that export most of their output, a possible explanation may lies on the characteristics of the industries in which Colombia has a comparative advantage. For example, a successful export industry such as the garment industry is labour intensive, pays wages that are about half the manufacturing average, and relies predominantly on female blue collar workers [*Berry and Escandón*, 1999, p. 176]. In addition, it is likely that firms in labour intensive and low wage industries in which Colombia has a comparative advantage tend to be relatively small.

In order to control for other factors that may have an influence on the wage, I estimate the following regressions:[11]

$$\begin{aligned}\ln wage_{it} &= a + b_0\, exporter_{it} + q\,(exports/sales)_{it} + l \ln size_{it} \\ &\quad + d(capital/worker)_{it} + g_1 industry_{it} + g_2 region_i + g_3 year_t + e_{it}\end{aligned} \qquad (2)$$

$$\begin{aligned}\ln wage_{it} &= a + b_0\, exporter_{it} + q\,(exports/sales)_{it} + l \ln size_{it} \\ &\quad + d(capital/worker)_{it} + plant_i + g_2 year_t + e_{it}\,,\end{aligned} \qquad (3)$$

where $plant_i$ is a fixed plant effect included to account for unobserved sources of heterogeneity among plants. The results for Equation (2), which are included in the upper half of Table 6, show that the degree of capital intensity has a positive effect on the wage. Comparing these results with those of Table 5 it is clear that the inclusion of capital intensity in the regressions reduces the level of the wage premia. However, the premia remain significantly positive, ranging from 7% for blue-collar workers to 19% for managers.

The results for Equation (3) are included in the bottom half of Table 6 and show that even accounting for unobserved sources of plant heterogeneity, the wages paid by exporters are still significantly higher, though the premia are reduced to the 1%-4% range. An interesting result is that the differences between the wage premia of blue collar workers and managers disappear. This suggests the existence of an unobserved plant characteristic (perhaps managerial expertise) that is positively correlated with the managers' wage and that tends to be more pervasive for exporters than for nonexporters. Another interesting result is that, after accounting for unobserved plant heterogeneity, the wage premia now tend to increase with the export/sales ratio.[12]

Overall, Colombian exporters are larger, pay higher wages, and have higher degrees of labour productivity and capital intensity than nonexporters, confirming previous findings for the U.S. and Germany.[13] An interesting difference with the industrialised countries is that plants that export 70% or more of their output in Colombia pay lower wages to blue collar workers and tend to employ a smaller proportion of skilled workers than nonexporters. Although the regression results reported so far provide a fairly complete description of the characteristics of exporters, they are silent about the direction of causality. Is the exposure to export markets that makes plants invest more heavily, hire better managers, increase their labour productivity, and pay better wages? Or are the levels of labour productivity, capital intensity, and quality of the management that make it easier for a plant to enter the export market? I tackle these questions in the following section.

IV. CAUSALITY

The results of the previous two sections are based on the full sample, which contains 70,983 observations corresponding to 10,747 plants. Defining an exporter as a plant that has exported at least in one year, the full sample contains 2,012 exporters. In the present section, I am interested in comparing the performance of new exporters with plants that never export. I am also interested in assessing the performance of new exporters and nonexporters over time, as opposed to the snapshot approach of the previous two sections. For that purpose, I work with a subsample of 47,316 observations corresponding to 5,559 plants (652 of which are new exporters). A new exporter is defined, following Bernard and Wagner [1997], as a plant that exports for the first time after at least three years in the sample. Then, the subsample includes only plants that have at least four consecutive annual observations and do not export in any of their first three annual observations.[14]

The first question addressed is whether future exporters are larger, pay better wages, and have higher degrees of labour productivity and capital intensity *before* exporting for the first time. A related question is whether employment, wages, labour productivity, and capital intensity *grow faster* for future exporters than for nonexporters before entry into the export market. The regressions to be estimated are

$$\ln X_{it} = \alpha + \beta_1 exporter_{it+3} + \lambda \ln size_{it} + \gamma_1 industry_{it} + \gamma_2 region_i + \gamma_3 year_t + \varepsilon_{it} \qquad (4)$$

$$\Delta \ln X_{it} = \alpha + \beta_2 exporter_{i(t+1\,or\,t+2)} + \gamma_1 industry_{it} + \gamma_2 region_i + \gamma_3 year_t + \varepsilon_{it}, \qquad (5)$$

where $exporter_{it+3}$ is a dummy variable that takes a value of one if the plant will export for the first time in three years, $exporter_{i(t+1\,or\,t+2)}$ is a dummy variable that takes a value of one if the plant will export for the first time in either one or two years, and $\Delta \ln X_{it} \equiv \ln X_{it} - \ln X_{it-1}$. Since the event 'entering the export market for the first time' may happen only once, each plant has, at most, one $exporter_{it+3}$ dummy with a value of one and at most two $exporter_{i(t+1 \text{ or } t+2)}$ dummies with a value of one. In order to interpret the estimated values of β_1 and β_2 as average percentage differences between future exporters and nonexporters, I exclude all the observations of exporting plants in which $exporter_{it+3} = 0$ in the estimation of Equation (4) and all the observations of exporting plants in which $exporter_{i(t+1 \text{ or } t+2)} = 0$ in the estimation of Equation (5).[15]

The results for Equation (4) are shown in the first three columns of Table 7. They show that future exporters are significantly larger than nonexporters: after controlling for industry, region and year, they employ 67% more workers and sell twice as much. Moreover, future exporters are already more productive than nonexporters (20% to 24% more) and their investment per worker ratios exceed those of nonexporters by around 50%. Finally, future exporters pay substantially higher wages to technicians and managers (around 14%). The only plant characteristic in which future exporters do not have a large and statistically significant premium over nonexporters is the blue-collar wage.

The last three columns of Table 7 report the results for Equation (5). They show that employment grows 1.4% faster and sales grow 4.6% faster for plants that will enter the export market in one or two years than for nonexporters. As a result, labour productivity increases between 3% and 4% faster for these plants. Additionally, the capital/worker ratio increases 5% faster, and the wages of blue collar and white-collar workers increase 2% and 2.5% faster for future exporters than for nonexporters. Taken together, the results of Equations (4) and (5) suggest not only that future exporters are larger, more capital intensive, and more productive than nonexporters but also that these differences increase over time before entry into the export market actually takes place.

The next logical question is what happens after entry. Do the new exporters keep increasing their size, capital intensity, and productivity at rates that exceed those of nonexporters? To investigate this question I estimate the following variant of Equation (5):

$$\frac{\ln X_{it} - \ln X_{it-n}}{n} = a + b_3\, exporter_{it-n} + g_1 industry_{it} + g_2 region_i + g_3 year_t + e_{it}, \qquad (6)$$

where $exporter_{it-n}$ is a dummy variable that takes a value of one if the plant exported for the first time *n* years ago. In other words, these regressions capture the differential growth between new exporters and nonexporters over horizons of *n* years. As before, I exclude all the observations of exporting plants in which $exporter_{it-n} = 0$ for the estimation.

The results for horizons of one, three, and five years (*n* = 1, 3, and 5) are reported in Table 8. For horizons of one year after entry, the differences in growth rates between exporters and nonexporters are, with the exception of total employment and employment of blue-collar workers, not significantly different from zero at the 95% level. Total and blue collar employment grows around 3% faster for exporters after entry. For horizons of three and five years after entry, employment of white collar workers, technicians, and managers grows at significantly faster rates for exporters than for nonexporters (4% to 7%). As a result, the ratio of nonproduction to total workers increases. Additionally, sales grow significantly faster for exporters than for nonexporters. The growth differential is 4%, slightly less than during the two years leading to entry (4.6%, see Table 7).

Interestingly, labour productivity grows 1.5% faster for exporters than for nonexporters over horizons of five years after entry. Is this evidence of learning effects associated with exports? In other words, does a longer exposure to export markets contribute to increased productivity? Not necessarily. A simpler explanation has to do with sample selection. The data for the group of new exporters observed over an horizon of five years after entry corresponds to the years 1989 to 1991,[16] during which the real exchange rate was at record high levels and exporting was very attractive. Chances are that the favourable export conditions allowed these exporters to boost sales and labour productivity. But other exporters should have also been favoured. In order to control for export conditions, I re-estimate Equation (6) for horizons of one and three years for a subsample that includes only the years t = 1989 to 1991.[17]

Table 9 shows the results. As conjectured, sales and labour productivity grow significantly faster for new exporters than for nonexporters over one-year horizons (at 8% and 5%, respectively), suggesting that favourable export conditions may have influenced labour productivity growth over five-year horizons. However, one pattern observed in Table 8 is robust to the sample selection: Exporters experience a significantly faster growth of blue collar workers one year after entry and of more qualified workers three years after entry.[18] Notice that there is no evidence of capital deepening for exporters after entry into the export market, as opposed to the period that preceded entry (refer to Table 7).[19] The pattern that emerges is then one of successful domestic plants that self-select into the export market after a period of expansion in sales, labour productivity, and physical capital accumulation. After entry, these plants keep a favourable sales growth differential over nonexporters, but their physical capital accumulation slows down. Instead, it seems like after a few years of experience they start to invest more in human capital, by increasing the proportion of skilled workers in their work force.[20]

The results shown so far hide the fact that new exporters must have met varied degrees of success in the export market. For example, some plants could have failed to keep exporting after a first unsuccessful experience. Since these unsuccessful exporters are not going to receive any further 'learning' from exporting, we need to control them in the regression analysis. The following variant of Equation (6) discriminates between plants that remain exporting and stop exporting, and includes new entrants to the export market as an additional category:

$$\frac{\ln X_{it} - \ln X_{it-n}}{n} = a + b_1\, in_{it} + b_2\; out(n)_{it} + b_3\, stay(n)_{it} + g_1 industry_{it} + g_2 region_i + g_3 year_t + e_{it}\,. \quad (7)$$

in_{it} is a dummy that takes a value of one if the plant is entering the export market at time *t*, $out(n)_{it}$ is a dummy variable that takes a value of one if the plant entered the export market at time *t* - *n* and did not export at time *t*, and $stay(n)_{it}$ is a dummy variable that takes a value of one if the plant entered the export market at time *t* - *n* and did export at time *t*. It should be noted that the number of exporters in the sample is larger in Equation (7) than in Equation (6) because the latter also includes new exporters that enter the export market at time *t*.[21]

The first four columns of Table 10 report results for horizons of one year. Plants that enter the export market or keep exporting the year after entry experience sharp increases in sales (more than 10%) while their levels of employment increase by 3% to 5%. As a result, their labour productivity increases between 5% and 9%. In contrast, plants exiting the export market the year after entry experience a -12% drop in sales. Since their level of employment does not change, their lower sales translate into drops in labour productivity of the order of -10% to -12%. The significant increase in blue collar employment noticed in Tables 8 and 9 for one-year horizons is only for continuing exporters. Controlling for current export status also uncovers that continuing exporters also increase their employment of white collar workers one year after entry.

Over horizons of five years, the difference between continuing exporters and stoppers is still sharp, though not as dramatic. While continuing exporters experience a significant increase in sales and employment compared to nonexporters (4% and 2.3% respectively), the growth of stoppers is not significantly different from that of nonexporters. Additionally, notice the trend towards high investment in human capital for new entrants into the export market: a 3.7% growth differential for white collar workers and a 2.8% for managers. This trend clearly accelerates for continuing exporters, but it is not significantly different from zero for stoppers. Finally, the growth differential of labour productivity is somewhat higher for continuing exporters than for stoppers, but in both cases it is not significantly different from zero.

V. CONCLUSION

Two of the main arguments in favour of export-oriented trade policies (scale economies and reduction of X-inefficiencies) imply a causal relationship between exporting and some characteristics of plant performance that can be examined empirically. Following the work of Bernard and Wagner [1997] for Germany and Bernard and Jensen [1995, 1999a] for the U.S., this paper has investigated whether the act of exporting leads to increases in plant size, labour productivity, capital intensity, and wages, compared to plants that never export. The results can be summarised as follows.

First, there is clear evidence that Colombian exporters are already significantly larger and more capital intensive, have higher levels of labour productivity, and pay higher wages than nonexporters three years before exporting for the first time, and such advantages intensify in the years leading to entry. This result, that corroborates similar evidence for Germany and the U.S., suggests the existence of barriers of entry to the export market. Competing in the international market may require some 'critical mass' of managerial and technical skills, which is not available to all the plants, and such skills may be correlated with observable plant characteristics such as size, capital intensity, labour productivity, and wages. If this is correct, the favourable performance of exporters before starting to export may reflect the accumulation of such critical mass of managerial and technical skills.

Second, there is evidence that plants that enter the export market keep growing at significantly faster rates (around 4% per year) than nonexporters over horizons of 3 to 5 years after entry. However, new exporters do not resume the fast labour productivity growth differential of their pre-entry years after they started to export. Although they experience a mild recovery of labour productivity growth over horizons of five year after entry, this may be partly due to the exceptional export conditions of the period 1989-91, which favoured the subsample of plants with five or more years after entry in the export market.

Third, new exporters show a robust pattern of investment in human capital over horizons of three to five years after entry in the export market: Their employment of white collar workers, technicians and managers grows significantly faster than that of blue collar workers, compared to nonexporters. This phenomenon has been noticed by Clerides et al. [1998, p. 922], who interpret it as reflecting the needs for new product design and other forms of technical assistance associated with breaking into foreign markets. Interestingly, new exporters invest heavily in physical capital before entry in the export market, but not after entry.

Finally, there is an important degree of heterogeneity in the performance of plants that keep exporting after entry compared with those that stop exporting. In the short run, the latter suffer important setbacks in sales and labour productivity. In the medium run (five-year horizon), only continuing exporters show the consistently higher growth rates in sales and in the employment of skilled workers described above. The performance of plants that did not export five years after entry is not significantly different from that of nonexporters.

In sum, the evidence presented is supportive of the self-selection hypothesis, corroborating similar findings for developed and developing countries. This evidence, yet, does not completely rule out the possibility that successful Colombian exporters learn from their participation in export markets or that an open trade policy be advantageous for the economy. For one thing, sales and employment grow at significantly faster rates for exporters than for nonexporters. Given that the former are more productive than the latter because of the self-selection effect, a higher rate of growth of exporters will necessarily lead to improvements in aggregate productivity.[22] Second, entry into the export market is likely to involve planning, market research, and investments to expand capacity. The fast capital accumulation in the years leading to entry may have taken place with the express purpose of exporting. Therefore, it is possible that the growth in labour productivity observed in the years leading to entry into the export market is partly a result of the decision to export. Finally, the observed shift towards a higher investment in human capital by exporters is significant, and we cannot discard the possibility that it will lead to productivity increases over a longer time horizon.

REFERENCES

Aw, B.Y., S. Chung, and M.J. Roberts, 1998, 'Productivity and the Decision to Export: Micro Evidence from Taiwan and South Korea', NBER Working Paper 6558.

Aw, B.Y. and A.R. Hwang, 1995, 'Productivity and the Export Market: A Firm-Level Analysis', *Journal of Development Economics* 47(2), 313-332.

Bernard, A.B. and J.B. Jensen, 1995, 'Exporters, Jobs, and Wages in U.S. Manufacturing: 1976-1987', *Brooking Papers on Economic Activity: Microeconomics*, 67-119.

Bernard, A.B. and J.B. Jensen, 1999a, 'Exceptional Export Performance: Cause, Effect, or Both?', *Journal of International Economics* 47(1), 1-25.

Bernard, A.B. and J.B. Jensen, 1999b, 'Exporting and Productivity', NBER Working Paper 7135.

Bernard, A.B. and J. Wagner, 1997, 'Exports and Success in German Manufacturing', *Weltwirtschaftliches Archiv* 133(1), 134-157.

Berry, A., 1992, 'Firm (or Plant) Size in the Analysis of Trade and Development', in G.K. Helleiner (ed.), *Trade policy, industrialisation, and development: New perspectives*, Oxford: Clarendon Press.

Berry, A. and J.F. Escandón, 1999, 'Colombia's Small and Medium Exporters and their Support System', in B. Levy, A. Berry, and J.B. Nugent (eds.), *Fulfilling the Export Potential of Small and Medium Firms*, Boston: Kluwer Academic Publishers.

Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, J.W. Gunning, J. Habarurema, A. Oduro, R. Oostendorp, C. Pattillo, M. Söderbom, F. Teal, and A. Zeufack, 1999, 'Exports and Firm Level Efficiency in the African Manufacturing Sector', Mimeo, World Bank.

Clerides, S.K., S. Lach, and J.R. Tybout, 1998, 'Is learning-by-exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco', *Quarterly Journal of Economics* 113(3), 903-47.

Dollar, D. and K. Sokoloff, 1990, 'Patterns of Productivity Growth in South Korean Manufacturing Industries: 1963-1980', *Journal of Development Economics* 33(2), 309-327.

Edwards, S., 1992, 'Trade Orientation, Distortions, and Growth in Developing Countries', *Journal of Development Economics* 39(1), 31-55.

Esfahani, H.S., 1991, 'Exports, Imports, and Economic Growth in Semi-Industrialized Countries', *Journal of Development Economics* 35(1), 93-116.

Feder, G., 1983, 'On Exports and Economic Growth', *Journal of Development Economics* 12(1-2), 59-73.

Harrison, A., 1996, 'Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries', *Journal of Development Economics* 48(2), 419-447.

Helleiner, G.K., 1994, 'Introduction', in G.K. Helleiner (ed.), *Trade Policy and Industrialisation in Turbulent Times*, London: Routledge.

Kraay, A., 1999, 'Exports and Economic Performance: Evidence from a Panel of Chinese Enterprises', Mimeo, World Bank.

Krueger, A.O. and B. Tuncer, 1982, 'Growth of Factor Productivity in Turkish Manufacturing Industries', *Journal of Development Economics* 11(3), 307-325.

Liu, L., 1993, 'Entry-Exit, Learning, and Productivity Change: Evidence from Chile', *Journal of Development Economics* 42(2), 217-242.

Nishimizu, M. and S. Robinson, 1984, 'Trade Policies and Productivity Change in Semi-Industrialized Countries,' *Journal of Development Economics* 16(1-2), 177-206.

Ocampo, J.A., 1994, 'Trade Policy and Industrialisation in Colombia, 1967-91', in G.K. Helleiner (ed.), *Trade Policy and Industrialisation in Turbulent Times*, London: Routledge.

Ocampo, J.A. and L. Villar, 1995, 'Colombian Manufacturing Exports: 1967-1991', in G.K. Helleiner (ed.), *Manufacturing for Export in the Developing World: Problems and Possibilities*, London: Routledge.

Pritchett, L., 1996, Measuring outward orientation in LDCs: Can it be done?, Journal of Development Economics 49(2), 309-35.

Roberts, M.J., 1996, Colombia, 1977-1985: 'Producer Turnover, Margins, and Trade Exposure', in M.J. Roberts and J.R. Tybout (eds.), *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*, Oxford: Oxford University Press.

Roberts, M.J. and J.R. Tybout, 1996 (eds.), *Industrial Evolution in Developing Countries: Micro Patterns of Turnover, Productivity, and Market Structure*, Oxford: Oxford University Press.

Rodriguez, F. and D. Rodrik, 1999, 'Trade Policy and Economic Growth: A Skeptic's Guide to Cross-National Evidence', NBER working paper 7081.

Rodrik, D., 1992, 'Closing the Productivity Gap: Does Trade Liberalisation Really Help?', in G.K. Helleiner (ed.), *Trade Policy, Industrialisation, and Development: New Perspectives*, Oxford: Clarendon Press, Oxford.

Sachs, J.D. and A. Warner, 1995, ''Economic Reform and the Process of Global Integration', *Brooking Papers on Economic Activity* 1, 1-118.

Tybout, J.R., 1992, 'Linking Trade and Productivity: New Research Directions', *The World Bank Economic Review* 6(2), 189-211.

Tybout, J.R. and D. Westbrook, 1995, 'Trade Liberalisation and the Dimensions of Efficiency Change in Mexican Manufacturing Industries', *Journal of International Economics* 39(1-2), 53-78.

Table 1: Average annual exports by industry 1981-1991 - AMS vs. Customs data (US$ million)

Industry	AMS (1)	Customs (2)	(1) / (2)
Total	1465.74	1667.43	0.88
Food	461.13	252.69	1.82
Beverages	4.77	2.89	1.65
Tobacco	3.84	4.41	0.87
Textiles	104.37	128.30	0.81
Apparel	46.66	171.48	0.27
Leather	62.75	96.02	0.65
Wood	4.30	12.06	0.36
Furniture	2.73	4.22	0.65
Paper	25.58	29.04	0.88
Printing	22.38	70.38	0.32
Chemicals	148.08	170.71	0.87
Petroleum	309.81	338.99	0.91
Rubber	7.70	10.33	0.74
Plastic	20.10	11.33	1.77
Stone & clay	48.57	58.99	0.82
Primary metals	93.30	99.96	0.93
Fabricated metals	31.86	39.99	0.80
Machinery	13.55	27.57	0.49
Electric equipment	17.13	25.73	0.67
Transportation	20.55	19.01	1.08
Instruments	5.65	8.88	0.64
Misc. Manufactures	10.93	84.44	0.13

Source: Author's computation using information from the Colombian National Directorate of Statistics (DANE).

Table 2: Colombian manufacturing exporters, 1981-1991

Year	Plants	Percent of plants that export	Plant exports/ sales	Average number of employees	
				Exporters	Nonexporters
1981	5956	12.5	14.1	239	60
1982	6096	12.4	15.7	232	57
1983	6249	11.0	17.2	227	56
1984	6258	10.6	17.3	232	55
1985	6325	11.6	14.2	209	52
1986	6565	12.0	21.1	199	51
1987	6782	11.6	19.0	215	51
1988	6786	12.1	17.7	209	51
1989	6909	13.2	20.0	200	51
1990	6721	15.4	21.1	196	50
1991	6336	19.8	18.5	183	51

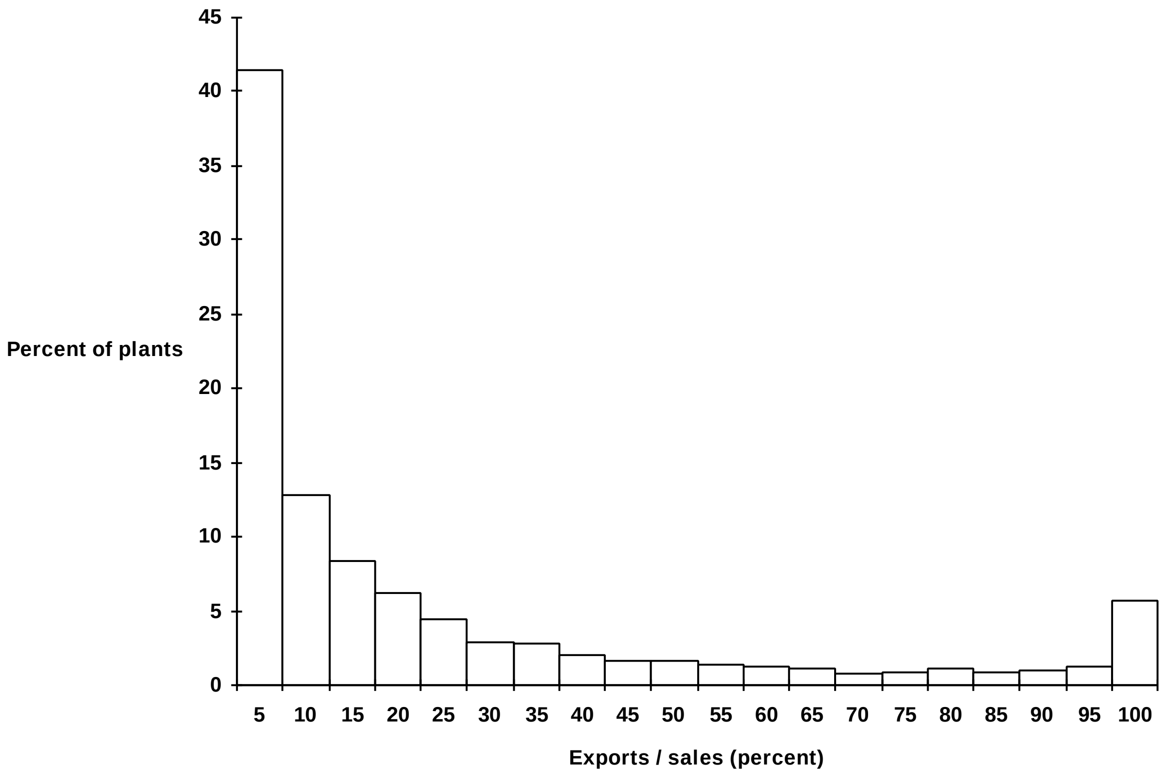
Source: Author’s computation using information from DANE.

Table 3: Colombian manufacturing exporters, 1981-91
Annual averages by industry

	All		Exporters				Non-exporters
Industry	Plants	Percent of total sales	Percent of total exports	Percent of plants	Plant exports/ sales	Average plant size	Average plant size
All	6453	100.00	100.00	12.9	17.8	213	53
Food	1099	24.85	31.63	8.0	32.6	237	53
Beverages	127	7.47	0.34	3.9	3.2	333	191
Tobacco	14	0.83	0.28	25.0	4.4	465	126
Textiles	434	7.59	7.14	14.5	12.9	401	77
Apparel	922	2.69	3.13	8.6	30.3	160	41
Leather	331	1.96	4.40	20.0	27.2	154	34
Wood	165	0.60	0.28	7.2	8.9	149	28
Furniture	187	0.37	0.18	5.0	30.0	89	37
Paper	138	4.10	1.70	14.9	7.0	234	52
Printing	338	2.55	1.52	9.1	12.9	191	47
Chemicals	403	13.63	10.27	25.1	9.5	219	59
Petroleum	26	5.54	20.63	15.5	40.1	993	97
Rubber	78	1.65	0.54	17.0	4.0	335	40
Plastic	296	2.98	1.36	16.5	7.9	141	45
Stone & clay	369	4.94	3.30	11.2	14.0	310	59
Primary metals	88	3.72	6.58	12.6	33.7	362	121
Fabricated metals	527	3.26	2.18	12.7	11.3	163	37
Machinery	300	1.67	0.90	19.4	10.8	99	37
Electric equipment	191	3.05	1.16	19.4	6.0	212	58
Transportation	214	5.27	1.33	12.8	5.7	204	75
Instruments	63	0.48	0.39	26.0	9.4	118	29
Misc. manufactures	145	0.81	0.74	22.6	13.8	109	35

Source: Author's computation using information from DANE.

Figure 1: Distribution of plant exports as a percentage of plant sales, 1981-91



Source: Author's computation using information from DANE.

Table 4: Average annual characteristics of exporters and nonexporters by plant size, 1981-1991

	All plants		Less than 30 workers		Between 30 and 100 workers		More than 100 workers	
	Ex-porters	Nonex-porters	Ex-porters	Nonex-porters	Ex-porters	Nonex-porters	Ex-porters	Nonex-porters
Annual observations	836	5618	118	3196	307	1829	411	593
Employment								
All workers	212.8	53.2	22.3	18.1	62.8	51.9	374.5	250.1
Blue collar workers	147.7	37.6	14.9	12.8	43.7	38.0	262.2	169.6
White collar workers	50.1	13.3	5.0	3.4	14.0	10.5	88.5	67.6
Technicians	13.3	4.5	2.2	1.7	4.4	3.0	19.3	11.7
Managers	6.1	2.5	1.9	1.6	2.8	2.3	8.9	5.8
Wages per worker								
All workers	76.6	46.2	48.5	38.6	62.6	48.4	95.0	80.0
Blue collar workers	58.9	40.3	38.2	34.9	48.2	41.3	72.7	66.5
White collar workers	88.7	53.6	50.2	42.7	70.2	57.1	112.4	93.6
Technicians	155.6	101.2	90.0	70.4	119.7	97.3	183.0	156.9
Managers	316.1	140.0	128.4	85.3	210.6	139.7	421.2	298.8
Productivity & capital								
Sales/worker	810.1	481.5	546.9	257.6	710.4	393.1	827.0	625.3
Value added/worker	380.5	214.5	194.7	93.1	283.1	138.5	395.8	310.4
Investment in Machinery/worker	42.9	21.4	17.4	7.0	22.2	13.1	45.9	32.3
Investment/worker	58.4	31.8	27.4	12.0	31.9	20.3	62.2	46.9
Capital/worker	429.9	224.0	180.0	89.3	205.2	140.5	462.3	330.0
Nonproduction/ Total workers (%)	29.8	29.8	33.0	29.1	30.4	26.7	30.0	32.2
% no zero observations								
Technicians	67.4	31.6	39.8	19.6	57.1	41.0	83.0	67.6
Managers	85.7	61.2	66.0	49.0	81.3	72.8	94.6	91.3
Owners working	26.8	56.1	51.6	67.6	33.3	47.4	14.8	21.0
Inv. in machinery	85.7	57.3	66.2	45.3	80.5	68.6	95.1	86.6
Investment	92.0	68.4	78.5	57.5	89.3	79.5	97.9	92.9

Source: Author's computation using information from DANE.

Table 5: Exporter premia

Dependent variable	Exporter	R^2	Exporter	Export/ sales	R^2	N
Wages per worker						
Average wage	0.1732***	0.46	0.2319***	-0.0027***	0.46	70976
	(38.0)		(42.9)	(-19.7)		
Blue collar wage	0.1116***	0.38	0.1647***	-0.0025***	0.39	70668
	(25.0)		(31.1)	(-18.7)		
White collar wage	0.1406***	0.42	0.1774***	-0.0017***	0.42	65108
	(26.7)		(28.5)	(-10.7)		
Technicians wage	0.1383***	0.39	0.1663***	-0.0016***	0.40	25737
	(15.2)		(16.1)	(-5.4)		
Managers wage	0.2537***	0.49	0.2842***	-0.0016***	0.49	45680
	(28.7)		(27.7)	(-5.9)		
Productivity & capital						
Sales/worker	0.4632***	0.46	0.4506***	0.0006*	0.46	70928
	(48.4)		(39.6)	(2.1)		
Value added/worker	0.4312***	0.42	0.4708***	-0.0019***	0.43	70762
	(50.3)		(46.3)	(-7.4)		
Inv. in mach./worker	0.4477***	0.13	0.5332***	-0.0042***	0.13	43251
	(17.7)		(18.1)	(-5.5)		
Total investment/worker	0.4807***	0.14	0.5421***	-0.0030***	0.14	50728
	(20.6)		(19.8)	(-4.3)		
Capital/worker	0.4863***	0.35	0.5471***	-0.0028***	0.35	70776
	(35.0)		(33.2)	(-6.7)		
Nonprod./total Workers	0.0444***	0.24	0.0648***	-0.0010***	0.24	70983
	(23.1)		(28.4)	(-16.7)		
Employment & sales						
Total employment	1.2373***	0.29	1.3649***	-0.0061***	0.29	70983
	(122.1)		(112.2)	(-18.3)		
Blue collar workers	1.2136***	0.25	1.3121***	-0.0047***	0.26	70668
	(111.4)		(100.2)	(-13.1)		
White collar workers	1.4299***	0.30	1.6480***	-0.0108***	0.31	65108
	(108.1)		(104.3)	(-24.8)		
Technicians	0.9291***	0.24	0.9983***	-0.0043***	0.25	25737
	(63.2)		(59.0)	(-8.2)		
Managers	0.6065***	0.18	0.6906***	-0.0046***	0.19	45680
	(67.4)		(65.4)	(-15.1)		
Sales	1.9723***	0.40	2.1130***	-0.0069***	0.40	70928
	(130.9)		(116.4)	(-13.9)		

Regressions include industry, region, and year dummy variables. They also include the log of total employment, except when the dependent variable is total employment, employment by type, or sales. Dependent variables are in logs, except for the share of nonproduction workers in total employment. t-statistics in parentheses. ***=significantly different from zero at 99.9% **= significantly different from zero at 99% *= significantly different from zero at 95%.

Table 6: Exporter wage premia

Dependent variable	Exporter	Export/ sales	Total employment	Capital/ worker	R^2
		Estimated with industry, region, and year dummies			
Average wage	0.1221***		0.1603***	0.1068***	0.52
	(28.1)		(107.9)	(91.5)	
Blue collar wage	0.0722***		0.1389***	0.0845***	0.43
	(16.6)		(93.7)	(72.3)	
White collar wage	0.0993***		0.2233***	0.0873***	0.45
	(19.2)		(123.8)	(60.0)	
Technicians wage	0.0874***		0.2483***	0.1301***	0.43
	(9.8)		(71.8)	(41.0)	
Managers wage	0.1900***		0.3888***	0.1448***	0.52
	(22.0)		(124.5)	(54.5)	
Average wage	0.1746***	-0.0024***	0.1585***	0.1062***	0.52
	(33.9)	(-18.7)	(106.5)	(91.1)	
Blue collar wage	0.1201***	-0.0022***	0.1371***	0.0838***	0.43
	(23.4)	(-17.1)	(92.3)	(71.9)	
White collar wage	0.1311***	-0.0015***	0.2219***	0.0870***	0.45
	(21.5)	(-9.5)	(122.7)	(59.8)	
Technicians wage	0.1087***	-0.0012***	0.2477***	0.1295***	0.43
	(10.8)	(-4.3)	(71.5)	(40.8)	
Managers wage	0.2132***	-0.0012***	0.3880***	0.1447***	0.52
	(21.2)	(-4.5)	(123.7)	(54.3)	
		Estimated with fixed plant and year effects			
Average wage	0.0394***		-0.0637***	0.0949***	0.85
	(9.7)		(-21.5)	(45.4)	
Blue collar wage	0.0388***		-0.0607***	0.0829***	0.77
	(8.5)		(-18.2)	(35.4)	
White collar wage	0.0134*		0.0790***	0.0670***	0.75
	(2.3)		(18.1)	(21.6)	
Technicians wage	0.0260**		0.1002***	0.0613***	0.78
	(2.7)		(10.8)	(9.3)	
Managers wage	0.0307***		0.1809***	0.0764***	0.83
	(3.6)		(25.7)	(15.0)	
Average wage	0.0308***	0.0007 ***	-0.0643***	0.0946***	0.85
	(6.9)	(4.8)	(-21.7)	(45.3)	
Blue collar wage	0.0326***	0.0005 **	-0.0611***	0.0827***	0.77
	(6.5)	(3.1)	(-18.3)	(35.3)	
White collar wage	0.0151*	-0.0001	0.0791***	0.0671***	0.75
	(2.4)	(-0.7)	(18.1)	(21.7)	
Technicians wage	0.0253*	0.0001	0.1001***	0.0613***	0.78
	(2.5)	(0.2)	(10.8)	(9.3)	
Managers wage	0.0232*	0.0007 *	0.1802***	0.0761***	0.83
	(2.5)	(2.3)	(25.6)	(15.0)	

t-statistics in parentheses. *** = significantly different from zero at 99.9% ** = significantly different from zero at 99% * = significantly different from zero at 95%.

Table 7: Exporter premia: Levels and growth rates prior to exporting

	Levels			*Growth rates*		
Dependent variable	Exporter	R^2	N	Exporter	R^2	N
Wages per worker						
Average wage	0.0627***	0.42	26866	0.0186**	0.02	32424
	(4.8)			(2.9)		
Blue collar wage	0.0224	0.35	26812	0.0191*	0.02	32297
	(1.7)			(2.5)		
White collar wage	0.0377*	0.35	24583	0.0256**	0.01	29110
	(2.4)			(2.6)		
Technicians wage	0.1491***	0.37	8694	-0.0028	0.02	9104
	(5.0)			(-0.2)		
Managers wage	0.1453***	0.42	16315	0.0011	0.01	18589
	(5.4)			(0.1)		
Productivity & capital						
Sales/worker	0.2437***	0.48	26846	0.0319**	0.01	32392
	(8.8)			(3.2)		
Value added/worker	0.2058***	0.41	26801	0.0407***	0.01	32300
	(8.7)			(3.3)		
Inv. in mach./worker	0.5068***	0.12	16192	0.1413*	0.01	14656
	(6.5)			(2.1)		
Investment/worker	0.4880***	0.17	20527	-0.0046	0.01	32420
	(7.0)			(-1.9)		
Capital/worker	0.2781***	0.33	26792	0.0502***	0.01	32335
	(6.6)			(4.9)		
Nonprod./total workers	0.0298***	0.26	26867	0.0018	0.00	32426
	(5.2)			(0.7)		
Employment and sales						
Total employment	0.6717***	0.22	26867	0.0139*	0.01	32426
	(22.2)			(2.0)		
Blue collar workers	0.6403***	0.19	26812	0.0094	0.01	32297
	(19.7)			(1.1)		
White collar workers	0.8216***	0.26	24583	0.0165	0.00	29110
	(19.7)			(1.3)		
Technicians	0.4379***	0.17	8694	0.0419*	0.01	9104
	(9.7)			(2.2)		
Managers	0.2691***	0.11	16315	0.0233	0.01	18589
	(9.5)			(1.8)		
Sales	1.0237***	0.37	26846	0.0462***	0.02	32392
	(22.5)			(4.7)		

Regressions include industry, region, and year dummy variables. The regressions in levels also include the log of total employment, except when the dependent variable is total employment, employment by type, or sales. t-statistics in parentheses. *** = significantly different from zero at 99.9% ** = significantly different from zero at 99% * = significantly different from zero at 95%.

Table 8: Exporter premia: Growth rates for various horizons

	One-year horizon			*Three-year horizon*			*Five-year horizon*		
Dependent variable	Exporter	R^2	N	Exporter	R^2	N	Exporter	R^2	N
Wages per worker									
Average wage	0.0028	0.01	21769	0.0011	0.03	13418	0.0057	0.05	7004
	(0.3)			(0.2)			(1.4)		
Blue collar wage	0.0025	0.01	21664	-0.0046	0.02	13344	0.0008	0.03	6964
	(0.2)			(-0.8)			(0.2)		
White collar wage	0.0023	0.01	20011	0.0014	0.02	12311	0.0099	0.04	6397
	(0.2)			(0.2)			(1.6)		
Technicians wage	-0.0010	0.02	6411	-0.0098	0.05	3621	-0.0132	0.11	1861
	(-0.0)			(-0.7)			(-1.1)		
Managers wage	-0.0186	0.01	13085	0.0023	0.03	7747	-0.0017	0.05	3944
	(-0.9)			(0.2)			(-0.2)		
Productivity & capital									
Sales/worker	-0.0018	0.01	21755	0.0160	0.03	13409	0.0157*	0.05	6998
	(-0.1)			(1.8)			(2.0)		
Value added/worker	-0.0050	0.01	21707	0.0044	0.02	13381	0.0153	0.05	6984
	(-0.3)			(0.4)			(1.9)		
Inv. in mach./worker	0.0908	0.01	9369	0.0424	0.03	5756	0.0283	0.04	2991
	(0.8)			(0.8)			(0.7)		
Investment/worker	-0.1150	0.09	17114	-0.1074***	0.18	10798	-0.0495*	0.22	5609
	(-1.8)			(-3.5)			(-2.1)		
Capital/worker	0.0071	0.01	21722	0.0021	0.03	13392	0.0050	0.05	6991
	(0.5)			(0.2)			(0.5)		
Nonprod./total workers	0.0022	0.00	21770	0.0072**	0.02	13419	0.0050*	0.04	7005
	(0.5)			(3.1)			(2.4)		
Employment & sales									
Total employment	0.0307**	0.01	21770	0.0247***	0.03	13419	0.0246***	0.06	7005
	(2.8)			(3.6)			(3.8)		
Blue collar workers	0.0332*	0.01	21664	0.0105	0.03	13344	0.0144	0.05	6964
	(2.4)			(1.2)			(1.8)		
White collar workers	0.0171	0.00	20011	0.0454***	0.02	12311	0.0427***	0.04	6397
	(0.9)			(3.9)			(4.1)		
Technicians	0.0539	0.01	6411	0.0738***	0.05	3621	0.0458**	0.08	1861
	(1.9)			(4.0)			(2.7)		
Managers	0.0370	0.01	13085	0.0382**	0.03	7747	0.0381***	0.06	3944
	(1.8)			(3.1)			(3.4)		
Sales	0.0289	0.02	21755	0.0405***	0.04	13409	0.0402***	0.07	6998
	(1.9)			(4.3)			(4.7)		

Dependent variables are annualised log differences over horizons of 1, 3, and 5 years. Regressions include industry, region, and year dummy variables. t-statistics in parentheses. *** = significantly different from zero at 99.9% ** = significantly different from zero at 99% * = significantly different from zero at 95%.

Table 9: Exporter premia: Growth rates for various horizons ending in the years 1989 to 1991

	One-year horizon			*Three-year horizon*		
Dependent variable	Exporter	R^2	N	Exporter	R^2	N
Wages per worker						
Average wage	0.0217	0.02	9976	0.0074	0.03	8380
	(1.7)			(1.2)		
Blue collar wage	0.0154	0.02	9913	0.0006	0.03	8329
	(1.0)			(0.1)		
White collar wage	0.0098	0.01	9259	0.0088	0.03	7742
	(0.5)			(0.9)		
Technicians wage	-0.0186	0.03	3027	-0.0023	0.07	2297
	(-0.4)			(-0.1)		
Managers wage	-0.0299	0.02	6294	0.0312*	0.05	4960
	(-1.0)			(2.0)		
Productivity & capital						
Sales/worker	0.0540*	0.02	9971	0.0118	0.03	8375
	(2.5)			(1.0)		
Value added/worker	0.0551*	0.01	9946	0.0043	0.02	8358
	(2.0)			(0.3)		
Inv. in mach./worker	0.2716	0.02	4368	0.0021	0.04	3602
	(1.7)			(0.0)		
Investment/worker	0.0404	0.01	9080	-0.0698	0.18	7244
	(0.7)			(-1.9)		
Capital/worker	0.0372	0.01	9956	0.0017	0.03	8364
	(1.7)			(0.1)		
Nonprod./total workers	0.0070	0.01	9977	0.0087**	0.02	8381
	(1.2)			(2.9)		
Employment & sales						
Total employment	0.0276	0.02	9977	0.0256**	0.04	8381
	(1.8)			(2.9)		
Blue collar workers	0.0415*	0.01	9913	0.0116	0.03	8329
	(2.1)			(1.1)		
White collar workers	-0.0018	0.01	9259	0.0525***	0.02	7742
	(-0.1)			(3.5)		
Technicians	0.0461	0.03	3027	0.0885***	0.09	2297
	(1.0)			(3.5)		
Managers	0.0409	0.01	6294	0.0310	0.03	4960
	(1.3)			(1.8)		
Sales	0.0817***	0.03	9971	0.0376**	0.05	8375
	(3.8)			(3.1)		

Dependent variables are annualised log differences over horizons of 1 and 3 years. Regressions include industry, region, and year dummy variables. t-statistics in parentheses. *** = significantly different from zero at 99.9% ** = significantly different from zero at 99% * = significantly different from zero at 95%.

Table 10: Exporter premia: Growth rates for various horizons controlling for current export status

Dependent variable	One-year transitions In	Out	Stay	R^2	Five-years transitions In	Out	Stay	R^2
Wages per worker								
Average wage	0.0146	-0.0086	0.0093	0.01	0.0232***	-0.0009	0.0093	0.06
	(1.8)	(-0.5)	(0.8)		(8.3)	(-0.1)	(1.6)	
Blue collar wage	0.0114	0.0011	0.0041	0.01	0.0211***	-0.0015	0.0016	0.04
	(1.2)	(0.1)	(0.3)		(7.0)	(-0.2)	(0.3)	
White collar wage	-0.0007	0.0007	0.0039	0.01	0.0098*	0.0028	0.0130	0.04
	(-0.1)	(0.0)	(0.2)		(2.4)	(0.3)	(1.6)	
Technicians wage	0.0081	-0.0624	0.0290	0.02	0.0045	-0.0356	-0.0063	0.1
	(0.3)	(-1.3)	(0.9)		(0.5)	(-1.8)	(-0.4)	
Managers wage	0.0303	-0.0383	-0.0070	0.01	0.0100	-0.0093	0.0074	0.05
	(1.7)	(-1.1)	(-0.3)		(1.4)	(-0.6)	(0.6)	
Productivity & capital								
Sales/worker	0.0896***	-0.1222***	0.0628***	0.01	0.0542***	0.0097	0.0180	0.05
	(6.7)	(-4.6)	(3.3)		(9.8)	(0.8)	(1.6)	
Value added/worker	0.0575***	-0.1006**	0.0473*	0.01	0.0483***	0.0056	0.0210	0.05
	(3.4)	(-3.1)	(2.0)		(8.6)	(0.4)	(1.8)	
Inv. in mach./worker	-0.1864*	-0.0345	0.1323	0.01	-0.0227	0.0216	0.0426	0.04
	(-2.0)	(-0.2)	(1.0)		(-0.8)	(0.4)	(0.9)	
Investment/worker	-0.1522**	-0.1840	-0.0739	0.09	-0.0084***	-0.0104*	-0.0219***	0.08
	(-2.7)	(-1.7)	(-0.9)		(-4.0)	(-2.1)	(-5.0)	
Capital/worker	0.0264*	0.0110	0.0048	0.01	0.0403***	0.0044	0.0020	0.05
	(2.1)	(0.4)	(0.3)		(6.2)	(0.3)	(0.1)	
Nonprod./total workers	0.0060	-0.0101	0.0085	0.00	0.0069***	0.0021	0.0076**	0.03
	(1.7)	(-1.5)	(1.7)		(5.0)	(0.7)	(2.6)	
Employment & sales								
Total employment	0.0281**	0.0024	0.0454***	0.01	0.0115*	0.0108	0.0236*	0.05
	(3.0)	(0.1)	(3.4)		(2.5)	(1.0)	(2.4)	
Blue collar workers	0.0135	0.0014	0.0501**	0.01	-0.0008	-0.0029	0.0161	0.04
	(1.1)	(0.1)	(2.9)		(-0.1)	(-0.2)	(1.4)	
White collar workers	0.0437**	-0.0421	0.0485*	0.01	0.037***	0.0175	0.0515***	0.03
	(2.7)	(-1.3)	(2.1)		(5.0)	(1.1)	(3.4)	
Technicians	-0.0019	0.0463	0.0511	0.01	0.025*	0.0396	0.0405	0.07
	(-0.1)	(0.9)	(1.5)		(2.0)	(1.4)	(1.9)	
Managers	0.0270	0.0290	0.0451	0.01	0.0277***	0.033	0.0364*	0.05
	(1.5)	(0.9)	(1.7)		(3.5)	(1.9)	(2.5)	
Sales	0.1178***	-0.1199***	0.1082***	0.02	0.0661***	0.0204	0.0416**	0.06
	(9.3)	(-4.8)	(5.9)		(10.2)	(1.4)	(3.1)	

Dependent variables are annualised log differences over horizons of 1 and 5 years. Regressions include industry, region, and year dummy variables. t-statistic in parentheses. *** = significantly different from zero at 99.9% ** = significantly different from zero at 99% * = significantly different from zero at 95%.

NOTES

[1] See e.g. Krueger and Tuncer [1982], Feder [1983], Nishimizu and Robinson [1984], Dollar and Sokoloff [1990], Esfahani [1991], Edwards [1992], Sachs and Warner [1995], and Harrison [1996].

[2] A World Bank project made a pioneering effort in collecting and analysing large manufacturing data sets of a series of developing countries. See Tybout [1992], Liu [1993], Tybout and Westbrook [1995], and the volume edited by Roberts and Tybout [1996].

[3] See Berry [1992] for a review of studies of Colombia, Brazil, and other countries; Aw and Hwang [1995] for a study on Taiwan's electronic equipment industry; Bernard and Jensen [1995] for the U.S. and Bernard and Wagner [1997] for Germany.

[4] Yet, the evidence against the learning-by-exporting hypothesis is not fully conclusive. Aw, Chung, and Roberts [1998], Kraay [1999], and Bigsten et al. [1999] find some evidence in its favour using data from, respectively, Taiwan, China, and four African countries.

[5] Based on their own econometric results, Clerides et al. [1998, p. 931] suggest that 'the bias associated with cost function estimators that treat lagged participation as exogenous may be negligible'.

[6] See Roberts [1996] for a description of the data set.

[7] For comparison, 14.6% of U.S. plants exported 10% of their sales in 1987 [*Bernard and Jensen*, 1995, p. 77], and 44% of the plants in Lower Saxony, Germany exported 40% of their output in 1992 [*Bernard and Wagner*, 1997, p. 137].

[8] See Bernard and Jensen [1995, p.77] and Bernard and Wagner [1997, p. 138].

[9] The AMS asks plants to report their total wages and benefits paid during the year and the number of employees as of November 15 of each year, for different categories of labour. I compute wages per worker as the ratio between both figures.

[10] These findings corroborate previous results by Ocampo and Villar (1995) from a sample of 991 manufacturing exporters from the 1990 Colombian Annual Manufacturing Survey.

[11] Bernard and Wagner [1997] also include production worker hours and a multi-plant dummy, variables that are not available for the Colombian data set.

[12] The data also suggests the presence of an unobservable characteristic (perhaps unionisation or efficiency wage considerations) that makes larger plants pay better wages, especially to blue collar

workers, while other unobservable characteristic (perhaps workers' skills) makes the more capital intensive plants pay higher wages to white collar workers and managers.

[13] Incidentally, a comparison of the estimates obtained for the three countries reveals that exporter premia tends to be larger in Colombia than in the U.S and Germany.

[14] Of the 70983 observations of the full sample, 10510 were eliminated because the plants exported in at least one of their first three years, 5688 because the plants had less than 4 observations, and 7469 because the plants had at least one missing annual observation.

[15] As a result, the 'treatment group' (future exporters) includes one or two observations per plant, while the 'control group' (non-exporters) includes more than one observation per plant.

[16] These are plants that started to export between 1984 and 1986.

[17] The sub-sample includes plants that entered the export market between 1988 and 1990 for one-year horizons and between 1986 and 1988 for three-year horizons.

[18] Interestingly, the growth differential in the employment of managers over a three-year horizon is not significant during 1989-1991, but the wage of managers grows significantly faster for exporters than for non-exporters, suggesting a scarcity of managers among export firms.

[19] Table 8 shows a negative growth differential in the investment/worker ratio for new exporters. This suggests that some plants must have undertaken important investments during the year of entry into exporting. Plant-level investment time series, though, are often very erratic, so we cannot discard the presence of outliers in influencing the strong negative estimated coefficient.

[20] In an additional series of estimations of the regressions shown in Table 8 I included additional controls for initial levels of employment, wage, and the ratio of non-production to total workers, following Bernard and Jensen [1999a]. The controls do not modify the general pattern described.

[21] Now the 'treatment group' (new exporters) may include up to two observations per plant: one for the entry year and another for *n* years after entry.

[22] See Bernard and Jensen [1999b] for a similar argument for the United States.