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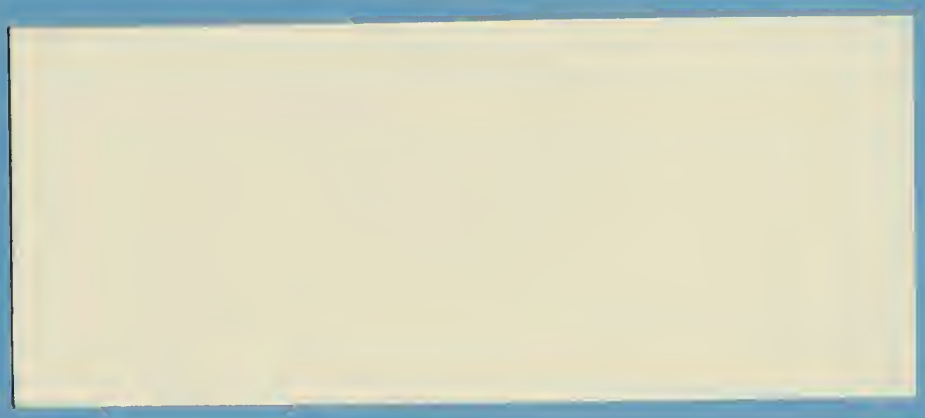

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EXPORTERS, JOBS AND WAGES IN U.S. MANUFACTURING: 1976-1987[1]

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Abstract

The issue of international competitiveness is close to the surface in debates regarding trade and industrial policy. Exporters are touted as "winners" in the global competition. While exporters are perceived and reported to be winners, and thus especially important to the domestic economy, few facts are available on the performance or structure of these firms. This paper documents the role of exporters in U.S. manufacturing from 1976-87. Using newly available plant level data for more than 50,000 establishments, the paper describes a variety of characteristics of exporting plants. The paper also examines the performance of exporters, focusing on employment, output, and labor productivity growth. The major results show that exporters are important to the domestic economy. In the cross-section, exporters account for a large share of manufacturing activity and are larger, more productive, and pay higher wages than non-exporters, . Additionally, exporters exhibit better short-term growth than non-exporters. However, long-term performance is conditional on the exporting status of the plant over the period under consideration; plants that become exporters grow the most, plants that cease exporting exhibit poor relative performance.

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[2] Opinions expressed in this paper are those of the authors and do not necessarily reflect official positions of the Bureau of the Census.

1. Introduction

Perhaps at no point in recent years has the debate over the direction of trade policy so demanded public attention. Whether it is Al Gore and Ross Perot clashing on national television about the merits and pitfalls of NAFTA, or individual members of Congress attempting to provide additional protection for domestic industries in the GATT treaty, the debate over the pace and scope of changes in trade regulations and tariffs is omnipresent. Both proponents and opponents of NAFTA and GATT have argued that the implementation of these treaties will have large and important effects on the domestic economy.

Close to the surface in this debate is the issue of U.S. manufacturing "competitiveness." The experience of increasing import competition, particularly from export-led economies like Japan, Korea, Singapore, and Taiwan, concurrent with stagnant living standards over the 70's and 80's and decreasing employment in manufacturing, has left some people wondering aloud about the competitiveness of U.S. manufacturing. The concerns include the long-term viability of important industries and the number of jobs and level of wages associated with them.

Opponents of free trade suggest that more openness will exacerbate these trends. Proponents of free trade suggest that lower trade barriers will reduce the costs of goods to consumers and will provide more markets for American exporters. In the new era of global competition, exporters are touted as winners, and thus should be supported. There is a perception that exporters are more "competitive" than non-exporters, and are "good" for the economy. Exporters are believed to be more productive, more profitable, and provide more, or better, employment opportunities. Based on the belief that exporters are good for the economy, programs are advocated to support and advance exporting and exporters.

While the arguments rage, the scope of solid information about the role of exporters in the U.S. economy is scant. The debates, both academic and public, have centered on the ability of industries to adapt to the provisions of the treaties; however, there has been little accompanying evidence presented about the effects of trade, exchange rate, or foreign demand shocks on domestic firms. Discussions usually focus on industries and regions and rarely provide information about the nature of exporting plants or firms. In this paper, we step back from the controversies regarding the merits of free trade and explore the role of exporting plants in the manufacturing sector. Are exporters different from non-exporters within the same industry? If exporters are different, are these differences meaningful in terms of performance? We provide a picture of the structure of U.S. manufacturing exporters and how they perform over time.

This paper attempts to fill a gap in our knowledge of the role of exporters in the manufacturing sector. Making use of panel data on a large cross-section of manufacturing plants, we explore the role of exporting establishments in the U.S. Since, to our knowledge, there have been no comprehensive studies of exporting at the plant or firm level, we provide a multitude of facts about exporting industries and exporting establishments. Traditionally, the study of international trade, and thus exports, has used countries or industries as the relevant unit of observation. Countries trade, and particular industries export, due to differences in technology, endowments, and the structure of production. This focus on differences at the industry level potentially masks important heterogeneity across plants within industries. We make use of exactly this heterogeneity to develop our understanding of the role of exporting in plant performance and structure. We focus on the decision to export at the firm, or plant, level. Firms decide to export for the same reasons that they decide to enter domestic production, i.e., to maximize profit. Exporting is thus analogous to the decision to enter a new product market. Firms weigh sunk costs, the opportunity cost of waiting, the level and variance of expected returns and the market structure in considering entry. In developing an understanding of the factors that enter the decision of the firm to begin exporting, we document the changes in production structure, particularly the levels of

employment and wages, and formally test for the presence of sunk costs in the exporting decision.

To guide us through the vast quantity of information available from our panel of manufacturing plants, we focus on a narrowly specified set of questions. Are exporters important in the manufacturing sector in terms of shipments and employment? If so, does their structure of production differ from that of non-exporters? In particular, what is their role in the labor market - do they provide so-called 'good jobs' at 'good wages'? Finally we tackle the daunting question of what determines plant success or failure by asking whether the sample of export plants can help us understand which plants succeed and which fail. Along the way we focus on the response of domestic industries to foreign demand and exchange rate shocks and provide some evidence on the presence of hysteresis in U.S. exports.

It is not immediately obvious that exporters should be distinguished from other manufacturers. Although direct exports as a share of manufacturing have risen from 3.9% in 1963 to 9.0% in 1988, this is still a relatively small share of total output and thus the overall importance of exporters, and exports, is potentially overemphasized by economists. We will start by considering the importance of exporting establishments in total U.S. manufacturing. While exporting establishments made up only 10.4% of manufacturing plants in 1976 and 14.6% in 1987, these plants accounted for over 50% of total shipments and 40% of total employment in both years. Exports per se are a small fraction of shipments at each plant, but the plants that manufacture them play a larger role in overall production.

Although exporters are a substantial presence in the manufacturing sector, there remains the issue of whether they are different from non-exporters. Throughout the paper we focus on two main competing hypotheses. First, we assume that export markets do not differ substantially from domestic markets except for their locations and associated transport costs. Under this assumption, exporters should not differ from their non-exporting counterparts either at a point in time or in their subsequent performance.

Alternatively we consider the idea that selling in international markets is a special and difficult status for a plant to achieve. This corresponds to the notion that exporters are 'winners' in the global race to be competitive. If true, this hypothesis suggests that exporters should differ significantly in terms of size and productivity from non-exporters in the same industry in any year.[3] To distinguish between the hypotheses, we consider whether exporters and non-exporters differ in their structure of production within industries.

In addition to static comparisons of the two types of plants, we consider their productivity, employment, sales, and wage growth over time. If participating in international markets provides a benefit to plants, perhaps through increased awareness of productive and/or market possibilities, then we might expect to see faster productivity and output growth at exporting plants. Conversely, if exporting plants are merely contemporaneously successful and receive no additional long term gains from selling abroad, then we would expect no significant differences between exporters and non-exporters.

The policy debate over trade and jobs has often focused on the question of whether exporting industries are creating so-called 'good' jobs. We concentrate instead on the concept of 'good' plants. We consider several potential interpretations of 'good' plants, including those that have higher labor productivity levels and growth rates, above average job creation, offer higher pay, and increased chances of survival.

To determine if exporters offer 'better' jobs than non-exporters, we test whether exporters pay higher than expected wages given plant and industry characteristics. Additionally, we look at labor productivity in exporting establishments and at their record of job creation and wage growth.

The results are revealing. Compared at a point in time, along every dimension exporters

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[3] This approach sidesteps the more difficult question of why exporters are different.

exhibit 'better' performance characteristics than non-exporters. Exporters are larger, more productive, and more capital-intensive. In addition, exporting establishments pay on the order of 10% to 24% more than non-exporting plants in the same 2-digit SIC classification. On average over 1976-87, a production worker in an exporting plant with 250-499 employees earned $3429 more than a production worker in a non-exporting plant of the same size. Non-production workers earned $2479 more in those same exporting plants.[4] After controlling for other inputs and variables known to be correlated with higher wages at the plant, the export wage premium is still significant and between 7% and 11% although industry variation accounts for much of the premium. These plant characteristics support the hypothesis that exporting is an activity undertaken by successful establishments.

The evidence on the benefits of export experience to the plant is mixed. Exporters do perform significantly better in the short run than non-exporters in terms of survival as well as in the growth of sales and employment. However, short run growth in other areas, such as labor productivity and wages, and long run performance in all areas is negatively correlated with export status in the initial year. The source of these negative correlations is not hard to find. The transition rate into and out of exporting is high; 18% of exporting plants exit the export market and 9% of non-exporters begin foreign shipments in an average year. These transition plants dominate the correlations of long run growth with initial export status. In particular, plants that start exporting increase employment, wages, productivity, and shipments at dramatically higher rates while plants that cease exporting fare poorly over short and long horizons.

The results show that exporters are important in terms of size and employment in the domestic economy and show all the characteristics of currently successful plants. Additionally, exporters exhibit better short-term growth than non-exporters. Long-term performance is conditional on the exporting status of the plant over the period under consideration; plants that become exporters grow the most, plants that cease exporting exhibit poor relative performance. Thus, exporting is associated with success. But, when we control for plant attributes that are associated with exporting (and that other studies show are associated with success), the performance differences between exporters and non-exporters decrease.

The paper is organized as follows: in Section 2, we discuss the data, its advantages and limitations. Section 3 analyzes the composition and structure of exports at the industry level. In Section 4 we present a set of stylized facts about exporting plants which hold even after controlling for industry, location and plant size. In Section 5, we document the labor market characteristics of exporting and non-exporting plants. Section 6 considers the dynamics at the plant level. To better understand the performance of exporting plants over time, we consider the value of export status as an indicator of future success of the plant in Section 7. Section 8 concludes and discusses the implications of the findings.

2. Data

2.1. Data Sources

We use newly available, detailed plant-level data from the Census Bureau's Annual Survey of Manufactures (ASM) to investigate the relationship between exporting and plant performance. The ASM surveys U.S. manufacturing establishments and collects information on production and non-production employment, production hours, salaries and wages, shipments, value-added, capital measures, ownership structure, and direct exports.

For exports, the ASM asks establishments to "Report the value of products shipped for

[4] These numbers are calculated in 1987 dollars.

export. Include direct exports and products shipped to exporters or other wholesalers for export. Also include the value of products sold to the United States Government to be shipped to foreign governments. Do not include products shipped for further manufacture, assembly, or fabrication in the United States." To the extent that plants do not know the ultimate destination of products they ship, these directly reported exports understate the true value of exports from establishments. The ASM was conducted in every year over the period 1976-1987; however, in 1978, 1979, and 1982 the direct export question was not asked. In 1987, every plant in the Census of Manufactures was asked to report direct exports. We use this Census to construct detailed cross-section comparisons and the ASMs to examine the performance of exporters and non-exporters over time.

While we are able to link plants' information across time, the ASM is not designed as a long-term panel. Instead, the ASM is a series of 5-year panels of U.S. manufacturing establishments. Each five years the sample is partially redrawn. Questionnaires are sent to about 56,000 of the 220,000 establishments that are surveyed in the Census of Manufactures (which occurs every five years). Some of the 56,000 establishments are included in the sample with certainty. These 'certainty' cases include establishments with large total employment (greater than 250 employees), establishments with large value of shipments, and establishments owned by large enterprises.[5] Other establishments are sampled with probabilities ranging from 0.99 to 0.005, based on the size and industry of the establishment. The sample is designed to be representative of the population of manufacturing establishments in terms of industry and plant size. Establishments are assigned weights which are inversely proportional to their sampling probabilities. The weights are used to produce aggregate industry totals.

The plant level data, while limited by the nature of the panel and sampling issues, gives us the ability to identify and control for differences between plants in the same industry.[6] This is important because of the considerable heterogeneity that exists within industries, even at the 4-digit SIC level. Size, production techniques, output, and propensity to export all vary considerably across plants within the same 4-digit SIC category.

Throughout this paper we refer to exporting plants or exporting firms. Our definition of an exporting plant is one that reports any magnitude of direct exports in the ASM or Census. We treat export status as the relevant plant characteristic and use a dummy variable for exporting in most of our analyses. An alternative approach might treat the share of exports from the plant as the appropriate plant-level variable. However, as will be shown presently, export share at the plant level is small and relatively stable across plants and over time. As a result, we focus on the role of exporters in the manufacturing sector and not on their volume of exports. None of our conclusions depend on this choice of the plant level export variable.

2.2. *Export Coverage by Industry and Sample*

As described above, we use two sources of plant-level data to examine the role of exporters in the manufacturing sector, the 1987 Census of Manufactures primarily for cross-section analyses and the Annual Surveys of Manufactures to study changes over time. Both surveys have potential drawbacks as data sources on exporting. Since these surveys only capture direct exports from establishments, they systematically undercount aggregate and industry exports. To identify the magnitude of this undercount, we compare the ASM direct export totals to data on all exports collected by the Foreign Trade Division (FTD) at the Census Bureau. The FTD data is collected at the port of export and, as a result, includes all exports. Figure 1 shows total exports from the FTD

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[5] While the criteria for inclusion in the panels has changed over time, particularly between the 1974-1978 ASM panel and subsequent panels, the general principle of sampling based on size and importance has held the period we study.

[6] Details on the variables used in the paper are presented in Appendix A.

series and direct exports from the ASM. The undercounting of exports by the ASM is evident throughout the time period, averaging about 70% of the Foreign Trade reported totals, and is particularly poor for 1987 when our calculated numbers capture only 60% of total exports.

Coverage by two digit industry exhibits substantial variation. When comparing industry totals from the FTD for 1976 and 1987, we find that ASM coverage is poorest in industries making up a small percentage of total exports.[7] These industries include textiles, apparel, wood, furniture, printing, leather, and miscellaneous manufacturing. The major exception is electronic equipment which comprises 11% of total exports in 1987. ASM direct exports for electronic equipment capture only 58% and 45% of the FTD total in 1976 and 1987 respectively.[8]

An additional shortcoming of the data is that the ASM sampling weights are not explicitly designed to aggregate exports. The sampling scheme is designed to provide accurate estimates of total employment and total shipments. Because of the sampling design of the ASM, the Census Bureau adjusts the weighted ASM totals before reporting them.[9] For most of our analyses, we avoid these problems by performing calculations at the plant level. However, whenever we report industry-level or aggregate numbers from the ASM these potential problems arise, so we briefly discuss their importance below.

To examine the coverage of our calculated ASM export totals, we use two reference points. We compare our weighted export totals to the published, adjusted ASM totals, and we compare our weighted 1987 ASM totals to the 1987 Census totals. Figure 1 shows how the aggregate numbers compare between the published ASM and our weighted ASM totals. Our weighted totals are close to the published, adjusted totals. In addition, industry tabulations from our data are within 5% of reported ASM direct exports for almost all industries.

Since we use Census numbers to conduct the cross-section analyses of the characteristics of exporting establishments, we also are interested in the relationship between Census totals and their ASM counterparts. Across two digit industries only 4 of 20 show differences in total exports of more than 5%, apparel, wood, printing and leather which total less than 3% of direct exports. In fact, the correspondence between the export totals in the Census and ASM is better on average than the correspondence between reported employment and shipments figures.[10]

3. Exporting Industries

For the most part, we focus on the role of exporting at the plant level, considering within industry heterogeneity. However, substantial differences exist at the industry level and we briefly review them here.

3.1. Export Concentration: Sectoral and Geographic

Table 1 reports industry characteristics on the percentage of shipments and exports, average plant size at exporters and non-exporters, and average shipments exported at exporting plants.

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[7] Since small plants are undersampled in the ASM, we find that industries dominated by smaller establishments are poorly covered. The poor coverage could also be due to the fact that small plants are less likely to export directly.

[8] This is troubling because computer related equipment falls in this category and represents and an increasing share of total exports during the period.

[9] Unfortunately, we do not have access to the adjustments that are made to the data, and thus our weighted ASM totals will not match the published ASM totals. Weighted export totals are not the only aggregates that are adjusted for ASM publication; employment, shipments, and other aggregates are also adjusted. For a more detailed discussion of ASM sampling issues see Davis, Haltiwanger and Schuh (1991).

[10] Coverage is less precise for more disaggregated industries, although most four digit industries in the ASM are within 10% of the corresponding Census totals.

Large industries, those accounting for more than 5% of total shipments, include (in descending order) transportation equipment, food, chemicals, machinery, electronic equipment, and petroleum. With the exceptions of food and petroleum and the addition of instruments, these industries also dominate total direct exports. In fact, exports are much more heavily concentrated in these sectors, transportation equipment accounts for 27% of exports and 14% of total shipments, while electronic equipment is almost 13% of exports and 9% of shipments. Looking at exporting establishments, we find they are also concentrated in these sectors, although less so than shipments, 7 different industries show more than 20% of plants exporting.

Plant size is substantially larger for exporters (253 employees) than non-exporters (58 employees). This is true within every industry although the size differences are not systematically related to the prevalence of exports in total shipments. While the percentage of exporting establishments varies considerably across industries, from 43% in instruments to 4% in apparel, the percentage of output shipped abroad by an average exporter does not vary much. In 13 of the 20 industries, exporters ship between 7%-15% of their total product abroad.

Table 2 reports export characteristics by states. 14.6% of all manufacturing plants report direct exports in 1987 and there is little variation across states. As with industry totals, exports are concentrated in states with large fractions of total manufacturing. Relative to their share in output, only Alaska, West Virginia, Vermont, and especially Washington are particularly intensive in exports.

4. Characteristics of Exporting Plants

While it is common knowledge that General Motors and Boeing are perennial top-ranked U.S. exporters,[11] few facts are available about the systematic differences between exporting and non-exporting firms or plants. In this section, we develop a basic set of facts about the production and ownership structure of exporting plants and firms. We consider whether the facts hold over time and across plants of different sizes. In addition, we provide evidence on the robustness of the facts over different industries and regions.

Taking the plant as the unit of analysis, we calculate plant means separately for exporting and non-exporting establishments in 5 categories: size, labor productivity, labor inputs, capital intensity and ownership structure. In Table 3 we report these means for all plants in the 1987 Census. Table 4 calculates the means for two broad size categories from the same Census, small establishments, i.e. those with fewer than 250 employees, and larger establishments with more than 250 employees. In Table 5 we consider the variation across time and report means for large plants (500+ employees[12]) in 1977 and 1987 to examine how exporting plants have changed over time.

Perhaps the most striking difference between exporters and non-exporters is their size disparity; exporters are substantially larger than non-exporters both in terms of shipments and employment. On average, exporters are over 4 times larger in terms of employment and over 6 times larger in terms of the value of shipments. Even within size categories, exporters are significantly larger. In 1977, of plants with 500 or more employees, exporters were larger in terms of both employment and shipments, 43% and 67% respectively. In 1987, even though the average size of manufacturing establishments had fallen,[13] the size differential between exporters and non-exporters had increased to 46% for employment and 94% for output.

Exporting plants are also more productive than their non-exporting counterparts with higher

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[11] See *Fortune*, August 22 1994 p. 132.

[12] As plants of this size are sampled with certainty in the ASM, we can be certain that our coverage within the size class is complete. In addition, plants with more than 500+ employees account for over 68% of total exports in both years.

[13] See Davis and Haltiwanger (1991).

shipments per employee and value-added per employee. Labor productivity, whether measured by shipments or value-added, was approximately a third greater for exporters across both large and small plants in 1987. Over time the gap actually widened by more than 7% for the largest plants.

Exporting plants show higher levels of compensation per worker across all measures, both wages and benefits, for all categories of workers.[14] Additionally, benefits per employee are higher at exporting establishments. The wage differentials between the plant types were substantially bigger for large plants, especially for production workers, 26% in plants with 250 or more employees in 1987. Over time, in the largest establishments, the gap increased slightly for both categories of employees.[15]

Capital inputs differ for exporters and non-exporters as well. Capital-labor ratios are higher at exporting establishments as are investment rates in machinery and equipment per employee. Exporters are considerably more capital intensive than non-exporters, especially in large plants where the capital-labor ratios and investment rates are more than 45% greater. Again the largest category of plants showed a slight increase in the gap between exporters and non-exporters from 1977 to 1987.

While exporters are more likely to be part of a multi-plant firm, we find looking at the differences across size categories that this is due primarily to the size distribution of exporters. Over 85% of large plants of both types are members of larger firms.

4.1. Controlling for Industry, Size and Location

As shown in Section 3, the incidence of exporting varies substantially across industries. While the facts reported above hold over time and across broad size categories, there remains the possibility that the differences between exporters and non-exporters are due primarily to location or industry group. To more precisely estimate the difference between exporters and non-exporters, we calculate the percentage differences for the stylized facts after controlling for 4-digit SIC industry classifications and state-SMSA[16] geographic dummies. In addition, to account for the probable differences in production structure across plants of different sizes we also control for plant size as given by total employment.

Table 6 reports the percent differences in the characteristics after controlling for these factors. The coefficient on the export status dummy is strongly positive and significant for all the characteristics. Considering measures of plant size, we find confirmation for the anecdotal evidence that exporters are substantially larger than non-exporters even within industries and regions. Employment at exporting plants is more than 93% greater than at non-exporters within the same 4-digit industry. The total value of shipments is 110% higher at exporters than non-exporters.[17]

Examining the labor market, we find plant wages are on average 9% higher in exporting establishments than in non-exporters of a similar size in the same industry and location. Looking at wages by worker category, the exporter wage premium is slightly smaller, 7.4% for production

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[14] Throughout this paper we refer to this variables as wages. A more precise definition might be earnings since the numbers represent annual receipts and not hourly compensation.

[15] Osterman (1994) reports from a 1992 establishment survey that selling in international markets is positively correlated with the introduction of modern flexible work practices. The relationship between these practices and higher compensation is less obvious.

[16] There are 448 regional dummies which are state dummies interacted with SMSA dummies where appropriate, i.e. a plant within a SMSA in a given state is different than a plant in the same state outside the SMSA. Also two plants in different states in the same SMSA receive different region dummies.

[17] This log approximation actually underestimates the size differences.

workers and 5.4% for non-production workers. The higher average wage differential in part reflect the composition of the workforce. Non-production workers account for 12.4% more of total employment at exporting establishments.[18] As found in other studies, higher wages are not offset by lower non-wage benefits. Total non-wage benefits, including both mandated and supplemental, were also substantially higher (12.7%) at exporting plants. These facts taken together confirm that there remain substantial differences in labor force characteristics at exporters and non-exporters.

Measures of factor intensity and labor productivity are also significantly higher for exporters. The capital labor ratio is 9.3% greater for exporters than non-exporters and correspondingly the rate of investment per employee is almost 4% greater.[19] Perhaps not surprisingly given the labor market and capital characteristics, we also find measures of labor productivity such as shipments per worker are almost 15% greater for exporters. Finally, exporters are 8% more likely to belong to a multi-plant firm.

This section has detailed plant level differences between establishments that export some of their product and those that export none. The portrait of the typical exporting plant is one that is much larger, pays higher wages, is more capital-intensive, and more productive than its non-exporting counterpart. These plant characteristics hold over time, across size classes and are even true within fairly narrowly defined industries and regions. In the next section, we examine in more detail the labor market attributes of this sets of plants.

5. Exporters and the Labor Market

5.1. Wage Premia for Exporters

The existence of inter-industry wage differentials has been documented and analyzed by a variety of authors. Using data from the CPS, Krueger and Summers have shown that after controlling for observable worker characteristics there remain substantial industry wage premia.[20] Partly in response to these findings, authors have suggested a variety of sources for the persistent industry-level wage gaps. The explanations fall into two main categories. One strand of the theoretical literature maintains that labor markets are perfectly competitive and that observed industry differentials can be understood in the context of either unobserved worker characteristics, such as innate ability, motivation, and non-education training, or through unobserved job characteristics which affect workers' utility and must therefore be compensated through wages.

A more recent explanation for industry wage differentials comes from the efficiency wage literature which argues that wage premia across industries cannot be accounted for by either worker or job characteristics. Instead, proponents in this literature suggest that wages are above the competitive return to labor, even after considering the unobserved job and worker characteristics that affect utility and marginal product. Numerous reasons are cited for the existence of non-competitive wages in profit-maximizing firms, including the desire to increase effort, minimize turnover, induce loyalty, and select high-skilled employees.[21]

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[18] The higher employment share of non-production workers at exporting plants coupled with gains in their share of total manufacturing employment contributed substantially to the rise in wage inequality across these types of workers in the manufacturing sector during the 1980's. See Bernard and Jensen (1994).

[19] Other studies using these data sources have found that a substantial fraction of plant level investment is bunched in relatively short time periods, see Roberts and Dunne (1993). This should not effect the estimate of average investment per worker rates across exporters and non-exporters, but limits our ability to discuss in detail the investment characteristics of these plants.

[20] See Krueger and Summers (1988).

[21] In this tradition are studies by Katz (1986), Krueger and Summers (1988), and Katz and Summers (1989a).

Both the competitive and efficiency wage arguments for wage premia are relevant for our study of exporting establishments. If production for export requires more highly skilled workers than production for domestic sale, then exporting plants should pay higher wages, even within fairly detailed industry classifications. This will be true particularly if standard industry classifications hide a large degree of product heterogeneity, as is the case for 4-digit SIC codes. Unobserved job characteristics will play a similar role in raising wages in exporting plants.

The standard efficiency wage arguments might also apply in the case of exporters. If export production requires increased monitoring or worker effort, possibly to reduce the incidence of product defects, or if worker quality selection is more important for exporters, then we would expect to see higher wages. Since efficiency wage arguments are often at the firm or plant level, we would expect plant characteristics to be an important determinant of wages.[22]

One advantage of examining wages at the plant level is the ability to control for industry and location effects and to determine wage premia across plants within an industry. In addition, the panel nature of the data will allow us to remove fixed plant effects and estimate the change in wages when a plant increases its exports or moves from producing entirely for domestic consumption to exporting some of its production.

Under either interpretation, efficiency wage or competitive labor market, the existence of a wage premium at exporting establishments will confirm their relative importance in the domestic manufacturing sector.

5.2. Plant Level Evidence on Wages

In this section we lay out the basic results on the relationship between exports and wages. We consider first the existence of wage premia for exporters across plant characteristics. Previous work on plant level heterogeneity in wages has emphasized plant size and technology.[23] To determine if exporting plants with varying characteristics pay higher wages, we report average wage differentials over the period 1976-1987 in constant dollars per worker per year by plant characteristic, export status, and job type in Table 7. The numbers represent the difference between mean plant wages in that category and the mean wage for the overall sample of plants.

For every plant characteristic,[24] the exporter wage is larger (or less negative) than the non-exporter wages. This result holds across size, age, ownership and capital intensity categories. In addition, the premium exists for both production and non-production workers, and is slightly larger for production workers in categories with large, capital-intensive, and older plants, and plants that are part of a larger firm. The magnitude of the premium is substantial: for plants with between 1000 and 2499 employees, production workers in exporting establishments earn $2674 more than their counterparts in non-exporting plants. For non-production workers in the same size category, the export premium is even larger at $3356.

The size-wage premium found by others holds for both exporters and non-exporters across the two types of workers, although it is generally larger for production workers than non-production workers. An average production employee in the largest category of exporting plant earns $12387 more than an average production worker in an exporting plant with 20-49 workers, for non-exporters the gap is $11490. The export premium does not vary systematically with plant characteristics for either type of labor.

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[22] Davis and Haltiwanger (1991) argue that time series changes in the between and within plant dispersion of wages cannot be easily explained by non-competitive factors, such as efficiency wages.

[23] See Davis and Haltiwanger (1991) and Dunne and Schmitz (1993).

[24] The only exception is for production workers in plants with 2500-4999 employees, a category whose mean is dominated by a few outliers.

To see how these differentials have moved over time, Table 8 shows the 1976-1987 changes in the differentials in 1987 constant dollars. Most categories of plant characteristics show larger increases (or smaller decreases) in the wage premium for exporters during the period. In particular, the change in the wage differential is positive for most exporter categories and negative for most non-exporter categories suggesting that the differences between the two types of plants have increased over the period. Bigger plants saw an increase in the wage differential for exporters but not for non-exporters suggesting the increases in the size-wage premia found by others are due primarily to changes at plants that export.[25]

To test for the existence of wage differentials for exporters and non-exporters controlling for multiple plant characteristics, we estimate a simple wage regression. The basic relationship is given in Equation 5.1 below.

$$W_{ijt} = f(P_{it}, I_j, L_i, A_t, X_{ijt}) + \varepsilon_{ijt} \qquad \textbf{5.1}$$

where W_{ijt} is the log real wage in plant i, industry j, at time t . P_{it} represents a vector of plant variables changing over time, I_j are time-invariant industry-specific variables, L_i are location-specific variables, A_t are aggregate shocks over time, and X_{ijt} is the indicator of export status at the plant.

As shown in Section 4.1, exporting plants within 4-digit industries are larger, more capital intensive, and have higher labor productivity than their non-exporting counterparts. All of these characteristics raise wages, thus biasing upwards the export premium we observed at the 4-digit level. Our set of plant level controls includes the log of the capital-labor ratio, the age of the plant, the log of plant size measured by total employment, the log of production hours per production worker, and a dummy indicating whether the plant is part of a multi-plant firm. As our export variable, we report results including a dummy for whether a plant is exporting or not in the current period.[26]

Table 9 reports the results for a variety of specifications for total wages per employee.[27] Running the regression for the pooled sample from 1976-1987 including only plant characteristics and year dummies but no regional or industry controls (Column 1 in Table 9) yields an estimate of the export wage premium of 11.6%, statistically significant at the 1% level. The results suggest a very large wage premium in exporting plants even after controlling for plant characteristics known to increase wages. This simple specification accounts for 31.0% of the variation in average wages across plants and over time even without accounting for regional or industry effects. The plant characteristics enter significantly with the expected signs. Total employment and capital-intensity are positively related to the wage, as are production hours per production employee. Somewhat surprisingly, given the results on wage premia by plant characteristics in Table 7, the coefficient on the multi-plant firm dummy is negative and significant, indicating 3.6% lower wages at multi-plant firms.[28]

In column 2 in Table 9, we add controls for regional effects and variation across 2-digit industries. The export dummy remains significant although the magnitude of the premium is reduced. For total wages, the export premium is 4.4%. Since 2-digit industries are still extremely

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[25] This is not true for the largest category of exporting establishments where non-production workers saw a substantial decline in their wage premium over the period.

[26] Results including both the dummy for export status and the share of shipments exported by the plant were virtually identical to those reported here and are available from the authors by request.

[27] Ideally, we would want to estimate an hourly wage but hours for non-production employees are not collected in the ASM.

[28] This effect disappears when more disaggregated industry dummies are included.

heterogeneous, we re-estimate the wage regression controlling for 4-digit industries in column 3. Export status of the establishment still enters with a positive and significant coefficient, and the magnitude of the premium is essentially unchanged at 4.5%. This suggests that within 2-digit industries the exporter wage premium is relatively stable. Note that we are explaining over 52% of wage differentials across plants over time with this specification.

The premium in average wages at exporting plants could result from either higher wages for each type of worker or different compositions of workers at exporting than non-exporting plants. Using the two worker categories present in the ASM data, we estimate the wage premia for production workers and non-production workers for the three specifications reported above. Due to the lack of data on non-production worker hours we perform all estimations on annual wages and salary per worker. Looking at the two types of workers separately, we continue to find positive and significant wage premia, although the magnitudes are somewhat smaller. Only controlling for plant characteristics, exporters pay production workers 8.0% more than non-exporters while non-production workers receive 7.3% higher wages at exporting plants. After controlling for regional and industry differences, the wage premium for both worker types falls to between 2-3%. The substantial drop in the export premia for individual worker categories suggests that composition of the workforce may play a significant role in the cross-sectional dispersion of plant wages for exporters and non-exporters.[29] However, even controlling for 4-digit industry, the export premium is still positive and significant for both worker types.

These results confirm that exporting establishments pay systematically higher wages than their non-exporting counterparts even after controlling for plant, region, and industry factors that might raise wages. The premium is found for both high and low skilled workers. Since we do not have more precise evidence on the composition of workers at exporting and non-exporting plants, there remains the possibility that our results are driven by within plant heterogeneity or other omitted variables such as plant-specific technological intensity.[30] Since this could represent additional unobserved heterogeneity in the composition of the workforce, we take advantage of the large cross-section dimension of our panel and estimate our wage equations using plant fixed effects.

The fixed effects formulation provides additional evidence for an export wage premium (see Table 11). The coefficients must be interpreted somewhat differently from the earlier results, as the export dummy now represents the impact on wages of the within plant change from non-exporter to exporter controlling for changes in other plant characteristics and removing aggregate year effects. Column 1 reports the results from fixed effect model for average plant wages. The coefficient on the export dummy remains positive and strongly significant, although the magnitude of the premia for switchers is smaller at 1.7%. The results for production and non-production workers show wage changes of similar magnitudes. Production worker wages increase 1.2% in response to a switch from non-exporting to exporting by the plant while the increase in non-production worker wages is slightly larger at 1.8%. These results suggest that plants changing their export status are undergoing substantial changes in production structure.[31]

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[29] In a regression of the non-production share in total employment on the same set of controls, the export dummy is significant with a coefficient of 0.028.

[30] See Doms, Dunne, and Troske (1994).

[31] In the fixed effects specification with non-production employment share as the dependent variable, the export coefficient is significant but small at 0.002, confirming that plants switching export status also change their employment composition.

5.2.1. Instruments and Robustness Checks

In the preceding results there remains the possibility that the export status of the plant is proxying for another plant characteristic that is truly driving the wage differentials. To address this problem we employ a set of instruments, correlated with exports yet arguably uncorrelated with other changes in plant characteristics. To do this we must sacrifice some of the detail in our data set since there are no other available variables to use as plant level instruments for export status.

We use as instruments 4-digit SIC export-weighted exchange rates and 4-digit export-weighted foreign income variables. The foreign income variable is weighted aggregate income in the export destinations for a given industry. Using data on destinations of U.S. exports by 4-digit SIC classification we first construct annual export share weights for each country for each industry.[32] An average share of exports for each country for each industry over the period 1976-1987 is used as the final weight. The income variables are foreign GDP in 1985 prices, converted to US currency used PPP exchange rates calculated by Summers and Heston.[33] The country exchange rate measures are real exchange rate indices with 1976-77=100.[34]

Neither of these measures is likely to be correlated with plant or industry omitted variables, yet both have the potential disadvantage of possessing only weak correlation with plant level export status. However, an F-test in the first stage regression strongly rejects the null hypothesis that the instruments are uncorrelated with the export status of the plant.[35]

The results using the industry variables as instruments for plant export status are reported in Table 12. For average plant wage the export status variable is positive and significant and the estimated magnitude of the export effect has increased substantially to 0.29. For the two worker categories the estimate of the exporter dummy are insignificantly different from zero. These IV results provide additional evidence that composition effects are playing a large role in the wage increase at exporting plants.

To provide some evidence on the robustness of our results on the wage premium, we explore the effects on the export coefficients of splitting our sample of plants by labor productivity and size classifications. One possible explanation for the significant positive effects of wages on exports is rent-sharing due to increased labor productivity of exporting plants. The reasoning is that more efficient plants can overcome fixed costs associated with exporting and thus be competitive in foreign markets. Since we cannot control for labor productivity directly in our specification we split the sample into ten labor productivity categories based on initial value-added per worker. To avoid issues of different waves of the ASM discussed earlier we restrict ourselves to the years 1984-1987.[36] The export wage premium does not vary systematically with respect to initial labor productivity levels and remains significant, suggesting that the result is not driven by a correlation with plant labor productivity. However, the percentage of plants exporting does increase dramatically as labor productivity rises confirming the fact that high-productivity plants are more

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[32] We only consider exports to the top 25 countries ranked by value of US exports. These countries account for over 90% of US exports in every year. Exports for each country by industry come from the Census Foregin Trade Division Compro database for various years. These industrial classifications are matched with the 1972 4-digit industrial classifications used in the ASM and Census of Manufactures.

[33] See Summers and Heston (1991).

[34] Real exchange rates are calculated as nominal exchange rate adjusted for foreign and domestic inflation. While this measure might be problematic if used for comparison if income or consumption levels across countries, it yields an appropriate measure of the foreign price movements for each industry.

[35] The first stage is a linear probability model, the F-statistic on the joint significance of the two instruments is 49.31.

[36] There are still entering and exiting firms but this sample minimizes problems of comparing productivity levels across years.

likely to be exporters.

Another possible explanation for the export-wage relationship is the size-wage premium for large plants. Although we controlled for plant size in our specification through total employment, plant size still be playing a role. To check this we estimate the wage regressions separately for 10 size categories. Again the export premium remains across plant size categories.[37]

In this section, we have documented the existence of a wage premium in exporting plants for both production and non-production workers. This premium holds across all types of plants even after controlling for capital, size, labor productivity, and ownership characteristics. Wages also increase in plants that shift from non-exporting to exporting status.

5.3. Wage Growth

The results on wage differentials over time suggest that the export premium has been growing for plants in most categories. However, this is distinct from the issue of whether wages have been rising more rapidly at exporting plants. To determine whether export status is a good predictor for wage increases, we regress both annual and long run wage changes at individual plants on initial plant characteristics, including initial export status. We consider both the predictive value of knowing the plant's status in the initial year and the wage changes conditional on knowing the plant's export status in the initial and final years.

The results are reported in Table 13 and Table 14 for the annual changes. Average annual regressions of growth in wage per worker on export status in the initial year are given in Table 13 and show that for all worker types, changes in wages are negative for plants that are exporting in the initial year. The effects on both types of workers are small but significant, a 0.6% annual decline for production workers and a 0.4% decline for non-production workers in exporting plants relative to those in non-exporting establishments. Plant size in the initial year is positively correlated with wage growth while higher capital intensity is negatively correlated with wage growth.

In Table 14 we look at the export status of the plant in more detail by considering both the initial and final export status of the plant.[38] The negative coefficient on initial export status is driven largely by the strong relative wage decline in plants that stopped exporting. Relative wage growth was highest for plants that started exporting and was essentially identical in plants that exported throughout or who did not export in either year. These results confirm the findings of the fixed effects regressions performed above. Starting(stopping) exporting is significantly positively correlated with wage increases(decreases) for all types of workers. This is particularly true for non-production workers whose wages decrease 4.3% in plants that stop exporting relative to those in plants that begin exporting during the year. The magnitude of the starting and stopping effects is roughly symmetric.

Table 15 and Table 16 contain long run regressions where the dependent variables are percent wage changes from 1976 to 1987. Plants in this sample are those who were in the 1976 ASM and were still in existence in 1987. As a result the sample consists of 'successful' establishments. We consider the relative wage growth of plants within industries that stayed in operation. For all three wage variables, initial export status enters with a small, negative, and insignificant coefficient. Export status does not appear to predict above or below average wage changes over long horizons. Considering the effects of other plant characteristics, we find that initial plant size and the multi-plant status of the plant are both positively correlated with long-run wage increases, especially for non-production workers. Capital intensity again is negatively

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[37] These results are available upon request from the authors.

[38] While the exogeneity assumption for initial export status seems reasonable, this is not true for the final export of the plant. These results indicate correlations but not necessarily causality.

correlated with the wage changes.

Breaking the export status into the four beginning and ending categories, we again find plants that stop exporting show the largest wage decreases relative to plants that begin exporting during the period. Unlike the results on the annual changes, exporters throughout perform better than their non-exporting counterparts.

6. Dynamics of Exporting Plants

The results of the preceding section on the characteristics of exporting establishments have ignored the determinants of export status and treated it as exogenous. This is clearly incorrect, plants decide to export or not and their labor market and investment decisions are likely jointly chosen with the export decision.

We analyze the movement in and out of exporting using both industry and plant data. At the industry level, we consider the role of exogenous foreign demand shifts, both prices and income, in determining the percentage of plants that export within an industry as well as in the change of the value of shipments exported. At the plant level we examine the transitions in and out of exporting and estimate a reduced form model of the decision to export to identify the importance of plant characteristics and sunk costs.

6.1. Foreign Shocks and U.S. Manufacturing

In this section we examine the sensitivity of industry exports, sales, and employment to foreign demand shocks. Our foreign demand instruments are the sectoral level foreign exchange and foreign income variables described in Section 5.2.1 and we estimate the supply responses by domestic industries. We consider the growth in foreign and domestic sales due to increased foreign demand as well as the change in the number of establishments.

6.2. Foreign Demand and U.S. Exports

Using the demand instruments described above, we test for the impact of foreign output and exchange rate movements on the exporting sectors of 4-digit industries. The basic specification is a fixed effects regression in logs

$$\ln Y_{it} = \alpha_t + \delta_j + \beta \ln X_{it} + \varepsilon_{it}$$

where α_t are year dummies and δ_j are 4-digit industry dummies and X_{it} is the vector of foreign demand instruments. Our dependent variables, Y_{it}, include the response of exports and the percentage of plants exporting as well as the changes in total employment and domestic sales.

Table 17 contains the regression results. By setting up a fixed effects specification, we are estimating the within industry response to foreign demand shocks controlling for aggregate business cycle effects. Both the fraction of plants exporting within an industry and the value of exports themselves increase in response to favorable foreign exchange rate and demand shocks.[39] The estimated income elasticity for the percentage of plants exporting is substantially larger than the corresponding price elasticity. Considering exports directly, the variables again enter with the correct signs, although the exchange rate variable is now insignificant. The point estimate of the export-income elasticity is substantially higher at 1.51, however with much larger standard errors. The results suggest that the change in exports due to positive foreign demand shocks is due primarily to increases from existing exporters rather than from increasing numbers of exporting plants.

To understand whether foreign demand shocks shift production from domestic to foreign

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[39] Since exchange rates are denominated in foreign currency per $US, a fall in exchange rates improves relative prices for US exporters.

sales, we estimate the response of exports as a percentage of shipments, total employment and domestic sales on the foreign demand variables. Both income and exchange rates are positively and significantly correlated with the export share in total shipments. However, the results are mixed for both total industry employment and domestic sales. Favorable exchange rate shocks appear to increase total employment and domestic shipments, while favorable foreign income shocks are negatively correlated with both measures.

6.3. Plant Transitions

The flow of plants in and out of exporting is substantial. Table 18 reports the percentage of plants changing export status from year to year.[40] On average 9.4% of non-exporters start exporting in a given year, while 18.7% of exporters stop. The percentages change substantially over time In earlier years, the flow into exporting was higher than average while in the later years the flow out of exporting increased.

To understand the determinants of exporting at the plant level, we consider a simple framework where plant and industry characteristics influence the probability of exporting and (potentially) interact with sunk costs (Appendix B presents a short version of the model). The hypothesis of sunk costs in exporting, and the resulting hysteresis have been the subject of increased attention in recent years.[41] The empirical literature, perhaps due to a paucity of microeconomic data, has not kept pace with the theoretical work on hysteresis.[42]

We estimate a reduced form of the 0-1 decision to export or not where there are potentially sunk costs in starting or stopping exporting. Plants decide to export based on expected profitability of exporting, balanced by the option value of waiting due to the presence of sunk costs in entering the export market.[43] The reduced form is given by

$$Y_{it} = f(c_t, X_{it}, Y_{it-1}, c_t Y_{it-1}, X_{it} Y_{it-1}) + \varepsilon_{it} \qquad 6.1$$

where Y_{it} is 1 if plant i is exporting in year t. The time varying constants, c_t, and the vector of plant characteristics, X_{it}, enter the export decision directly as well as indirectly through their interaction with sunk costs. Lagged export status, Y_{it-1}, proxies for the sunk costs of exporting.[44] If a plant is exporting then it does not need to pay the sunk costs again and is more likely to export in the current period. The interaction of the year dummies and lagged export status captures any aggregate time-variation in sunk costs, and the interaction of lagged export status and plant characteristics allows us to examine whether certain types of plants face differing sunk costs.

Several practical issues concerning sample selection and econometric difficulties arise in the estimation of Equation 6.1. We select a balanced panel of plants from 1984-1987 on which we perform the probit analysis. This is the longest period in our data on exports that is covered by a single ASM panel, reducing the probability of plants being dropped for sampling reasons. In choosing a balanced as opposed to an unbalanced panel we drop any plants that failed during the period. This simplifies the estimation procedure as we do not have to model the probability of

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[40] These numbers represent the percentage of surviving plants from the ASM in the two export categories. Non-exporters fail at higher rates, see Section 7.1.1.

[41] The seminal work in this area includes Dixit (1989), Baldwin (1988) and Krugman (1989).

[42] An exception is Tybout and Roberts (1993) who study the role of sunk costs in the decisions by Colombian manufacturing plants to export.

[43] See Tybout and Roberts (1993) for a model of this type.

[44] If there are no sunk costs of entry into or exit from the export market, then the current export status of a firm will not enter into the decision to begin exporting.

death jointly with the probability of stopping exporting.[45] Varying the panel in terms of length of coverage and dropping the balanced nature of the sample did not change the major results.

Two econometric issues remain: first, there are likely to exist plant specific factors not absorbed by our vector of plant characteristics which are correlated with the probability of exporting. Second, the export status of the plant in the initial year is not exogenous and should be modeled directly. In our current analysis, we ignore both these effects thus potentially rendering the estimates inconsistent.

The results for the probit on the balanced 1985-87 panel are given in Table 19. The vector of plant characteristics includes total employment, non-production/total workers, capital/labor, a multi-plant dummy, the 4-digit industry foreign demand variables (income and exchange rates), as well as 2-digit industry dummies. Lagged export status of the plant is included to account for sunk costs and other plant-specific factors influencing exporting and is interacted with the vector of plant characteristics.[46]

For the most part, plant characteristics enter with expected signs and are significant. Larger, more capital-intensive plants with a higher proportion of non-production workers are more likely to export, as are plants that are part of a multi-plant firm. As expected, beneficial foreign exchange rate and income shocks increased the probability of exporting, although the income variable was not significant. A test for the joint significance of lagged export status and interacted lagged export status is also rejects the null hypothesis that there are no sunk costs/plant effects.

Looking at the interactions of lagged export status and plant characteristics, we find that there is no systematic relationship with plant size, i.e. larger plants do not seem to face lower sunk costs. Multi-plant establishments and those with high capital-labor ratios faced higher sunk costs while plants with high non-production-total workers ratios faced lower sunk costs. Relative to 1987, plants were less likely to export in 1985 or 1986, and interacted year dummies also showed higher sunk costs in 1985 and 1986.

7. Learning About Success: Employment, Output, and Productivity Growth

In previous sections we have examined the characteristics of exporters and the effect of exporting plants on the labor market. We now turn to examining the broader performance of exporters over time. Do exporters experience more employment, output, and labor productivity growth? In this section we take a first look at the growth of employment, output and labor productivity from 1976-1987 for exporters and non-exporters. We start by grouping plants into broad sample and export classes and considering their performance over the period 1977-1987. Next, we track a sample of plants in 1976 to 1987, looking at survival, growth and levels of performance characteristics. A more formal analysis of the role of exporting as a predictor of plant survival and plant success follows.

In this section, the problem of sample selection is acute. Since large firms are sampled with higher probability, the panel of plants that exist in both the initial and final year of a given sample is biased towards larger establishments. While this panel has the disadvantage of being skewed towards larger plants, it still represents over half of manufacturing employment and two-thirds of manufacturing output during the period.

Because of the structure of the ASM, when we want to compare one plant across two points in time, we must divide the plants into three different sample categories: plants that exist throughout the period and are sampled in both years (Both), plants that start or stop production within the

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[45] As will be shown in Section 7, exporting plants are less likely to fail over short horizons, so the bias in using the balanced panel may be small.

[46] The 2-digit industry dummies were not interacted with lagged export status of the plant.

period (Births/Deaths), and plants that exist throughout the period but for whom we have no information on exports (Other Both). We are predominantly interested in the export status of a plant, but because of the limitations of the data, we only consider the export status of plants in the Both sample, dividing them into four categories. Exporters in the initial year may continue exporting (Throughout) or stop exporting during the period (Stoppers). Similarly, plants that do not export may continue producing only for the domestic market (Neither) or start exporting (Starters).

Table 20 shows the changes in total, non-production, and production employment by sample classification and export status. Total employment for all manufacturing firms decreased by 4.4%, or about 800,000 workers, over the period. The job losses were not spread evenly across employment categories or plants. While employment in production worker jobs decreased by over 1.4 million workers, a 10.6% decline, non-production worker employment increased by 600,000 workers, an increase of 13.4%. The relatively larger decrease in production worker jobs increased non-production workers share of total manufacturing employment from 26.1% to 30.9% from 1977 to 1987. The growth of employment varied substantially by sample category. Plants in the "Both" panel suffered overall job losses of over 824,000, representing 7.7% of their total initial employment. As with the overall population of plants, these continuing establishments actually gained non-production workers while shedding production employees. Births of new plants added 4.5 million new jobs, while deaths of plants cost 5.2 million jobs. The group of plants labeled "Other Both" grew substantially, to over 3.3 million employees in 1987.[47]

In addition to a shift between job categories, there was also a shift between exporters and non-exporters. In 1977, exporters accounted for 60% of the jobs in the Both panel, down to 55% by 1987. Non-exporters experienced a 1.7% decrease in total employment, shedding 6.3% of their production workers, but adding 12.3% to non-production employment. "Stoppers" experienced the biggest job losses in the panel, losing both production (-24%) and non-production (-14%) jobs. In contrast, "Starters" increased their employment by 8%, almost all the gain coming from increases in non-production workers. Exporters throughout fair relatively poorly, with a 11.0% decline in employment, losing production workers and gaining non-production workers.

Table **21** reports the value of shipments and labor productivity for these broad sample and export classes. Overall output in manufacturing increased 16.0% over the period while value-added per employee rose 29.2%.[48] The pattern for shipments broadly parallels the movement in employment. "Starters" perform the best, raising output by almost 29% while "Stoppers" showed an output decline of 1.2%. Non-exporters did better than exporters although shipments from exporters still represented the bulk of output in both periods. Growth rates for labor productivity show much smaller differences across export categories. The fastest growth came from exporters in the initial year, "Starters" and "Throughout" showed rises of 37% and 33%, while non-exporters throughout fared less well.

Even looking at these broad classes of plants we see substantial differences between exporters and non-exporters. Levels of employment, shipments and labor productivity are substantially higher at plants that exported in 1977. However, the changes over time suggest that "Starters" are the clear winners, growing faster in all dimensions. The obvious losers are plants that exit the export sector during the period, while exporters throughout do better than non-exporters

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[47] Births of new plants also contributed to the shift to non-production workers. Plants that began operation over the period had a non-production to total employment ratio of 29.9% while plants that ceased operation over the period had a non-production to total employment ratio of 24.2%. Plants in the "Other Both" category changed their employment mix in similar fashion.

[48] Both shipments and value-added per employee rose dramatically at plants in the "Other-Both" category again representing the ex-post success of these initially small plants.

only in labor productivity.

7.1. Ex Ante Predictions

The previous results suggest that the exporting status of a plant is associated with the plant's performance over time. However, this is in part an ex-post measure of exporting. While plants that become exporters during the period experience above average growth, we would like to know if the export status of the plant in the initial period predicts the plant's performance over time. We consider the role of export status in plant survival and in plant success along a number of dimensions: including employment, output, and labor productivity.

To evaluate the role of exporting in plant survival, we tabulate one year survival rates for exporters and non-exporters as well as long run performance measures for plants present in the 1976 ASM. Finally we estimate whether export status increases the probability of survival over short, medium and longer horizons conditional on other plant characteristics.

Table 22 gives annual failure rates by initial export status for plants in the ASM.[49] The annual failure rate for exporters is 3.0%, while that for non-exporters is 8.9%, almost three times higher. The large differences in these unconditional failure rates may in part reflect the size differences between exporters and non-exporters. Large plants fail less often and as shown in Section 4, exporters are substantial larger than non-exporters.

Due to the changing samples in the ASM, we are unable to follow groups of plants over long stretches of time. However, since the entire 1987 Census was asked the direct exports question, we can ask how plants in the ASM have fared with respect to survival, growth, and exporting over longer horizons. As a simple experiment, we classify plants in the 1976 ASM into two broad categories, exporter and non-exporter, and then group exporters into 10 additional classes based on their 1976 export sales.[50] Table 23 describe the average employment, sales, labor productivity, and exports of these plants in 1976 and 1987. Column 2 reports the percentage of plants from each group that survive to 1987.

Most striking are the systematic differences in mean employment, shipments and labor productivity by export category in 1976. Non-exporters have the smallest average size, shipments and labor productivity, while the largest exporters are also the largest plants and the most productive. Also notable is the difference in the survival rates between exporter and non-exporters. Only slightly more than half of the non-exporters in the 1976 ASM survive to 1987. In contrast, almost 71% of the exporting plants in the 1976 ASM survive to the 1987 Census. Within exporters, plants with higher exports had higher rates of survival, increasing from 61.8% for the lowest decile to 80.7% for the largest exporters.[51] It is also interesting to note that fully 17.1% of non-exporters in 1976 had become exporters by 1987.

For plants that survive the period, the mean non-exporting plant increased total employment and shipments substantially faster than surviving exporters. The largest exporters actually showed decreases in employment and exports over the period, while the smallest exporters showed the largest output growth among exporters. The non-exporters that survived also show dramatic increase in export growth. This is consistent with the results of the previous section which

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[49] We only calculate these rates within ASM panels to avoid issues regarding changing samples. Since larger plants are oversampled in the ASM and fail less often, these failure rates are lower than those for all manufacturing plants taken together.

[50] Non-exporters are in group 0, exporters are sorted into 10 categories according to total value of exports in 1976, lowest in category 1 and highest in category 10. All means are unweighted plant means.

[51] It is important to remember that this sample of plants is larger than a representative sample and that size has been found to be important in plant survival. See Dunne, Roberts, and Samuelson (1989). The next section controls for plant size in determining the relationship between survival and export status.

show plants that start exporting growing faster than average. Productivity growth was fairly uniform across the categories, with the exception of the largest exporters. This group has the highest productivity levels in both periods, but lower growth.

7.1.1. Survival

The above results suggest that export status is related with plant survival and growth. However, we know from results in Section 4 that exporting is associated with plant characteristics such as size and capital intensity that have been shown in previous research to increase the probability of survival. To identify whether there is an independent effect of the initial export status of a plant on survival, we estimate the probability of survival to a subsequent Census of Manufactures conditional on being an exporter in the initial year and other plant characteristics. We examine the survival to subsequent Censuses to avoid the sample selection problems of using the ASM. We take three base years for which we have exporting information: 1976, 1981, and 1986. We estimate the probability of the plant surviving to the 1977, 1982 and 1987 Censuses conditional on initial plant characteristics including initial year export status. We see in Table 24 that if a plant is an exporter in 1976 it is more likely to survive to 1977 than non-exporters, controlling for plant size, capital/labor ratio, plant productivity, plant ownership status, and 2-digit industry. This suggests that exporting plants in 1976 of equal productivity and size in the same 2-digit industry are more likely to survive to the next year than non-exporting plants. Exporters in 1976 appear to have a slightly higher probability of survival to 1982 than non-exporters, though this is not statistically significant. Exporting in 1976 does not seem to have much effect on the probability of survival tens years out. The results are similar for plants that export in 1981. One year out, exporters a higher probability of survival. For the longer period to 1987, exporting still has a positive effect on survival. The results for the probability of survival for exporters in 1986 to the 1987 Census suggest a positive though not statistically significant relationship. These results suggest that exporting is associated with increased survival for short periods, but that exporting is not associated with survival over longer periods controlling for other plant characteristics.

7.1.2. Growth

We also examine the annual growth rates of plants conditional on their survival to see if exporting in the initial period is associated with higher employment, output, or labor productivity growth after controlling for other plant characteristics. We pool annual differences in employment, output, and productivity (measured as value added per worker) and estimate the relationship between plant characteristics in the initial year, including the plants export status, and employment, output, and labor productivity growth. These pooled measures are conditional on the plant surviving to the second period. We see for the period 1976-87 that exporters have higher average annual changes in employment (both types) and shipments, controlling for other plant characteristics. The magnitude of the changes is significant. The one year employment change at exporters is 2.4% higher and the one year output increase is 1% larger. Surprisingly, the change in labor productivity growth is 0.8% lower at exporters.

The results on the annual changes suggest that exporting may be an indicator of short term success. In Table 26, we look at the relationship of annual changes to both initial and final year export status. For all measures of performance, plants that begin exporting during the year show the largest gains, with exporters throughout also doing well. Relative to plants that do not export in either year, starters have 3% higher employment and labor productivity growth, and 7% faster growth in total shipments. Plants that stop exporting fare the worst. Relative to exporters throughout, their employment drops 2.5% more, their output falls 7% more, and their labor productivity 5%.

To investigate the relationship between exporting and long term growth, we estimate the

effect of exporting in 1976 on the plants' performance characteristics over the entire period 1976-87. These results are reported in Table 27. Exporting in 1976 does not appear to be associated with better long run performance. In fact, exporting in 1976 seems to be associated with significantly lower than average labor productivity and output growth.

The sources of these results are not hard to locate. First, this sample uses only plants that survive from 1976 to 1987. Thus, this sample is skewed to the successful plants in each category. Second, we are grouping plants that continue to export and plants that stop exporting together as initial exporters. We group plants that do not export over the period and plants that become exporters together as initial non-exporters. We saw that starting to export plays an important role in short and long run wage changes and that in year-to-year changes starters perform substantially better. We know that plants that become exporters over the period experience higher that average labor productivity, output, and employment growth than other plants. These results for long run changes are confirmed in Table 28. Over the 11 year horizon, stoppers suffer a 28% employment loss relative to starters. Exporters throughout also fare well, with 18% higher employment growth than non-exporters throughout. The results are similar for other measures of plant success. Output growth is best at starters, 10% faster than exporters throughout and 28% and 39% better than non-exporters and stoppers respectively. Relative labor productivity movements are not quite so pronounced, starters gain 8% relative to exporters and non-exporters throughout and 14% relative to stoppers.

For both short-run and long run performance the results are clear. Plants that begin exporting dramatically outperform all other types. The differences are especially pronounced relative to plants that stop exporting. However, using current export status as a predictor of future success is problematic due to the confounding of continuing exporters and stoppers.[52]

The picture that emerges from the analysis is that exporters are an important component of the manufacturing sector. When we examine groups of plants that survive the period 1976-87, plants that export throughout and plants that become exporters contribute the bulk of employment and output, have higher labor productivity levels, and have greater labor productivity growth than other plants. We know that these plants have other attributes that are also associated with survival and labor productivity growth, namely size and capital intensity. To examine the independent effect of exporting, we control for plant characteristics and estimate the effect of exporting in the initial period on the probability of survival and the growth rates of plants. While exporting in the initial period is not associated with higher survival probabilities or higher growth rates over the longer term (after controlling for other plant characteristics), exporting does appear to be a contemporaneous measure of success and predictor of short term growth. This does not suggest that exporters are not important. On the contrary, plants that are exporters are more likely to survive and grow in the short term. Plants that become exporters experience higher employment, output, and labor productivity growth rates than other plants. Plants that stop exporting suffer larger employment losses and smaller output and labor productivity gains than other plants. However, when we control for other plant characteristics that are associated with success, the performance differences between exporters and non-exporters decrease.

8. Conclusions

In this paper we have documented the role of exporting plants in the manufacturing sector. We perform two distinct analyses: first, we document the characteristics of exporters and non-exporters testing whether exporters are successful plants. Second, we examine how these plants

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[52] Among continuing exporters we divided the sample into those that increased their export share of shipments and those that decreased their export share. There were no systematic, significant differences between the groups.

have behaved over time, considering plant variables that influence exporting and whether exporters perform better than non-exporters.

Perceptions that exporters are 'better' than non-exporters are borne out by the cross-section evidence. While exports make up a small fraction of total manufacturing output, exporting plants have a disproportionate weight in total employment and output. Exporters are substantially larger than non-exporters within industries and regions, and systematically differ in their input characteristics. Capital intensity and investment per employee both are higher at exporters. In the labor market, both non-production and production workers receive higher pay at exporting plants, in addition the difference in the average plant wages is augmented by the higher ratio of non-production to production workers at these plants. These wage differentials are small but significant even after controlling for other plant characteristics known to be correlated with higher wages. In addition to their higher wage payments, exporters also show higher labor productivity, measured by value-added or shipments per employee.

While all signs point towards current exporters having better performance attributes than non-exporters, the evidence on exporting as an indicator of future success is less clear-cut. Controlling for observed plant characteristics, exporter perform better in the short run than non-exporters: the probability of survival, as well as growth rates of output and employment are higher for exporters. Productivity and wage growth are negatively correlated with initial export status over one year horizons. Good long run performance shows less correlation with initial export status. Only employment growth is above average for exporters over 11 year horizons.

The driving force behind these mixed performance indicators can be identified quite easily. Breaking plants into categories based on their export status in both the initial and the final year, we find plants that become exporters perform substantially better than plants that do not change their export status. In addition, plants that stop exporting show the worst performance characteristics. These findings confirm the perception that 'good' plants are exporters, but they do not support the notion that on average today's exporters will be tomorrow's success stories.

This combination of results about cross-section characteristics and performance over short and long horizons reinforces the perception that exporters are important plants in the manufacturing sector but that current export status is, at best, an indicator of short run success and not of long-run success. In other words, current exporters have been successful in the past, most likely helping them become exporters, but there is no guarantee that current exporters will continue to outperform other establishments in the future.

Given the sustained policy interest in promoting exports as a way of increasing the performance of the US manufacturing sector, these results call for substantial caution. Consider a policy that aids plants designated as 'winners'. Our results suggest that using current export status as the selection criterion *may* pick plants that will do well over short horizons but not necessarily over longer periods.

Based on our findings, we conclude that there is an important role for exporting plants in the economy and that future research should focus on how plants move from domestic production to a combination of domestic and foreign sales. By being able to identify exporters with contemporaneous success we can learn what distinguishes successful plants from failures in the same markets.

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Appendix A: Data Description

Descriptions of variables are from Census of Manufactures General Summary MC87-S-1 Bureau of Census (1987). Total employment represents the total number of employees at the plant, which is broken into two components, production workers and non-production workers. Production workers are employees (up through the working foreman level) engaged in fabricating, processing, assembling, inspecting, receiving, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial and watchman services, product development, auxiliary production for plant's own use (e.g., powerplant), record-keeping and other services closely related with these production activities at the establishment. Non-production workers include those employees of the manufacturing establishment engaged in factory supervision above the level of line supervisor, including sales, sales delivery, advertising, credit, collection, installation, service, clerical, executive, purchasing, financial, legal, personnel (including cafeteria, medical, etc.), professional, and technical employees. These two categories of employment are clearly inadequate for describing the changing composition of employment within plants, however, they do capture some of the within industry heterogeneity across exporters and non-exporters. Salaries and wages represent the total gross earnings paid in the calendar year to employees at the establishment. Benefits are supplemental labor costs, both those required by State and Federal laws and those incurred voluntarily or as part of collective bargaining agreements. Salaries and wages and benefits are deflated by the Bureau of Labor Statistics (BLS) regional consumer price index (1987=100). Total value of shipments represents the output of the plant. We use the machinery assets at the end of the year as our capital measure. It represents the original cost of all production machinery, transportation equipment, and office equipment and any costs incurred in making the assets usable.[53] Value-added is derived by subtracting the cost of materials, containers, fuel, purchased electricity, and contract work from the value of shipments. The result of this calculation is adjusted by the net change in finished goods and work-in-process between the beginning and end-of-year inventories. Shipments, capital, and value-added are deflated by 4-digit sectoral deflators.[54] In addition to plant characteristics, we make use of information on the ownership structure of the firm. We construct a dummy for plants that are owned by a larger firm comprised of other establishments, either manufacturing or other (retail, wholesale, etc.).

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[53] Other research suggests that this measure of capital performs comparably to more detailed measures such as perpetual inventory methods. See Bailey, Hulten, and Campbell (1992).

[54] See Bartelsman and Gray (1994).

Appendix B: A model of sunk costs and exporting

In this section we briefly describe a model of exporting and sunk costs which yields the reduced form estimated in Section 6.3.[55] Plants decide whether or not to export and if they enter the export market they must pay a fixed cost, F_{it}. Similarly, to leave the export market the plant pays a fixed exit cost, L_{it}. The additional expected profits from are given by π_{it}.[56] Export status in year t is represented by Y_{it}, where $Y_{it}=1$ means the plant is exporting.

Single period profits from exporting in year t are given by

$$P(Y_{it}, Y_{it-1}) = Y_{it}\pi_{it} - Y_{it}(1 - Y_{it-1})F_{it} - Y_{it-1}(1 - Y_{it})L_{it}$$

The discounted stream of profits is given by

$$V_{it}(I_{it}) = \max_{\{Y_{it}\}} E_t\left[\sum_{s=t}^{\infty} \delta^{s-t} R_{it} \mid I_{it}\right]$$

where I_{it} is the information set of the plant in year t and the firm picks the sequence of export decisions. The plant's current export status, Y_{it}, is the value that satisfies

$$V_{it}(I_{it}) = \max_{Y_{it}}\left(P_{it}(Y_{i+j}Y_{it-1}) + \delta E_t(V_{it+1}(I_{t+1}) \mid Y_{it})\right)$$

The plant will export if

$$\pi_{it} + \delta\left[E_t(V_{it+1}(I_{it+1}) \mid Y_{it} = 1) - E_t(V_{it+1}(I_{it+1}) \mid Y_{it} = 0\right] \geq F_{it} + Y_{it-1}(-F_{it} - L_{it})$$

The left-hand side of this expression (Y_{it}^*) can be thought of as the latent variable in a discrete choice equation.

$$Y_{it} = 1 \quad \text{if} \quad Y_{it}^* - [F_{it} + Y_{it-1}(-F_{it} - L_{it})]$$
$$= 0 \quad \text{otherwise}$$

If sunk costs equal zero then the right hand side equals zero, the latent variable is just this period's exporting profits, and past export status does not affect the probability of exporting today.

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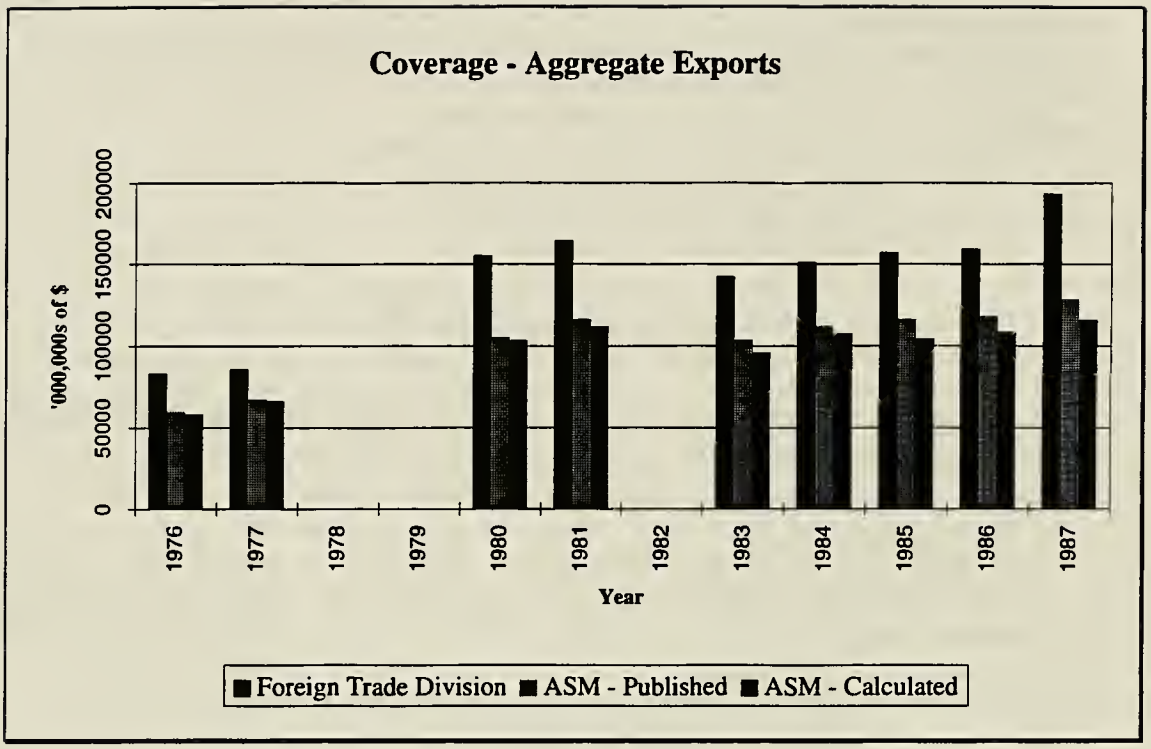
[55] This description closely follows Tybout and Roberts (1993).

[56] Profits represent the additional profits due to exporting. The presentation abstracts from issues of exogenous and endogenous variables in the plant's profit function.

Figure 1


Coverage - Aggregate Exports
'000,000s of $
0
50000
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1976
1977
1978
1979
1980
1981
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1983
1984
1985
1986
1987
Year
Foreign Trade Division
ASM - Published
ASM - Calculated

Table 1: Industry Characteristics

Industry	All		Exporters				Non-Exporters
	# Plants	Industry/ Total Shipments	% Plants	Plant Size (Empl.)	Industry/ Total Exports	Plant Exports/ Shipments	Plant Size (Empl.)
All	193463	--	14.6	253	--	10.0%	58
Food	11796	13.40%	12.9	245	4.70%	5.1%	97
Tobacco	91	0.88%	40.7	979	1.45%	10.8%	153
Textiles	3794	2.55%	14.7	320	0.64%	4.2%	146
Apparel	13662	2.47%	3.9	145	0.35%	5.7%	73
Wood	16452	2.75%	6.5	106	1.47%	13.1%	34
Furniture	6066	1.53%	7.4	253	0.18%	2.4%	66
Paper	4512	4.54%	18.0	302	3.73%	8.7%	94
Printing	27842	4.66%	2.9	161	0.41%	3.2%	43
Chemicals	7312	9.12%	30.3	216	13.94%	12.0%	58
Petroleum	1815	5.67%	12.8	204	1.55%	3.2%	46
Rubber	8758	3.42%	22.2	154	1.86%	6.5%	68
Leather	1052	0.37%	17.0	182	0.30%	11.6%	102
Stone, Clay	10292	2.57%	9.0	182	1.16%	7.0%	37
Primary Metals	4626	4.93%	22.1	369	2.17%	4.0%	83
Fabricated Metals	21940	6.00%	15.2	160	3.66%	7.5%	45
Machinery	27003	8.95%	19.6	186	15.87%	13.9%	34
Electronic Eq.	9525	8.60%	34.6	370	12.74%	11.5%	105
Transportation	5439	13.59%	23.5	974	27.03%	12.9%	122
Instruments	4232	2.74%	43.1	218	6.09%	15.5%	67
Misc Manu..	7254	1.26%	13.0	114	0.69%	7.3%	37

Numbers are tabulated from 1987 Census of Manufactures. Exporters include all plants that report direct exports. Industry/total shipments (exports) are the industry's share in manufacturing shipments (exports). Plant size is the mean number of workers at establishments in the industry. Plant exports/shipments is calculated as total industry exports divided by industry shipments from exporting plants.

Table 2 Exports By State (1987)

State	% of Plants Exporting	Exports ('000,000s of $)	Share of Total Exports
Maine	17.87%	528	0.42%
New Hampshire	17.14%	686	0.55%
Vermont	16.15%	331	0.27%
Massachusetts	17.28%	3755	3.02%
Rhode Island	14.26%	415	0.33%
Connecticut	18.05%	3253	2.61%
New York	10.49%	7106	5.71%
New Jersey	15.06%	2287	1.84%
Pennsylvania	16.68%	3926	3.16%
Ohio	19.46%	9486	7.62%
Indiana	17.49%	3261	2.62%
Illinois	16.69%	5327	4.28%
Michigan	17.07%	8961	7.20%
Wisconsin	19.03%	2640	2.12%
Minnesota	16.72%	2637	2.12%
Iowa	18.77%	1587	1.28%
Missouri	13.70%	3919	3.15%
North Dakota	14.18%	148	0.12%
South Dakota	17.00%	133	0.11%
Nebraska	16.36%	457	0.37%
Kansas	17.26%	1150	0.93%
Delaware	17.37%	353	0.28%
Maryland	11.79%	1441	1.16%
Virginia	11.87%	2475	1.99%
West Virginia	15.09%	766	0.62%
North Carolina	13.48%	3497	2.81%
South Carolina	16.11%	1924	1.55%
Georgia	11.49%	2249	1.81%
Florida	11.26%	3313	2.66%
Kentucky	15.34%	1786	1.44%
Tennessee	13.41%	1996	1.61%
Alabama	11.30%	1181	0.95%
Mississippi	12.17%	1020	0.82%
Arkansas	13.33%	685	0.55%
Louisiana	11.33%	2308	1.86%
Oklahoma	14.35%	720	0.58%
Texas	11.87%	9036	7.26%
Montana	7.36%	57	0.05%
Idaho	11.99%	411	0.33%
Wyoming	7.73%	10	0.01%
Colorado	13.40%	956	0.77%
New Mexico	7.66%	79	0.06%
Arizona	9.96%	1275	1.03%
Utah	12.89%	296	0.24%
Nevada	11.78%	92	0.07%
Washington	17.07%	8462	6.80%
Oregon	13.22%	1242	1.00%
California	13.95%	14259	11.46%
Alaska	20.89%	537	0.43%

Numbers are tabulated from the 1987 Census of Manufactures. Share of total exports is the state's share in total direct manufacturing exports. States are grouped into Census regions. Hawaii is grouped with Rhode Island due to coding errors.

Table 3: Plant Characteristics, 1987 Census (Plant means by export status)		
	Exporters	**Non Exporters**
Total Employment	253.66	57.89
Total Value of Shipments	44180.00	6814.64
Wage/Worker	24.37	20.42
Production Wage/ Worker	20.67	18.02
Non-Production Wage/Worker	33.27	29.05
Benefits/Worker	5.72	4.31
Total Value of Shipments/Worker	146.23	107.00
Value Added/Worker	71.54	51.53
Capital/Worker	40.84	27.63
Investment/Worker	3.48	2.31
Non-Production/Total Workers	0.33	0.26
Multi-Plant Establishment	0.61	0.31

Numbers are tabulated from the 1987 Census of Manufactures and represent plant means. Dollar amounts are in thousands of 1987 $.

Table 4: Plant Characteristics 1987 Census By Size Category				
	<250 Employees		250+ Employees	
	Exporters	Non-Exporters	Exporters	Non-Exporters
Total Employment	76.47	38.36	885.72	541.28
Total Value of Shipments	10943.81	4168.41	162737.92	72314.23
Wage/Worker	23.70	20.41	26.79	20.87
Production Wage/Worker	19.86	17.99	23.55	18.63
Non-Production Wage/ Worker	32.76	28.99	35.04	30.55
Benefits/Worker	5.49	4.29	6.57	4.80
Total Value of Shipments/ Worker	139.56	106.13	169.99	128.57
Value-Added/Worker	68.56	51.20	82.16	59.75
Capital/Worker	36.40	27.37	56.67	34.19
Investment/Worker	3.08	2.28	4.93	3.12
Non-Production/Total Workers	0.33	0.26	0.31	0.26
Multi-Plant Establishment	0.51	0.29	0.94	0.87

Numbers are tabulated from the 1987 Census of Manufactures and represent plant means. Dollar amounts are in thousands of 1987 $.

Table 5: Plant Characteristics 500+ Employees 1977, 1987				
	1977		1987	
	Exporters	Non Exporters	Exporters	Non Exporters
Total Employment	1485.46	1038.84	1492.14	1019.11
Total Value of Shipments	211524.21	126568.83	284191.00	146467.00
Wage/Worker	27.62	22.66	28.76	22.93
Production Wage/Worker	25.07	20.98	25.47	20.66
Non-Production Wage/Worker	34.83	31.18	36.29	32.10
Benefits/Worker	6.43	4.62	7.10	5.37
Total Value of Shipments/Worker	135.27	112.45	186.47	144.54
Value-Added/Worker	62.04	48.48	89.63	66.47
Capital/Worker	46.62	31.72	65.04	43.37
Investment/Worker	4.92	3.33	5.72	3.74
Non-Production/Total Workers	0.32	0.28	0.28	0.24
Multi-Plant Establishment	0.98	0.94	0.97	0.96

Numbers are tabulated from the 1977 and 1987 Annual Surveys of Manufactures and represent plant means. Dollar amounts are in thousands of 1987 $.

Table 6: Regression Estimates of the Effect of Export Status on Plant Characteristics	
Dependent Variable	Export Dummy
Wage per Worker	0.093*** (0.0027)
Wage per Production Worker	0.074*** (0.0028)
Wage per Non-Production Worker	0.054*** (0.0036)
Benefits per Worker	0.127*** (0.0033)
Total Shipments per Worker	0.149*** (0.0043)
Value-Added per Worker	0.158*** (0.0046)
Capital per Worker	0.093*** (0.0063)
Investment per Worker	0.036*** (0.0091)
Non-Production/Total Employment	0.124*** (0.0039)
Total Shipments	1.10*** (0.0089)
Total Employment	0.936*** (0.0076)
Multi-plant Establishment	0.080*** (0.0029)

Reported numbers are coefficients (and standard errors) on an export status dummy in a plant level regression for the years 1976-77, 1980-81, 1983-87 controlling for 4-digit SIC, 448 state-SMSA regions and the log of total plant employment (except in the Total Shipments and Total employment regressions). Dependent variables are in logs except for non-production/total employment and the multi-plant indicator. Standard errors are in parentheses.
***Indicates significance at the 1% level.

Table 7: Wage Differentials by Plant Characteristics

($/Worker) Weighted by Total Employment

	Production Workers		Non-Production Workers	
	Exporters	**Non-Exporters**	**Exporters**	**Non-Exporters**
Size Class				
1-20 Empl.	-2692	-3778	-1285	-6029
20-50	-2906	-4524	2166	-1061
50-100	-2695	-4700	1034	-1182
100-250	-1555	-4190	-431	-2518
250-500	-566	-3995	-1355	-3834
500-1000	1303	-2241	-448	-2939
1000-2500	4007	1333	2015	-1341
2500-5000	8428	8759	6388	4076
5000+	9481	6966	7304	6076
Age				
0-4 yrs	-887	-5209	345	-3591
5-9 yrs	-1223	-4830	-297	-2674
10+ years	3677	-2022	2366	-1626
Ownership Type				
Single Plant	-3827	-5232	2550	-1084
Multi-Plant	3502	-1869	1949	-2541
Capital Intensity				
1st Quintile	-5117	-8428	-3017	-5707
2nd Quintile	-2807	-6135	-1903	-3711
3rd Quintile	316	-3219	-196	-2628
4th Quintile	1888	-992	1281	-1095
5th Quintile	7737	2787	5446	1734

Source: Annual Survey of Manufactures, various years. The wage differential is given as the difference between the mean plant wage for the given category and the overall mean plant wage. Numbers represent the average differential for the years 1976-77,1980-81, 1983-87. All differentials are denominated in constant 1987$ per year per worker. Plants are weighted by sampling weights and total employment.

Table 8: Change in Mean Wage Differentials 1976-1987 ($/Worker)

Weighted by Total Employment

	Production Workers		Non-Production Workers	
	Exporters	**Non-Exporters**	**Exporters**	**Non-Exporters**
Size Class				
1-20 Empl.	2640	1701	92	1000
20-50	-771	-249	-2955	-1370
50-100	-1117	-694	-2523	-1076
100-250	-868	-618	344	-1281
250-500	-35	-967	1222	-311
500-1000	53	-941	1600	-40
1000-2500	1371	-985	1899	-783
2500-5000	3914	-451	2246	-1990
5000+	378	-3528	-1656	146
Age				
0-4 yrs	4451	-219	2751	-1601
5-9 yrs	-2827	-2073	-460	-1477
10+ years	-377	-1232	185	-1027
Ownership Type				
Single Plant	-408	50	-445	140
Multi-Plant	274	-1068	456	-1069
Capital Intensity				
1st Quintile	-1300	-321	1536	-571
2nd Quintile	829	-193	760	-2084
3rd Quintile	721	-806	-242	-123
4th Quintile	746	-581	1546	-328
5th Quintile	1004	579	1063	511

Source: Annual Survey of Manufactures, 1977, 1987. Numbers represent the change in the wage differential by category from 1977 to 1987. The wage differential is given as the difference between the mean plant wage for the given category and the overall mean plant wage. All amounts are denominated in constant 1987$ per year per worker. Plants are weighted by sampling weights and total employment.

Table 9: OLS Regressions of Log Wages on Plant Characteristics Pooled 1976-1987			
Variable	Salaries and Wages		
Exporter	0.1162 (0.00117)	0.0443 (0.00109)	0.0446 (0.00109)
Capital per Worker	0.1343 (0.00044)	0.1097 (0.00045)	0.0976 (0.00048)
Hours per Worker	0.3880 (0.00246)	0.3745 (0.00217)	0.3529 (0.00208)
Size of Plant	0.0167 (0.00044)	0.0334 (0.00040)	0.0366 (0.00042)
Multi-Unit	-0.0353 (0.00137)	-0.0025 (0.00203)	-0.0008 (0.00119)
Age Dummies	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
2-Digit SIC Dummies	No	Yes	No
4-Digit SIC Dummies	No	No	Yes
State and SMSA Dummies	Yes	Yes	Yes
R^2	0.311	0.472	0.525

Dependent variable is log real salary and wages per employee. Standard errors are in parentheses.

Table 10: OLS Regressions of Production and Non-Production Wages on Plant Characteristics

Pooled 1976-1987

Variable	Production Wages			Non-Production Wages		
Exporter	0.0803 (0.00128)	0.0222 (0.00123)	0.0280 (0.00122)	0.0732 (0.00173)	0.0236 (0.00180)	0.0202 (0.00187)
Capital per Worker	0.1400 (0.00048)	0.1109 (0.00051)	0.0911 (0.00054)	0.0853 (0.00067)	0.0800 (0.00077)	0.0771 (0.00085)
Hours per Worker	0.5749 (0.00271)	0.5684 (0.00246)	0.5432 (0.00236)	0.0722 (0.00388)	0.0553 (0.00381)	0.0395 (0.00381)
Size of Plant	0.0152 (0.00048)	0.0321 (0.00046)	0.0367 (0.00047)	0.0386 (0.00070)	0.0473 (0.00071)	0.0488 (0.00077)
Multi-Unit	-0.0172 (0.00252)	0.0143 (0.00138)	0.0212 (0.00134)	-0.1129 (0.00209)	-0.0022 (0.00337)	-0.0762 (0.00209)
Age Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
2-Digit SIC Dummies	No	Yes	No	No	Yes	No
4-Digit SIC Dummies	No	No	Yes	No	No	Yes
State and SMSA Dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.326	0.455	0.509	0.067	0.117	0.138

Dependent variables are log real production salary and wages per production worker and log real non-production salary and wages per non-production worker. Standard errors are in parentheses.

Table 11: OLS Fixed Effect Regressions of Wages (by worker type) on Plant Characteristics

Pooled 1976-87

Variable	Salaries and Wages	Production Wages	Non-Production Wages
Exporter	0.0168 (0.00096)	0.0123 (0.00118)	0.0179 (0.00205)
Capital per Worker	0.0423 (0.00063)	0.0315 (0.00077)	0.0371 (0.00138)
Hours per Worker	0.2685 (0.00178)	0.4638 (0.00219)	-0.0461 (0.00399)
Size of Plant	-0.0704 (0.00098)	-0.0426 (0.00120)	-0.0566 (0.00218)
Year Dummies	Yes	Yes	Yes
Plant Fixed Effects	Yes	Yes	Yes

Dependent variables are log real wages per worker. Standard errors are in parentheses

Table 12: IV Wage Regressions (by worker type) on Plant Characteristics Pooled 1976-87			
Variable	Salaries and Wages	Production Wages	Non-Production Wages
Exporter	0.2915 (0.07747)	0.1051 (0.08142)	-0.0157 (0.11199)
Capital per Worker	0.0923 (0.00215)	0.0930 (0.00227)	0.0754 (0.00306)
Hours per Worker	0.3459 (0.00292)	0.5385 (0.00311)	0.0412 (0.00529)
Size of Plant	0.0136 (0.00826)	0.0360 (0.00871)	0.0469 (0.01254)
Multi-Unit	-0.0308 (0.00345)	0.00877 (0.00361)	-0.1029 (0.00509)
Year Dummies	Yes	Yes	Yes
4-Digit SIC Dummies	Yes	Yes	Yes

Instruments for export status of the plant include 4-digit industry foreign demand and foreign exchange rates.
Standard Errors in parentheses

Table 13: OLS Regressions of Year to Year % Wage Changes

Export Status in Initial Year

Pooled 1976-87

Variable	Salaries and Wages	Production Wages	Non-Production Wages
Exporter in initial year	-0.0072 (0.0011)	-0.0062 (0.0013)	-0.0040 (0.0020)
Size of Plant	0.0137 (0.0004)	0.0123 (0.0005)	0.0113 (0.0008)
Multi-Plant Firm	-0.0018 (0.0012)	0.0046 (0.0014)	-0.0075 (0.0022)
Capital/Worker	-0.0124 (0.0005)	-0.0086 (0.0006)	-0.0109 (0.0009)

All variables are in logs, except for ratios. Dependent variables are % changes in real wages per worker. Additional controls include plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

Table 14: OLS Regressions of Year to Year % Wage Changes

Export Status in Initial and Final Year

Pooled 1976-87

Variable	Salaries and Wages	Production Wages	Non-Production Wages
Non-Exporter in Year 0 & Exporter in Year 1	---	---	---
Exporter in Year 0 & Non-Exporter in Year 1	-0.0352 (0.0023)	-0.0301 (0.0028)	-0.0431 (0.0043)
Exporter in Year 0 & Exporter in Year 1	-0.0159 (0.0018)	-0.0141 (0.0022)	-0.0138 (0.0033)
Non-Exporter in Year 0 & Non-Exporter in Year 1	-0.0160 (0.0017)	-0.0141 (0.0021)	-0.0201 (0.0032)

Dependent variables are % changes in real wages per worker. Additional controls include logs of initial employment, capital-labor, multi, plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

Table 15: OLS Regressions of % Wage Changes - Long Differences

Export Status in Initial Year

Pooled 1976-87

Variable	Salaries and Wages	Production Wages	Non-Production Wages
Exporter in initial year	-0.0046 (0.0041)	-0.0067 (0.0046)	-0.0103 (0.0082)
Size of Plant	0.0169 (0.0018)	0.0112 (0.0020)	0.0271 (0.0039)
Multi-Plant Firm	0.0165 (0.0055)	0.0220 (0.0062)	0.0238 (0.0111)
Capital/Worker	-0.0070 (0.0021)	0.0002 (0.0024)	-0.0050 (0.0043)

All variables are in logs, except for ratios. Dependent variables are % changes in real wages per worker. Additional controls include production hours per production worker, plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

Table 16: OLS Regressions of % Wage Changes - Long Differences

Export Status in Initial and Final Year

1976-87

Variable	Salaries and Wages	Production Wages	Non-Production Wages
Non-Exporter in Year 0 & Exporter in Year 1	---	---	---
Exporter in Year 0 & Non-Exporter in Year 1	-0.0396 (0.0064)	-0.0342 (0.0072)	-0.0635 (0.0128)
Exporter in Year 0 & Exporter in Year 1	-0.0140 (0.0056)	-0.0208 (0.0064)	-0.0107 (0.0113)
Non-Exporter in Year 0 & Non-Exporter in Year 1	-0.0313 (0.0053)	-0.0309 (0.0059)	-0.0342 (0.0107)

Dependent variables are % changes in real wages per worker. Additional controls include logs of initial employment, capital-labor, multi, plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

Table 17: OLS Fixed Effect Regressions of Industry Characteristics on Foreign Demand Variables

Pooled 1976-87

Dependent Variable	Log Foreign Exchange	Log Foreign Demand
% Change Exporters	-0.0675* (0.0399)	0.4938*** (0.0848)
% Change Exports	-0.2000 (0.2597)	1.5121*** (0.5508)
Change in Exports/Total Shipments	-0.0159** (0.0079)	0.0729*** (0.0167)
Change in Share of Employment at Exporters	-0.0473 (0.0323)	0.2890*** (0.0687)
% Change Employment	-0.2213*** (0.0827)	-1.0128*** (0.1756)
% Change Domestic Shipments	-0.2614*** (0.0923)	-0.9631*** (0.1958)

Dependent variables are at 4-digit SIC industry level. Additional variables include 4-digit industry dummies and year dummies. Foreign exchange rate is 4-digit SIC industry export-share weighted foreign currency per $US. Foreign demand is 4-digit SIC industry export-share weighted GDP in 1985 PPP-adjusted $US. Standard Errors are in parentheses.

*** indicates significance at the 1% level.

** indicates significance at the 5% level.

* indicates significance at the 10% level.

Table 18: Export Transition Rates

Year *t* Status	Year *t+1* Status	1976-77	1980-81	1983-84	1984-85	1985-86	1986-87	Average
Non-Exporter	Non-Exporter	0.924	0.879	0.848	0.930	0.915	0.902	0.906
	Exporter	0.076	0.121	0.152	0.070	0.085	0.098	0.094
Exporter	Non-Exporter	0.130	0.167	0.146	0.253	0.180	0.223	0.187
	Exporter	0.870	0.833	0.854	0.747	0.820	0.777	0.813

Source: Annual Survey of Manufactures, various years. Numbers represent the percentage of surviving plants in each category.

Table 19 Determinants of Exporting

Balanced Panel 1985-1987

Probit Analysis

(Exporting=1, non-exporting=0)

Constant	-1.921***
Foreign Exchange	-0.447***
Foreign Income	0.147
Total Employment	0.212***
Non-Production/Total Employment	0.227***
Capital/Labor	0.038***
Multi-Plant Firm	0.056***
Value-Added per Worker	0.067***
Year Dummy -1985	-0.185***
Year Dummy - 1986	-0.086***
Lagged Export Status	0.820***
Interacted Variables (with lagged export status)	
Foreign Exchange	0.213
Foreign Income	25.955***
Total Employment	0.015
Non-Production/Total Employment	-0.151***
Capital/Labor	0.030***
Multi-Plant Firm	0.035
Value-Added per Worker	0.079***
Year Dummy -1985	0.172***
Year Dummy - 1986	0.288***

Other variables include 2-digit industry dummies.

*** indicates significance at the 1% level.

Table 20 Employment By Sample Status, Export Status

Sample Status	Export Status	Total Employment			Production Workers			Non-Production Workers		
		1977	1987	% Change	1977	1987	% Change	1977	1987	% Change
All		18507773	17698087	-4.4%	13684346	12230128	-10.6%	4823427	5467959	13.4%
Both		10703163	9878369	-7.7%	7773222	6727612	-13.5%	2929941	3150757	7.5%
	Neither	3258422	3203726	-1.7%	2452155	2297926	-6.3%	806267	905800	12.3%
	Stoppers	1489011	1171293	-21.3%	1090205	828011	-24.0%	398806	343282	-13.9%
	Throughout	4891017	4353386	-11.0%	3433308	2793026	-18.6%	1457709	1560360	7.0%
	Starters	1064713	1149964	8.0%	797554	808649	1.4%	267159	341315	27.8%
Births/Deaths		5239186	4474065	-14.6%	3969239	3134414	-21.0%	1269947	1339651	5.5%
Other Both		2565424	3345653	30.4%	1941885	2368102	21.9%	623539	977551	56.8%

All numbers come from the 1977 and 1987 Census of Manufactures which includes plants labelled as 'administrative records'. Other Both contains plants in the 1977 and 1987 Censuses but for whom their are no export records in 1977.

Table 21 Shipments, Productivity By Sample Status, Export Status

Sample Status	Export Status	Total Value of Shipments ('000s of 1987$)			Value-Added Per Employee ('000s 1987$ per worker)		
		1977	1987	% Change	1977	1987	% Change
All		2127913912	2467930388	16.0%	50.89	65.73	29.2%
Both		1438244788	1652982309	14.9%	58.88	77.16	31.0%
	Neither	363792887	435522087	19.7%	47.35	60.09	26.9%
	Stoppers	201331579	198908352	-1.2%	57.49	75.17	30.7%
	Throughout	707902492	805589831	13.8%	67.09	89.51	33.4%
	Starters	165217830	212962039	28.9%	58.38	79.98	37.0%
Births/Deaths		505048702	524715351	3.9%	41.52	55.99	34.9%
Other Both		184620420	290232728	57.2%	36.73	45.02	59.9%

All numbers come from the 1977 and 1987 Census of Manufactures which includes plants labelled as 'administrative records'. Other Both contains plants in the 1977 and 1987 Censuses but for whom their are no export records in 1977.

Table 22: Survival Rates

Year *t* Status	Year *t+1* Status	1976-77	1980-81	1984-85	1985-86	1986-87	Average
Non-Exporter	Survived	0.906	0.931	0.919	0.910	0.889	0.911
	Failed	0.094	0.069	0.081	0.090	0.111	0.089
Exporter	Survived	0.974	0.987	0.969	0.960	0.961	0.970
	Failed	0.026	0.013	0.031	0.040	0.039	0.030

Numbers represent percentage of plants that are found in the subsequent ASM. 1983-84 results are not included since the ASM sampling frame changed between these years.

Table 23: Plant Survival and Growth

		Employment			Shipments ('000s of 1987$)			Labor Productivity ('000s of 1987$ per Worker)			Exports ('000s of 1987$)		
Export Decile	% Survivors	1976	1987	Change	1976	1987	Change	1976	1987	Change	1976	1987	Change
(Non-Exporters) 0	53.9%	128	167	30.7%	14398	24716	71.7%	45.9	65.6	42.8%	0	627	--
1	61.8%	146	177	21.3%	17045	28522	67.3%	49.3	76.3	54.8%	35	346	874.8%
2	64.5%	177	197	11.1%	19676	28842	46.6%	50.7	73.2	44.4%	119	694	482.2%
3	64.2%	209	233	11.8%	25040	34204	36.6%	51.5	74.1	43.9%	243	1817	648.6%
4	69.6%	273	280	2.5%	30595	44597	45.8%	51.8	79.3	53.0%	431	1228	184.8%
5	68.7%	270	277	2.9%	28909	38982	34.8%	49.2	71.3	44.9%	715	1408	96.8%
6	72.6%	315	321	1.9%	36809	51033	38.6%	54.6	79.4	45.4%	1172	1692	44.4%
7	70.7%	372	379	1.9%	41303	56070	35.8%	52.7	78.2	48.4%	1927	2495	29.5%
8	76.5%	511	462	-9.5%	64005	75112	17.4%	56.7	80.4	41.8%	3408	3915	14.9%
9	77.2%	676	600	-11.3%	86461	108659	25.7%	58.4	86.8	48.6%	6851	7348	7.3%
10	80.7%	1814	1620	-10.7%	299496	354597	18.4%	71.7	98.4	37.2%	54315	45972	-15.4%
Exporters (avg)	70.6%	476	4801	1.0%	64904	87756	35.2%	60.8	86.7	42.5%	6920	7413	7.1%

This Table tracks plants that were in the 1976 ASM. Non-exporters in 1976 are in decile 0, exporters are ranked according to their value of shipments with the smallest exporters in decile 1 and the largest in decile 10. All numbers are plant means

Table 24: Probability of Survival

Probit Results

Initial Exporter:	1977 Census	1982 Census	1987 Census
Exporter in '76	0.1264 (0.0379)	0.0295 (0.0177)	-0.0085 (0.0149)
Exporter in '81		0.1408 (0.0316)	0.0721 (0.0017)
Exporter in '86			0.0368 (0.0333)

Controls include plant size, capital per worker, value-added per employee ,multi-plant dummy, and 2-digit industry dummies. Standard errors are in parentheses.

Table 25: Year-to-Year Percentage Changes Export Status in Initial Year Pooled Regressions 1976-87	
Dependent Variable	Exporter in Initial Year
% Change Employment	0.0239 (0.0017)
% Change Production Workers	0.0247 (0.0018)
% Change Non-Production Workers	0.0130 (0.0021)
% Change Shipments	0.0100 (0.0020)
% Change Value Added per Worker	-0.0084 (0.0027)

Controls include age, size, hours per worker, capital per worker, multi-plant, region, 4-digit industry. Standard Errors in parentheses

Table 26: Year to Year % Changes Export Status in Initial and Final Year 1976-87			
Variable	Total Employment	Total Shipments	Value-Added/ Worker
Non-Exporter in Year 0 Exporter in Year 1	---	---	---
Exporter in Year 0 Non-Exporter in Year 1	-0.0396 (0.0064)	-0.1051 (0.0043)	-0.0635 (0.0128)
Exporter in Year 0 Exporter in Year 1	-0.0140 (0.0056)	-0.0300 (0.0034)	-0.0107 (0.0113)
Non-Exporter in Year 0 Non-Exporter in Year 1	-0.0313 (0.0053)	-0.070 (0.0032)	-0.0342 (0.0107)

Dependent variables are % changes in real wages per worker. Additional controls include logs of initial employment, capital-labor, multi, plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

Table 27: % Changes Long Difference Export Status in Initial Year 1976-87	
Dependent Variable	Exporter in Initial Year
% Change Employment	0.0032 (0.0104)
% Change Production Workers	-0.0009 (0.0112)
% Change Non-Production Workers	-0.0103 (0.0133)
% Change Shipments	-0.0422 (0.0128)
% Change Value Added per Worker	-0.0549 (0.0120)

Controls include age, size, hours per worker, capital per worker, multi-plant, region, 4-digit industry. Standard errors in parentheses

Table 28: % Changes - Long Differences Export Status in Initial and Final Year 1976-87			
Variable	Total Employment	Total Shipments	Value-Added/ Worker
Non-Exporter in Year 0 Exporter in Year 1	---	---	---
Exporter in Year 0 Non-Exporter in Year 1	-0.2830 (0.0162)	-0.3885 (0.0198)	-0.1420 (0.0154)
Exporter in Year 0 Exporter in Year 1	-0.0412 (0.0143)	-0.1028 (0.0175)	-0.0859 (0.0165)
Non-Exporter in Year 0 Non-Exporter in Year 1	-0.2246 (0.0133)	-0.278 (0.0163)	-0.0855 (0.0154)

Dependent variables are % changes in real wages per worker. Additional controls include logs of initial employment, capital-labor, multi, plant age, year dummies, 4-digit SIC dummies, and state-SMSA region dummies. Standard errors are in parentheses.

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