Understanding Exports from the Plant Up*

BY GEORGE ALESSANDRIA AND HORAG CHOI

Some companies export their products abroad, while others choose to sell only in their home market. Similarly, over time, some nonexporters become exporters and some exporters stop exporting. The decision to export is a big, important decision for an organization, one that takes time and resources but one that can lead to an expansion of sales and profits. Policymakers recognize that although exporting isn't easy, it can boost sales and create jobs when successful. To help in this process, many states devote substantial resources to encouraging exports, including loans, trade missions, and trade fairs. Even the federal government has policies that encourage exporting, providing special tax treatment of profits on export sales and low-interest loans. In this article, George Alessandria and Horag Choi discuss some key factors that affect companies' decisions to export by describing some salient characteristics of establishments that export and then building a simple model of the decision to export that captures these features.

In January 2008, Mercedes officially began selling the Smart Four-Two car in the U.S. market. The arrival of this little fuel-efficient car was a long time coming, since Mercedes had been producing and selling different models of this car in Europe for almost 10 years. Indeed, the U.S. market was the 37th export market for the car, even though the U.S. market is the largest car market in the world.[1] With high gas prices and a well-known parent company, the launch of this new product in the U.S. created a lot of buzz and sales: about 11,400 cars in six months.[2]

Like Mercedes with the smart car, some companies export their products abroad, while others choose to sell only in their home market. Similarly, over time, some nonexporters become exporters and some exporters stop exporting. The decision to export is a big, important decision for an organization, one that takes time and resources but can lead to an expansion of sales and profits.

Policymakers recognize that exporting isn't easy but can boost sales and create jobs when successful. To help in this process, many states devote

[1] According to Global Insight.com, in 2007 the top three national car markets in terms of units sold were the U.S (16 million), China (8 million), and Japan (5.3 million).

[2] Based on data from motorintelligence.com.

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substantial resources to encouraging exports, including loans, trade missions, and trade fairs.[3] Even the federal government has policies that encourage exporting, providing special tax treatment of profits on export sales and low-interest loans. These policies are often justified by pointing to the desirable characteristics of exporters: Exporters tend to have more workers and are more productive than nonexporters.[4] The hope is that if exporting is encouraged, some firms will hire more workers and become more productive. But it could be the case that successful firms export rather than the case that exporting leads to success. If so, the policy implications are quite different.

In this article, we discuss some key factors that affect companies' decisions to export by describing some salient characteristics of establishments that export and then building a simple model of the decision to export that captures these features. Our analysis has four key benefits. First, our model of exporting allows us to think about whether establishments become bigger and more productive when exporting or whether bigger and more productive establishments become exporters. Second, it provides a framework for categorizing and interpreting the barriers to trade. Knowing what the barriers to trade are can help policymakers to design policies to lessen the impact of these barriers. Third, it also helps to explain the pattern of trade, since the number of establishments exporting is an important determinant of trade flows between countries. Finally, we explain how the decision to export may be important for the response of trade to changes in the costs of trade over time.

Focusing on establishments provides the cleanest look into the relationship between products produced and traded.

SOME KEY CHARACTERISTICS OF EXPORTERS

We start our analysis of exporters and nonexporters by focusing on their characteristics at a moment in time in a few countries. To be consistent with the theory we develop later, which studies the decision to sell a single product overseas, we use the establishment, rather than the firm, as our basic unit of analysis. An establishment is a physical location, or plant, where economic activity takes place, while a firm is a collection of establishments with the same owner. For instance, the Ford Motor Company owns a manufacturing assembly plant in Louisville, Kentucky, where about 4,000 workers assemble trucks.[5] This assembly plant is an establishment. Ford also owns many plants in other parts of the U.S. and throughout the world, each representing an establishment. To take the Ford example one step further, by looking at establishments, we can separately consider exports of large sport utility vehicles and subcompacts, since these products tend to be produced in different establishments. Thus, focusing on establishments provides the cleanest look into the relationship between products produced and traded.

The data we study are based on economic surveys of manufacturers undertaken by statistical agencies in each country. We focus on manufacturers because they produce the goods that are most easily traded across countries. For the U.S. our analysis is based on data from the Census of Manufactures, a survey of the economic activity of the universe of U.S. manufacturing establishments that is taken every five years.

Three key characteristics of establishments and trade emerge from the data. First, not all establishments export. In the U.S., out of 31,133 active manufacturing establishments in 2002 with 100 or more employees, only 46 percent exported anything. The percentage of exporters would be even smaller if we included establishments with fewer than 100 employees in our analysis. Second, exporters tend to be bigger than nonexporters, with nearly 50 percent more workers (an average of 388 workers for exporters and 257 for nonexporters) and twice as many annual sales (an average of $133 million vs. $67 million per year). Again, these gaps are even bigger if we include plants with fewer than 100 employees. Third, exporters are more productive as measured by labor productivity (the amount of output produced per worker). For instance, in our sample, exporters generate nearly 31 percent more sales per worker than nonexporters.

[3] An example of a state-level program to help companies export is the Pennsylvania Market Access Grant (MAG). The MAG provides small and medium-size companies with financial assistance and support for entering foreign markets. Specifically, the MAG program provides up to $5,000 in matching funds to both offset a portion of the qualifying expenses associated with new international initiatives and provide international business support (http://www.newpa.com/download.aspx?id=1114).

[4] Starting in 1971, the U.S. tax statutes allowed companies to create a separate sales organization for exports that exempted their export revenue from corporate taxes. Such tax breaks have been at the center of trade disputes between the European Union and the U.S. over the years and were eliminated only in 2006.

[5] This plant assembles the F-250-F550, Super Duty, Lincoln Navigator, and Ford Expedition. It is one of 81 manufacturing locations (http://media.ford.com/plants.cfm).

While the data show that exporters are bigger in terms of workers and sales than nonexporters, this ordering is not absolute. There are some small establishments that export, and some big establishments that sell only in the U.S., so that size is a useful, but imprecise predictor of exporting. Figure 1 shows how the fraction of establishments exporting varies with establishment size. For instance, in 2002 among U.S. manufacturing establishments with 100 to 249 employees, about 42 percent exported, while among establishments with over 2,500 employees, about 80 percent exported.

Across countries, we find similar features of manufacturing establishments. For instance, based on manufacturing data[6] on establishments in Canada (in 1999) and Chile (in 2001), Figure 1 shows that, as in the U.S., not all plants export but the fraction of establishments exporting increases with size. From Table 1, we also see that exporters are also relatively larger and more productive in these countries too. For instance, in Canada exporters have 50 percent more workers, 119 percent more sales, and 45 percent more sales per worker. Similar premiums are evident for Chilean exporters.

These characteristics of establishments are also robust across industries. For instance, using similar data for the U.S., Andrew Bernard and Bradford Jensen show that these exporter premiums are not just due to differences in industry composition or the amount of capital, such as machines, software, or infrastructure, that each worker has to work with. That is, within narrowly defined industries, we find similar differences between exporters and nonexporters.

[6] Statistics for Chile are based on a sample of 794 plants with 100+ employees and, for Canada, on a sample of 4,258 plants with 100+ employees.

FIGURE 1

Fraction of Establishments Exporting by Size

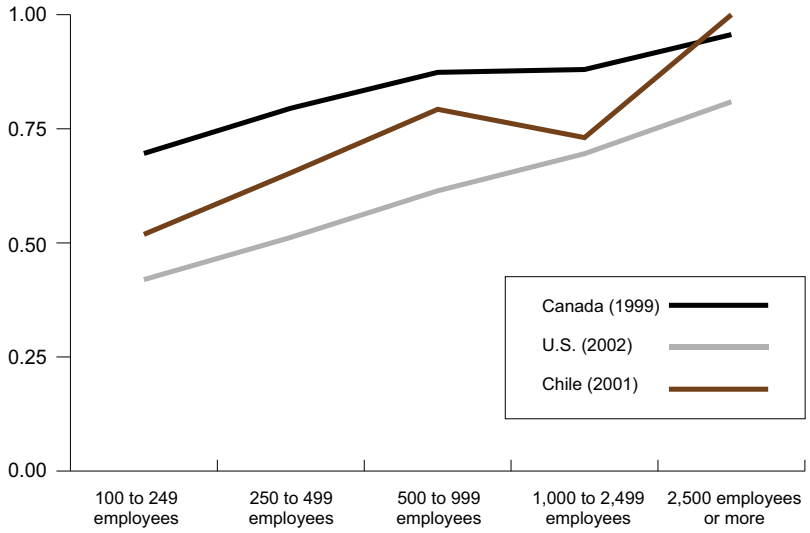


TABLE 1

Exporter Premiums in U.S., Canada, and Chile*

	U.S. (2002)	Canada (1999)	Chile (2001)
Employment	51%	50%	46%
Sales	97%	119%	102%
Sales per worker (labor productivity)	31%	46%	39%

* Based on plants with 100+ employees in the year of the survey. Premiums are calculated as premium = Xexporters /Xnonexporters -1, where X is the variable in question.

DYNAMIC CHARACTERISTICS OF EXPORTERS AND NONEXPORTERS

As in the case of the factory producing the Smart Four-Two in Hambach, France, for the U.S. market, not all establishments are born exporters but rather come to this decision over time. Thus, the key attributes of exporters and nonexporters we've just described reflect both current and past choices made by establishments. We now describe how the ins and outs of exporting are related to the life cycle of establishments.

While exporting is not a once-and-for-all decision, it is fairly persistent. For instance, using a sample of U.S. manufacturing establishments contained in the Longitudinal

Research Database (LRD), an annual survey similar to the Census of Manufactures but geared toward large establishments, Bernard and Jensen (1999) find that from 1984 to 1992, among U.S. exporters there was, on average, only a 14 percent probability that an exporter in one year stopped exporting in the next year (Table 2). Similarly, nonexporters are likely to continue not exporting from one year to the next. For instance, in the U.S. from 1984 to 1992, the typical nonexporter in the LRD had only about a 12 percent chance of becoming an exporter in the next year. The churning in exporting suggests that the typical exporter expects to spend about seven years exporting when it enters the export market. Similarly, medium-size nonexporting manufacturers expect to start exporting in eight and a half years.[7]

These movements in and out of exporting are also observed in other countries. In Chile, there are slightly fewer movements in and out of exporting, since only 11.5 percent of exporters stop exporting in the following year, while only 3.5 percent of nonexporters start exporting in the following year (Table 2).

These movements in and out of exporting are also not random. Indeed, prior to exporting, future exporters are already relatively big and growing fast. For instance, studying a panel of plants that are in continuous operation, Bernard and Jensen find that four years prior to starting to export, these future exporters already sell 27 percent more and have 20 percent more employees than firms that do not export at all over the same period. Not only are future exporters bigger than current nonexporters, but they also tend to grow relatively quickly prior to exporting. For instance, in the run-up to exporting, these future exporters tend to grow 1.4 to 2.4 percent faster in both sales and employment, respectively. These superior characteristics of future exporters in size and growth are even larger for future exporters among Chilean establishments (Table 3).[8]

A SIMPLE MODEL OF THE DECISION TO EXPORT

We now describe a simple theory that captures the key cross-sectional and dynamic features of plants involved in international trade. A key idea of this theory is that big plants have more to gain by exporting than small plants. Additionally, big plants are big because they tend to be good at what they do and so people want more of their products. Taken together, these two ideas suggest that big plants are both more likely to export and more likely to be productive. Thus, the desirable characteristics of exporters arise because producers with desirable characteristics have chosen to export.

This theory is based on the work of Mark Roberts and James Tybout (1997) and contains four distinct elements.

Producer Heterogeneity in Ability. The first element of the theory is that producers fundamentally differ in their ability and hence can be said to be heterogeneous. Some establishments produce products of higher quality, so that people are willing to pay more for them; other plants are more productive, so that they can produce the same products but more efficiently and hence more cheaply. Fundamentally, both these sources of heterogeneity imply that producers differ in how efficiently they can convert inputs, such as workers, raw materials, and machines, into revenue and ultimately profits.

To make this idea concrete, consider the market for MP3 players. Apple iPods tend to have higher prices than other brands with similar memory, yet Apple sells many iPods (over 200 million, and counting, since launch). Similarly, an establishment may come up with a great way of producing a good inexpensively and then

[7] The duration of exporting and nonexporting is calculated as the inverse of the probability of changing status (for an exporter 7.6 years =1/[1-0.86]).

[8] These calculations are based on plants that are continuously producing and do not take into account how the likelihood of survival differs by plant size or export participation. When examining the relationship between exporting and exiting, or going out of business, Bernard and Jensen find that plants that export are less likely to exit, controlling for other characteristics of plants.

TABLE 2

Probability an Establishment Starts or Stops Exporting

	U.S. (1984 to 1992)	Chile (1990 to 2001)
Probability of starting to export in t+1	12%	3.4%
Probability of stopping export in t+1	14%	11.5%

U.S. statistics are based on calculations from Bernard and Jensen (1999), which are based on data from the U.S. Longitudinal Research Database. Chile statistics are based on the industrial census.

TABLE 3

Exporter Premiums of Future Exporters

	U.S. (1984 to 1988)	Chile (1997 to 2001)
Levels (4 years prior to exporting)		
Sales	27%	85%
Employment	21%	51%
Growth rate (4 years leading to exporting)		
Sales	2.4%	3.6%
Employment	1.4%	3.0%

The top panel (levels) shows that plants that start exporting (in 1988 in U.S. and in 2001 in Chile) already have a size advantage, either in sales or employment, four years prior to starting to export (1984 in U.S. and 1997 in Chile). The second panel shows that these new exporters grow faster than plants that did not export at all in the entire period. U.S. statistics are from Bernard and Jensen, Tables 2 and 3. Chile statistics are based on our own calculations.

be able to undercut its competitors on price to attract more customers. In the iPod example, this can be thought of as the original innovation making it easy for people to carry an entire collection of music without pulling a trailer of CDs.

For simplicity, think of this heterogeneity as being summarized by an establishment's ability to convert work effort into a product consumers are willing to buy. Let's also suppose that an establishment that is better at converting its workers' efforts into revenue also sells more goods and earns a bigger profit. The two lines in Figure 2, Panel A show how an establishment's innate ability translates into its demand for workers and profits. A plant with a higher ability will have larger sales, which requires it to hire more workers and yields more profits.

Changes in Ability Over Time. The second element of the theory is that a plant's ability changes over time. This may arise from luck[9] or the uncertain returns from investing in product or process innovation. Take Apple again. Over 30 years it has had some real big hits, such as the Apple II, Mac, iPod, and iPhone, and some other products that didn't sell so well, such as the Apple III or Lisa. With its successes and failures Apple has expanded and contracted over time, adding and subtracting workers as profits rose and fell.

The specific points in Panel A of Figure 2 capture one possible path of a plant's ability over time in our simplified framework. In period 1, a plant starts out with low ability. In period 2, it becomes better and has high ability. In period 3, its ability slips back to medium. Notice that as a plant gets better and worse at producing, it adds and subtracts workers (from low workers to high workers to medium workers) and its profits fluctuate as well (from low profits to high profits to medium profits).

Costs of Exporting. The third element of the theory is that there are costs to exporting. To make things simple, we consider two types of costs: fixed costs, which don't depend on the amount being sold in the market; and variable costs, which depend on the amount sold in the foreign market.

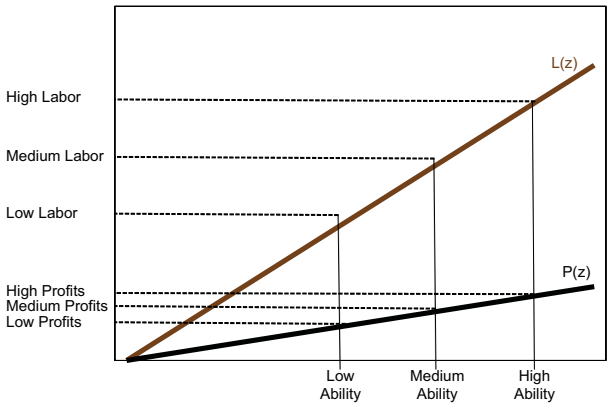
The fixed costs can also be split into upfront costs and continuation costs. Upfront costs reflect the investments that a plant must make prior to exporting its product. Some examples of these costs are the market research about the export market, investments to tailor its product to a specific market, and the creation of marketing and distribution networks. Many of these costs are specific to the product being exported and are said to be sunk costs, since they have no residual value to any other establishment. These investments are made upfront and do not really depend on how many units are subsequently sold. Continuation costs are costs incurred each period to continue selling in the market, and again, these do not depend on the amount to be sold in the current period. In the case of the Smart Four-Two, the product needed to be modified to U.S. safety and emission standards, a dealer network needed to be established with salesmen and mechanics, plus parts needed to be stocked for repairs. The costs of maintaining these dealer and repair networks must be incurred each period to keep selling in the U.S. and are typically lower than the costs of entering the export market. (See *Estimates of the Costs of Trade*.)

The variable costs to trade essentially are those costs that increase the cost to consumers in the destination

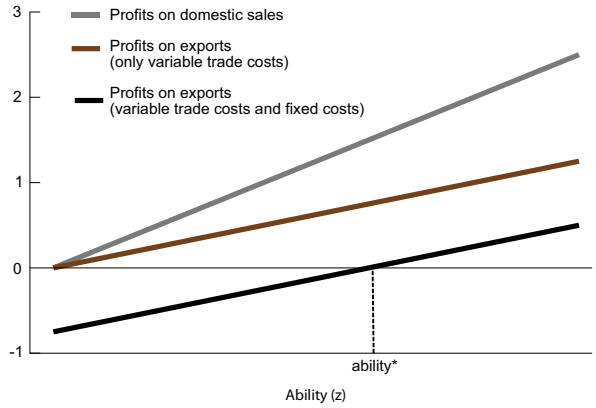
[9] By luck we mean that a producer's sales might be affected by something outside its control such as the weather or the decisions of other producers. For instance, a farmer may face a drought, a competitor may succeed in developing a product that makes another product obsolete, or alternatively, a customer may find a new use for an existing product, making it more valuable.

FIGURE 2

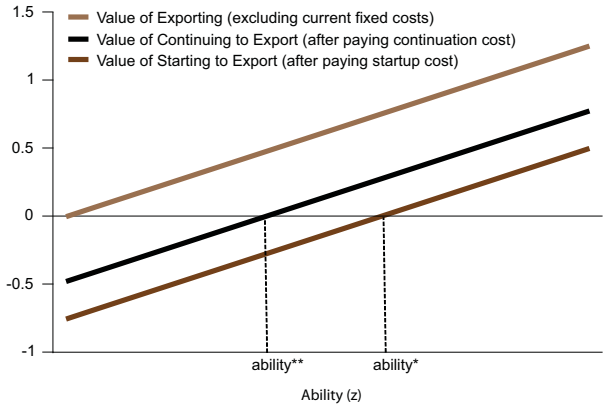
A. Labor Demand and Profits as a Function of Ability



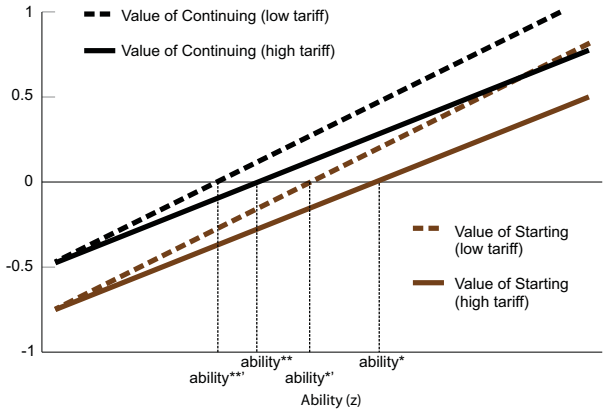
B. Profits as a Function of Ability and Trade Costs



C. Value of Exporting with Upfront and Continuation Costs



D. Value of Exporting and Tariffs



market of each unit shipped. Some examples of these costs are packaging, shipping (air, ocean, rail/truck), insurance, and tariffs.

How Ability and Export Costs Affect Sales at Home and Abroad. The fourth element of the model is explaining how a firm's ability in one market translates into its ability/profits in a second market, given the costs of trade. For now let's suppose that consumers like goods equally in both markets, so that if an establishment charges the same price overseas as it does at home, it will sell the same amount overseas as it does at home.

To start, suppose there are only variable trade costs; that is, fixed costs are equal to zero, so that it is more costly for a firm to sell more of its products in foreign markets. In this case, the firm would not want to charge the same price on exports, since these exports cost more to deliver to consumers in the export market and this will lower profits. For instance, suppose there is a 5 percent tariff, so that a product that sells in the U.S. for $100 will now sell overseas for $105. This higher price will tend to lower both the amount sold and hence profits on sales in the destination market. In Panel B of Figure 2 this is depicted by the brown line, which shows that for the same ability the plant will make lower profits on its exports than on its domestic sales.

Now, suppose that in addition to variable costs there are also fixed costs to exporting. Moreover, assume that the costs of starting to export are the same as the costs of continuing to

Estimates of the Costs of Trade

Identifying and measuring the barriers to international trade are important because it allows policymakers to prioritize reform. For instance, we can ask whether we should cut tariffs, improve infrastructure at ports and customs, alter product standards, provide exporters with financing, or alter the tax code.

In general, the barriers to trade are quite large. One way of measuring them is to ask: How much would these barriers have to add to the price of a good shipped internationally to explain the amount of trade we actually see in the data? This methodology assumes that trade makes imported goods relatively more expensive, lowering demand. In a recent *Business Review* article, Edith Ostapik and Kei-Mu Yi take this approach and find that barriers to international trade add about 74 percent to the price of foreign-produced goods.

Traditionally, these model-based measures of trade barriers ignore the salient characteristics of exporters we have summarized. However, a similar exercise can be undertaken using the model we have sketched out. In one of our studies (2007), we estimate the fixed costs (both upfront sunk costs and those to continue in the market) separately from the per unit cost of exports for U.S. exporters. We find that the cost of starting to export is nearly four times larger than the cost of continuing to export. Including these fixed costs, we now find that the per unit cost of trade adds about 45 percent to the price of imported goods, or about 75 percent of what one would find ignoring exporter characteristics (in which case the cost is closer to 66 percent). This suggests that the costs involved in entering and staying in export markets account for about one-quarter of the barriers to international trade.

export. There is now a simple tradeoff between current profits and the cost of selling overseas. Essentially, the profits of exporting are lowered by the cost of exporting so that export profits are lower at every ability level (denoted by the black line in Panel B of Figure 2).

To make things concrete, suppose a plant is considering exporting today and that exporting will cost $100 regardless of how much the plant sells overseas. For it to be worthwhile to export, the plant must earn enough extra profits in the foreign market to cover the $100 cost of entering the market. Consequently, excluding the $100 upfront cost, a plant that gains $125 in profit from exporting will enter the export market, since it will make a net profit of $25, while a plant that gains only $75 will not export, since it would end up losing $25 by exporting.

More generally, because producers don't like to lose money, they will export only when profits net of these export costs are greater than zero. Since profits increase with ability, this means that there is some minimum ability level, call it ability*, so that only establishments with ability equal to or above ability* will export.

Putting It All Together. The final piece of the model is to understand how the decision to export changes when the upfront costs of starting to export are larger than the costs of continuing to export. With this cost structure of exporting, a plant that pays the costs of starting to export today will have the option to continue exporting in future periods by paying the lower continuation costs. Because this investment in exporting lowers the plant's future costs of exporting, making it cheaper to continue exporting in the future, the plant must consider how both its current and future profits are affected by entering the exporting market. Thus, a plant will export when the total additional profits earned over time from exporting exceed the additional costs of exporting.

To make the dynamic aspects of the export decision clear, let's think about a plant that is considering exporting its product for two periods: today and tomorrow. Suppose it considers only two periods because its competitor is developing a superior product that is going to make its product obsolete. By exporting, it will earn profits of $100 today and $100 tomorrow. Suppose further that starting to export costs $125, while the cost of staying in the export market is only $25. If the plant exports today and tomorrow, it will lose $25 today and make profits of $75 tomorrow. Now, if the plant values future profits in the same way as current losses, it will start exporting because the total profits of $50 over the lifetime of the investment exceed the costs.

Consider now how the decision to export is different in the second period than in the first. Having arrived in the second period, the plant will continue to export as long as the profits from doing so exceed the costs, which are lower, only $25. So the plant will need a much smaller scale of operation to continue to export than it needed to start. Of course, the plant will take into account the likelihood of these

profits in the second period when deciding to start exporting in the first period.

Panel C plots the net gain in profits to a plant from exporting. Because this is based on a plant's current and future ability, just like current profits, this also increases with a plant's current ability. A plant that is not exporting but would like to export must pay a high cost to start exporting, so this will shift down the value of exporting by the entry cost and there will be a cutoff, ability*, so that only plants with ability greater than or equal to ability* find that the benefits of exporting exceed the costs. For a plant that is already exporting, the cost of continuing in the export market is smaller and so there is a different threshold, ability**, such that all producers with ability above ability** find it worthwhile to export. Given that the costs of starting to export are greater than the costs of continuing to export, the threshold to start exporting is higher than the threshold to continue exporting (ability*>ability**).

Finally, we consider how the gains to exporting affect the thresholds to export. Specifically, if the variable trade cost to a destination is lower (say, because tariffs are low or it is in close proximity, leading to lower shipping costs), a producer will sell more for the same ability. In panel D, this means that the value of exporting to this destination will be higher for a given ability. (In practice, this shows up as an upward rotation of the value of starting [brown dashed line] and the value of continuing exporting [black dashed line]). This makes that market more attractive. Because the export market is more attractive, some lower ability nonexporters will find it profitable to start exporting, leading to a lower threshold ability*'. Similarly, some low ability exporters will now find it worthwhile to continue exporting, so the threshold to continue exporting, ability**', will also be lower. With lower cutoffs, there will be more exporters and each exporter will sell more.

Having described our model, we can now study how changes in a plant's ability — recall that this is either productivity or quality — over time affect sales, employment, and the decision to export. Table 4 considers a particular sequence of abilities over a 10-year period for a single plant. We also include the labor that the plant hires each period to satisfy demand for its product at home and abroad (if it exports).

The plant originally starts small, selling just at home. Over time, as its ability improves, it adds workers. In year three, once it has become sufficiently productive, it starts exporting and needs to hire additional workers to produce goods for the foreign market. The plant's ability improves until year 6 and then starts to decline. In year 10, the plant's ability has fallen so far that it is no longer worthwhile to export and so it sells just at home. Notice that the plant continued to export even after its ability had slipped below the level when it started exporting. This is because the cost of staying in the market is lower than the cost of starting to export, and so the ability threshold to exit is lower than the ability threshold to start exporting.

SUCCEEDING TO EXPORT? OR EXPORTING TO SUCCEED?

With this simple model in place, we return to a key question about exporting: Does success beget exporting, or does exporting lead to success? We can use our model to see which of these views has more support. If success begets exporting, our model, which is based on this idea, should be able to explain the key facts we've described. If exporting really does lead to success, our simple model will not be able to capture these same facts.

First, consider how our model can capture the size advantages of exporters and the persistence of their export

TABLE 4

An Example of a Plant's Dynamics

Year	Ability	Workers for Domestic	Workers for Exports	Total Workers
1	1	5	0	5
2	1.8	9	0	9
3	2	10	2	12
4	2.2	11	2.2	13.2
5	2.4	12	2.4	14.4
6	2.8	14	2.8	16.8
7	2.2	11	2.2	13.2
8	2	10	2	12
9	1.8	9	1.8	10.8
10	1.5	7.5	0	7.5

Workers for exports are the additional workers hired to produce products for export.

participation. In our model, because of the fixed costs, not all establishments export. Exporting is worthwhile only when plants have high ability. Consequently, the model explains why exporters tend to be bigger and have more ability than nonexporters. Additionally, if the costs of continuing to export are low relative to the costs to start, once a plant starts exporting, it will continue exporting for a long time, as in the data. So the decision to export will be quite persistent, as in the data.

Next, consider how our model can also capture the level and growth advantages of future exporters described in Table 3.

With regard to the size advantages of future exporters, recall, for instance, that in the U.S., plants that will export in the future have about 27 percent more employees than those plants that will not export in the future. To understand how the model generates the size differences of future exporters, consider two plants with different abilities: one plant with ability 1 and the other with ability 1.5. Suppose that both plants' ability improves by 10 percent and that it takes an ability of 1.6 to start exporting. Now the higher ability plant, whose ability has improved to 1.65, will export, and the low ability plant, whose ability has improved to 1.1, will not export, generating a size premium of future exporters. As long as future ability depends positively on current ability, in the future, high ability plants will be more likely to export than low ability plants and there will be a size premium of future exporters.

Next, consider the growth advantages of future exporters. Recall that in the U.S., plants that export in the future grow 1.4 percent faster per year than plants that do not export in the future. Take two plants with the same ability today, normalized to 1. Suppose that, to export, a plant needs an ability of 1.5. If tomorrow we observe that one plant is exporting and the other is not exporting, it must be the case that the exporter's ability improved by more than that of the plant that did not export. This may explain why plants that eventually export experience more growth than those that don't.

Our simple model of exporting captures the key characteristics of exporters and nonexporters at a moment in time and over time. This is consistent with the idea that successful plants become exporters.

MACROECONOMIC CONSEQUENCES OF MICRO HETEROGENEITY

The basic model developed here captures the salient features of manufacturers that export. It also provides some insights into the determinants of aggregate trade flows across destinations and over time. We now show how the model of entry and exit from exporting can matter for aggregate trade flows by first looking at how the characteristics of U.S. exporters differ by destination. We then consider how changes in the characteristics of U.S. exporters are related to changes in the volume of U.S. exports to the rest of the world.

Looking at the volume of U.S. exports by destination[10] in 2006, we see from Figure 3 that the value of exports (measured in U.S. dollars) increases with the number of exporters. Indeed, the value of exports rises faster than the number of exporters, so that a destination with 10 percent more exporters tends to receive 12.8 percent more U.S. exports. This suggests that desti-

[10] The data for the destination-specific analysis described in this paragraph and in Figures 3, 4, and 5 come from the U.S. Exporter Database, available from the U.S. Department of Commerce's International Trade Administration division. Unlike the case with our plant-level data, the unit of analysis here is the firm. These data are available at http://ita.doc.gov/td/industry/otea/edb/index.html.

FIGURE 3

Value of Exports Rises Faster than Number of Exporters

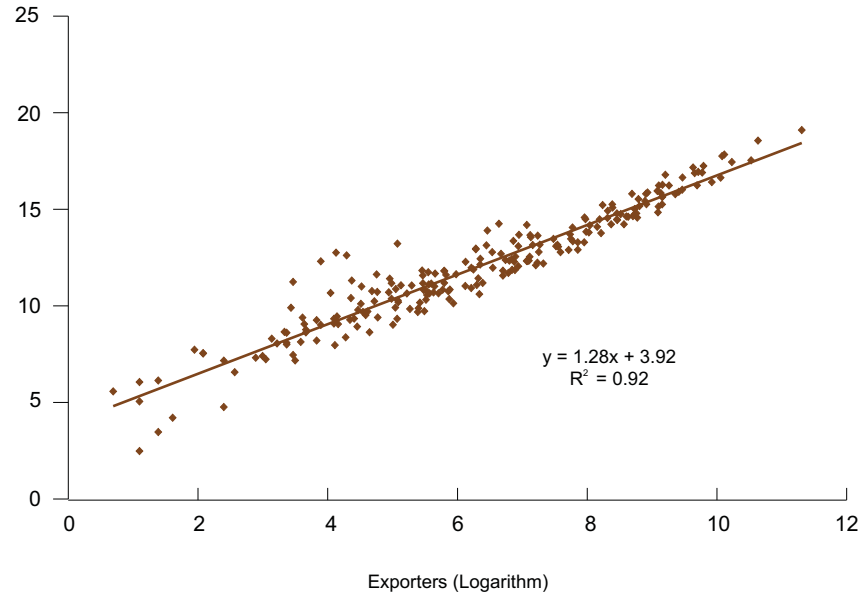


FIGURE 4

Exports Per Firm Are Rising With Number of Exporters

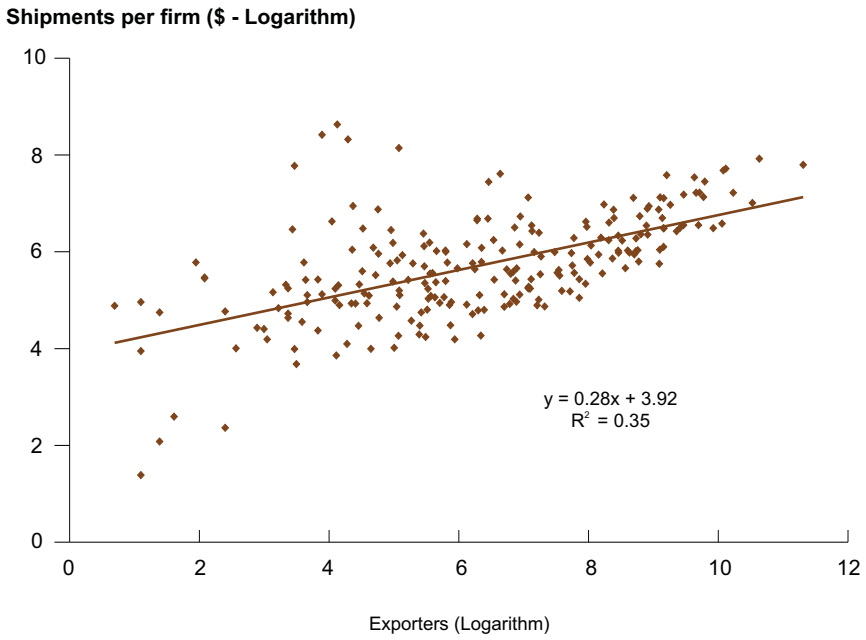
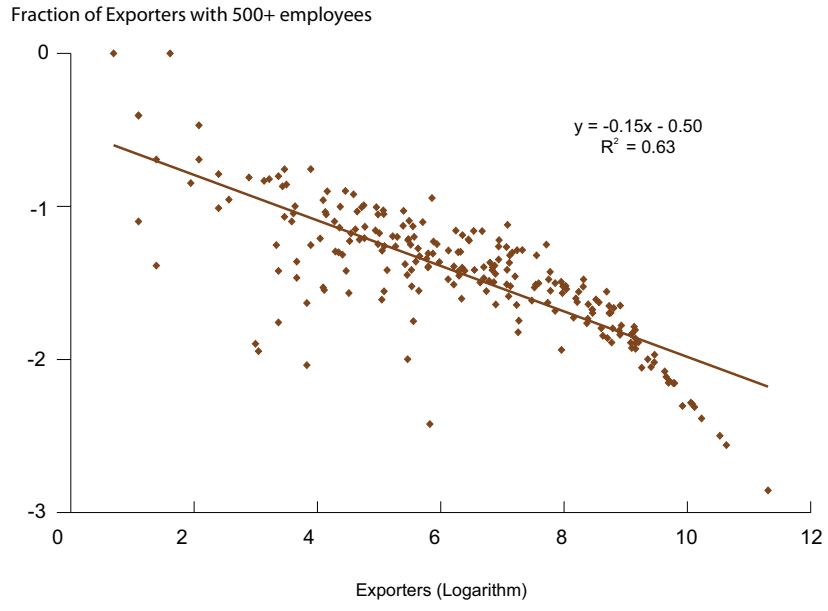


FIGURE 5

Markets with More Exporters Attract Smaller Exporters



nations with a high volume of exports tend to have exporters that are selling a lot on average. One way of seeing this is to plot the average exports per firm against the number of exporters in each destination market (Figure 4). Recall from our theory that firms sell more overseas if the variable costs are lower. So Figure 4 suggests that the costs of shipping to these destinations are lower, which increases demand for exports and sales per exporter. Additionally, because these variable costs are lower and firms can sell more in these markets, these markets also attract more exporters. Indeed, our theory says that these more attractive markets should attract more low ability firms. Figure 5, which plots the number of exporters against the share of big exporters (those with more than 500 employees) in 2006, shows this is the case. Destinations with more U.S. exporters also tend to attract a smaller share of large exporters.

Looking across destination markets provides some insight into how exports may expand through time. Another, perhaps more direct, approach is to directly examine how exports and the characteristics of exporters have changed over time.

In a recent paper (Alessandria and Choi, 2010), we study how the U.S. has increased its trade with the rest of the world. Specifically, we examine the change in the share of U.S. manufacturing output that was exported from 1987 to 2002. Again, focusing on those establishments with 100 or more employees, we find that the share of manufacturing output exported rose from 6.1 percent to 9.7 percent. We then show that this nearly 46.4 percent change in the share of output being exported[11] can be broken down

[11] Changes in this section are calculated using the log of a variable so that the change in trade of 46.4 percent equals ln(9.7/6.1).

into three distinct margins measuring the change in: 1) exporter intensity, 2) exporter premium, and 3) exporter participation.

The first margin, exporter intensity, measures the share of exporters' output that is exported. This term rose 42.3 percent, from 10.0 percent to 15.2 percent, as each exporter exported more of its output. In our theory, the amount that an exporter sells overseas is directly tied to the variable cost of exports, so that an increase in this margin is evidence of a fall in the variable costs of trade.

The second margin, the exporter premium, measures the size of exporters relative to all establishments in the economy, in terms of average sales. This term captures the idea that if exporters are big, then all else equal, this will raise the share of output being exported. Over time, the exporter premium fell from exporters being 64.5 percent larger than the average establishment to only 35.4 percent larger.

Finally, the third margin, exporter participation, measures the share of manufacturing plants that are also exporters. This rose from 37 to 46.9 percent. Taken together, the change in these last two margins tell us that the size gap between exporters and all plants is falling because more small plants are exporting.

The change in trade over time in the U.S. is consistent with what we see in the cross-section of destinations. Trade growth is a result of more sales per exporter and more plants exporting, although these additional exporters tend to be smaller than the plants exporting originally.

Our breakdown of trade growth sheds some light on why trade and exporting have grown. In particular, exporters will sell more abroad when the variable costs of selling are lower and this attracts more exporters. Given the rising share of exporters' output that is being exported, our research finds that the main source of growth in trade has thus been a fall in the variable costs of exporting, rather than a drop in the fixed costs of trade.

SUMMARY

The decision to export is an important decision for most establishments. Here we describe some of the key features of establishments that sell their products overseas. These exporters are superstars. They are bigger and both more productive and more profitable than nonexporters and remain so for a long time.

Some point to the success of these exporters and call for policies to encourage exporting with the hope that the process of exporting will transform less productive producers into superstars. But correlation is not causation. Our simple model shows that causation may run from superstar to exporting. Indeed, future exporters tend to be more productive and to grow faster even before they enter export markets.

Studying the export decision also provides some guidance about the structure of barriers to international trade and their magnitude. The relative size of exporters and the persistence of export participation suggest that the upfront costs to exporting may indeed be sizable. To the extent that these costs are man-made, policies that lower these barriers will encourage more exporters and more exports. Finally, studying the export decision sheds light on the determinants of the pattern of trade between countries. A key source of differences in exports by destination market is in the number of establishments that sell their products in a destination.

The cross-sectional dynamics of exporting suggest that the decision to export is important for the expansion of trade. Much export growth occurs when the value of selling in foreign markets rises enough so that some nonexporters start exporting and some current exporters earn enough to delay exiting and export for a longer time.

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