The Rise of Exporting By US Firms*

William F. Lincoln
Johns Hopkins University

Andrew H. McCallum
Federal Reserve Board of Governors

January 19, 2015

Abstract

Although a great deal of ink has been spilled over the consequences of globalization, we still do not yet fully understand the causes of increased wordwide trade. Using confidential microdata from the US Census, we document significant entry into foreign markets by US firms from 1987 to 2006. We show that this extensive margin growth is unlikely to have been due to significant declines in barriers to entry. We instead find evidence of a large role for foreign income growth and improvements in communication technologies in driving these trends.

*DISCLAIMER: Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the US Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. We especially thank our dissertation chairs Andrei Levchenko and Jim Levinsohn. Dan Ackerberg, Vanessa Alviarez, Wenjie Chen, Alan Deardorff, Ying Fan, Aaron Flaaen, Robert Feenstra, Jeremy Fox, Fariha Kamal, Bill Kerr, Brian Kovak, Pravin Krishna, CJ Krizan, Pawel Krolikowski, Rosana Lee, Day Manoli, Prachi Mishra, Ryan Monarch, Daniel Murphy, Justin Pierce, Mark Roberts, Danielle Sandler, Mine Senses, Jagadeesh Sivadasan, Heiwai Tang, James Tybout, and Jing Zhang all provided helpful comments. The staff at the US Census Bureau has been exceptionally helpful, particularly Clint Carter, James Davis, Barbara Downs, Cheryl Grim, Shawn Klimek, Margaret Levenstein, Arnold Reznek, Lynn Riggs, and Danielle Sandler. The authors can be reached at wlincoln@jhu.edu and andrew.h.mccallum@frb.gov. All errors are our own.

1 Introduction

One of the most notable and controversial trends in the last few decades is that worldwide trade has expanded significantly, both in terms of the volume of trade as well as the number of varieties of goods traded across countries. While much has been written on the consequences of these changes, we still have yet to fully understand their causes. In this paper we investigate the reasons for the large rise in exporting by firms worldwide by focusing on the experience of the United States. Similar to a number of other countries and consistent with more aggregate data, we document a large rise in exporting by firms in the US from 1987 to 2006. We find little evidence that this was due to significant declines in barriers to entry. We instead appeal to a new methodology for understanding the rise of exporting and conclude that growth in foreign income and improvements in communications technologies played a large role in the rise. As neither the evolution of barriers to entry nor a full accounting of the determinants of the rise of exporting by firms have been explored to date, we hope that our work contributes to a better understanding of the causes of the growth of trade worldwide.

Increases in the number of firms exporting across countries, and the associated increase in the number of varieties of goods traded, are likely to have had significant impacts on welfare worldwide through several channels. As in Krugman (1979) and more recently Feenstra (2014), if consumers have a love of variety, then access to a significantly larger set of goods is likely to have been beneficial to them. Broda and Weinstein (2006) in particular have argued that the impact of the tripling of varieties imported into the United States from 1972 to 2001 had such effects. On the producer side, access to a wider range of intermediate inputs is likely to have had an impact on the productivity of importing firms. Roughly 60% of international trade is in intermediate goods (Johnson 2014) and developing countries are often heavily dependent on imports from industrialized nations of capital goods that embody the latest technologies (Eaton and Kortum 2001). Access to a wider range of imported intermediates is also likely to have increased the incentives to develop new products domestically. For example, Goldberg et al (2010) find that the large declines in tariffs in the early 1990s in India led to a significant increase in the development of new products. To a large extent, this was driven by access to net input varieties from abroad. A better understanding of the causes of the rise in exporting is thus of first order importance to understanding rising standards of living worldwide.

A growing body of evidence has also highlighted the importance of better understanding the determinants of the extensive margin of trade. Hummels and Klenow (2005) and Bernard et al. (2009) show that the extensive margin accounts for most of the cross-country variation

in exports, particularly of US exports. Across a number of different countries worldwide for which we have firm level data, we have also seen significant increases in exporting by firms. This list includes Chile, Colombia, Mexico, and Morocco (Bergoeing, Micco, and Repetto 2011 and Roberts and Tybout 1997a). Although evidence at the firm level is naturally restricted by data availability, we also see dramatic increases in the number of varieties of goods sold across countries in disaggregated industry-level trade data (Evenett and Venables 2002, Broda and Weinstein 2006, and Harris, Kónya, and Mátyás 2011). These results are consistent with substantial foreign market entry by firms in different sectors for a wide range of countries. Dutt, Mihov, and Van-Zandt (2013) have in particular documented that increases in worldwide trade since the 1970s have been driven by growth in the extensive margin of the number of varieties of goods traded, rather than growth in the number of countries trading or expansions of trade of goods that were already traded across countries.

Our analysis begins by documenting a number of stylized facts that provide new insight into the US experience. Most notably, there was an increase in both the prevalence of exporting by firms as well as the average number of countries sold to by a given exporter. Together this lead to a 50% increase in the probability that a firm exports to a given country in our sample. These changes were even more dramatic at the plant level, with the percentage of plants with 20 or more employees that exported rising from 21% in 1987 to 39% in 2006. We find that this entry was also broad-based; it was experienced across a wide range of industries as well as geographic regions. While Mexico and China accounted for a significant share, the rise in exporting was generally broad based across countries as well.

A natural explanation for this large scale entry into foreign markets is that barriers to entry have declined over time. Despite the large literature on changes in other trade barriers such as tariffs and transportation costs, however, an analysis of how these costs have changed over time has not been done to date. Coupled with the fact that declines in these costs have been previously suggested as a potential cause of these extensive margin trends in other countries, we begin by looking at how much of a role they played. Simple fixed effects as well as simulated maximum likelihood estimations that consider the manufacturing sector as a whole find little change in these costs over time. Computationally intensive structural estimations on three particular industries using Bayesian Monte Carlo Markov Chain methods also suggest modest overall changes in these costs over time. Taken together, the results from these different approaches are evidence that declines in the costs of entering foreign markets are unlikely to have been the driving factor behind these trends.

We then turn to an analysis of other potential explanations for the rise of exporting. The prior literature on understanding the growth of worldwide trade has focused on total exports and typically used an ordinary least squares approach that ignores the effects of

unobservable factors. Borrowing decomposition methods from the labor economics literature that have been used to study the rise of female labor force participation, we introduce a new methodology into the literature on understanding changes in international trade. We find that although other factors played a role in the rise of exporting, foreign economic growth and the development of the internet were primary drivers. The decline of the effect of distance in our estimations also echoes arguments made in the popular debate on globalization about the world becoming more "flat" (Friedman 2005). These results suggest that the rise in exporting is unlikely to be reversed without significant changes in the trading system.

In the next section, we discuss our data sources and document several new stylized facts about US firms' exporting behavior from 1987 to 2006. In Section 3 we explore the evolution of barriers to entry in foreign markets. Section 4 analyzes the factors that accounted for the rise of exporting by US firms and Section 5 concludes.

2 Data and Stylized Facts

Our microdata come from two primary sources, each with its own advantages. The first is the Linked-Longitudinal Firm Trade Transaction Database (LFTTD). This data set contains records from US Customs and has information on the value, firm, and country of destination associated with all US export transactions beginning in 1993. We link these records to the Longitudinal Business Database (LBD) on the employment and payroll of every establishment in the US. This merged database has the advantage of allowing us to follow smaller firms over time and to perform analyses by country. Given the lack of information on firm characteristics outside of employment and payroll, however, it does not allow for the type of structural estimations that are possible with our other sources of data. It also only affords an analysis beginning in 1992. Information on exports to Canada is collected separately in the LFTTD and poses issues of measurement error not present for other countries (Bernard et al. 2009). In order to focus on better measured data, throughout we focus on firms with 20 or more employees. Where appropriate we also drop the years 1992 and 1998 due to evidence of especially large measurement error in these years. Firms with 20 employees, however, account for the overwhelming majority of both total exports as well as the number of firms exporting. To focus the analysis, we also limit our sample to the top 50 US export destinations. These countries accounted for the vast majority of the rise of exporting, both in terms of the number of firms as well as the volume of exports. They also account for around 95% of total U.S. manufacturing export volume. In all of our analyses, we utilize 2006 as our last sample year.

The second source of microdata is the Annual Survey of Manufacturers (ASM), which contains information on the operations of a sample of US manufacturing plants. While the ASM does not contain information on the countries from which export revenues came, its detailed information on plant characteristics are valuable for our structural estimations of barriers to entry in foreign markets. The time span of the data that include information on exports is also quite long, extending for 20 years from 1987 - 2006. The sampling frames in the ASM are redone in years ending in 4 and 9 (e.g. 1994) and establishments are followed over time for five years until the next frame is implemented. The survey includes large plants in every year with certainty but samples smaller plants according to their contribution to output. This design imposes some structure on our analysis. Due to the loss of non-certainty cases across different ASM panels, we limit our sample for panel analyses to plants with 250 or more employees. This avoids a number of challenges involved in following smaller plants over time and allows for comparability with previous studies that have used a similar approach. Despite this restriction, however, this sample covers a significant portion of economic activity and the great majority of total exports. For example, Bernard and Jensen (2004a) use a similar sample in 1987 and note that it accounts for 41% of employment, 52% of shipments, and 70% of exports.

With these data, we develop a number of new stylized facts regarding the pace and character of the rise of exporting by US firms.[1] We begin by discussing the changes seen in the LFTTD and then look at the plant-level patterns in the ASM that cover an even larger time frame. We find that the probability that a firm exports to a given country in our sample increases by 50% from 1993 to 2006. These changes can be broken down into different components. First, we find that the percentage of firms that export in our sample grew by 20% over this time period, from 40% to 48%. Taking the 40 percent figure from 1993 that we have requested disclosure for in the numerical section as a baseline, firms that were no longer in operation in 2006 were only modestly less likely to be exporters. Firms that entered and were producing in 2006 were similarly only slightly more likely to export. Finally, when considering firms that were in operation in both 1993 and 2006, the rise in exporting was even stronger, with a larger increase in the percent of firms exporting overall and a larger increase in the average number of countries sold to by exporters. We come to similar conclusions throughout this section when dropping the 20 employee restriction and considering all firms.

At the same time that the fraction of firms exporting was growing, the number of countries

[1] Bernard and Jensen (2004a) have previously documented a significant increase in the fraction of manufacturing plants that export over the period 1987-1992. Bernard, Jensen, and Schott (2009) additionally report significant extensive margin entry for US firms in goods (agriculture, manufacturing, and mining) sectors across the two years 1993 and 2000.

to which they sold to also increased. The average number of destinations for each exporting firm grew from 4.94 to 6.22 and the median number similarly increased from 2 to 3. This led to a 36% increase in the raw number of firm-country pairs that had exports. Looked at a different way that accounts for the overall decline in the number of manufacturing firms over the period, the probability that a firm exported to a given country in our sample rose from 3.96% to 6.00%, a 50% increase.

To get a better sense of these trends, we looked at them broken down by industry as well as region of the country. In Figures 2 and 3 we plot the probability of exporting to a given country in our sample across 2 digit 1987 SIC categories and US Census divisions of the country. We find that the rise of exporting was experienced across all but one sector as well as across each of the parts of the country. Given the switch in reporting of sectoral codes from SIC to NAICS in our data around 1997, we develop a concordance from NAICS to SIC codes which we describe in greater detail in the data appendix to follow firms across years. The fact that the rise in exporting was pervasive across these two dimensions suggests that these trends were not driven by idiosyncratic factors such as the rise of high-tech industries but rather changes that affected different types of firms broadly.

In a similar vein, we also looked at how the composition of the destinations of where firms exported to changed over time. In Figure 1, we plot the percentage of firms exporting to each country in our sample with the fraction in 1993 on the x axis and the fraction in 2006 on the y axis. Including a 45° line to see how the figures compare across every country in our sample. In a similar vein, in Table 1 we list the top 10 countries in terms of their contribution to the overall rise in the total number of firm-country pairs that show exports. A few conclusions come out of these initial figures. First, the growth in exporting was experience broadly across countries; no individual country accounts for more than 12% of the increase. The set of the most important contributors includes a variety of economies, from industrialized nations like Great Britain and Germany to fast growing developing economies such as India and China. It also accounts for nearly half of the rise in exporting. Given that the North American Free Trade Agreement was signed and passed during these years, it is perhaps not surprising that increases in exporting to Mexico played a significant role. With a 12% share, along with the fact that there were other favorable developments in the country, however, it is clear that NAFTA is not the primary factor driving these trends. With a share of 1.6%, it is also clear that, while not negligible, growth in exporting to Russia after the fall of the Soviet Union was also not an important driving factor underlying these trends.

Another notable feature of Figure 1 and Table 1 is that many of the most important countries experienced rapid economic growth. While China and India are the most notable examples of this, Mexico, Brazil, and Korea also experienced significant growth. In Figure

4 we plot the percentage change in market size for the countries in our sample against the growth in export participation in the country. Although there is significant variation across countries reflecting the impact of other factors, most countries lie close to the 45° line. This points to our results in Section 4 in which we find that foreign economic growth was a primary driver of the rise in exporting. That said, since no one country dominates this list and increases in exporting are observed for every country in our sample, the overall composition of where US firms exported to did not change dramatically. The rank correlation across countries from the beginning to the end of the sample is 89%.

In order to get a sense of how these changes relate adjustments along the intensive margin of trade we considered how foreign sales per exporter evolved over time across countries. We find that this measure increased overall. The rise in total export volumes was thus a product of both intensive as well as extensive margin changes. These trends are also informative about the evolution of barriers to entry. In their seminal work, Eaton, Kortum, and Kramarz (2011) show that a primary determinant of foreign sales per exporter are barriers to entry. If these costs are high, for example, then only the most efficient firms will export to the country at hand, be highly competitive in the foreign market, and capture a significant market share. These results suggest at the very least that if they did in fact decline, changes in barriers to entry were not of a sufficient magnitude to outweigh the other factors that increased average foreign sales.

Turning to our plant level data in the ASM, which exhibits an even earlier start date (1987), we see even larger foreign market entry. The trends are also consistent with the firm level evidence from the LFTTD. In Figure 2, we plot the fraction of plants with 20 or more employees that export over time. The share rises from 21% in 1987 to 39% in 2006. This rise in the percentage of plants exporting was similarly driven both by changes in the composition of firms as well as increases in exporting by firms that were present at the beginning and end of the sample as in the LFTTD. A significant portion of this growth also occurs 1987-1992, highlighting the benefits of looking at these changes with both the ASM and LFTTD data. We see a similar picture when we look at the plant-level versions of Figures 2 and 3 across 1987 to 2003. We find similar results both overall and across industries and regions when limiting the sample to plants with 10 or more employees or 250 or more employees. We further find similar results at the level of the firm in Census of Manufacturers years where we can aggregate the operations of plants. In the appendix we document additional stylized facts about the rise of exporting.

3 Barriers to Entry

A natural starting point for better understanding the large scale entry into foreign markets that we observe in the data is to examine how barriers to entry have changed over time. As these costs can not be directly observed, we use models of firm behavior to estimate changes in their magnitude across different time periods in our sample. We consider multiple approaches to ensure that our results are not being driven by the specifics of a particular model. We begin by considering regression evidence on the changes in these costs and then move on to structural estimations that will allow us to compare the magnitude of these costs in the earlier part of our sample relative to the later part.

3.1 Regression Evidence

Drawing upon the seminal work of Dixit (1989) and Baldwin and Krugman (1989), several prior studies have used a dynamic discrete choice model of whether or not to export to study the existence of barriers to entry in foreign markets.[2] Here, we use this approach to get a sense of how these costs have changed over time. While our structural estimations in the next section will additionally allow us to study a number of different industries in depth with the ASM, our approach here will give us a sense of how these costs have changed for the manufacturing sector as a whole. It will also allow for an analysis using the LFTTD at the country-by-country level. The basic premise of the model is that a firm will sell abroad if the benefits from exporting exceed the additional costs of doing so. The benefits include the extra gross revenues that it could make as well as any option value associated with being an exporter in the future. Firms that did not export previously, on the other hand, have to pay upfront costs to enter. Specifically, a firm that has not exported for more than two years must pay a sunk cost F_0 to enter the foreign market and a re-entry cost F_R if it last exported two years ago.[3] The model leads to a simple decision rule where

$$y_{it} = \begin{cases} 1 & \text{if } p^*_{it} - F_0 \cdot (1 - y_{it-1}) + (F_0 - F_R) \cdot \tilde{y}_{it-2} \geq 0 \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

[2] See for example Roberts and Tybout (1997b), Bernard and Wagner (2001), and Bernard and Jensen (2004a).

[3] Prior studies have found little difference between the costs of entering foreign markets anew and entering after three years of not exporting. They have also found a small difference between F_0 and F_R above. We find similar results. The model can be extended to include a cost of leaving the foreign market L, which makes the coefficient α_1 in equation (2) a function of $F_0 + L$. See Heckman (1981a) and Chamberlain (1985) for discussions of econometric issues relating to identifying true state dependence.

Here y_{it} is firm $i's$ export status in year t and $\tilde{y}_{it-2} = y_{it-2}(1 - y_{it-1})$ is an indicator function for whether the firm last exported two years prior to year t. The term p_{it}^* can be written as

$$p_{it}^* = p_{it} + \delta \left(E_t \left[V_{it+1} \mid y_{it} = 1 \right] - E_t \left[V_{it+1} \mid y_{it} = 0 \right] \right). \tag{2}$$

It is determined by the extra gross profit that the firm could make by exporting this year p_{it}, plus the option value associated with being an exporter next period. This option value, in turn, is given by the difference in the discounted future expected value of being an exporter today relative to only selling domestically. In the model if there are no costs to entering the foreign market, the condition for exporting in equation (1) collapses to $p_{it} \geq 0$. In this case, the firm decides whether or not to export based solely on what is most profitable today and ignores dynamic considerations. Thus, once controlling for factors that account for changes in p_{it}, if there are no costs to entering foreign markets we should see a lack of state dependence in exporting status.

To obtain an estimating equation that will allow us to look at changes in F_0 and F_R we need to parameterize $p_{it}^* - F_0$. We use the following functional form

$$p_{it}^* - F_0 \approx \mu_i + X_{it}'\beta + \phi_t + \varepsilon_{it} \tag{3}$$

to develop the specification

$$y_{it} = \mu_i + X_{it}'\beta + \alpha_1 \cdot y_{it-1} + \alpha_2 \cdot \tilde{y}_{it-2} + \phi_t + \varepsilon_{it} \tag{4}$$

This equation provides the basis for our estimations. The vector X_{it} contains a number of covariates that predict export market participation. Unobserved firm-specific factors that influence p_{it}^* are captured in the term μ_i. Business cycle effects and other time varying factors are absorbed into the year fixed effects ϕ_t. The coefficients $\alpha_1 = F_0$ and $\alpha_2 = (F_0 - F_R)$ parameterize the importance of barriers to entry in foreign markets. Larger estimates of α_1, for example, suggest higher sunk costs F_0.

As our ASM data give us the longest time horizon and allow us to control directly for a greater amount of heterogeneity in time-varying producer characteristics, we begin by estimating equation (4) at the plant level over 1989-2006. Table 2 presents the results. As a first step, in columns (1) and (2) we estimate the specification with a simple fixed effects regression. Standard errors in parentheses are clustered at the plant level and plant-specific characteristics in X_{it} are lagged by one period in order to avoid issues of simultaneity. These include the ratio of nonproduction worker employment to total employment, an indicator function for change of product, and the logarithms of employment, total factor productivity, and average wages. Across all of our results, productivity is estimated with the semi-

parametric approach of Levinsohn and Petrin (2003). We also include an industry-level trade-weighted exchange rate series and the years 1987 and 1988 are used as pre-sample years.

In column (1) we present our findings from estimating equation (2) as presented above. Controlling for other factors, exporting last year raises a plant's probability of exporting by 44%. In column (2) we include interaction terms of the variables y_{it-1} and $\tilde{y}_{it-2}$ with an indicator function for the post-1998 period $Post_{98}$. The coefficient estimates on these interaction terms indicate how the costs F_0 and F_R compare in the second half of the period to those in the first. We find little change in the coefficient α_1 in the second part of the panel and a somewhat larger decrease in α_2. These results are consistent with those found in column (1) in terms of how the coefficients on the interaction terms compare to those on the unaltered lagged export status covariates. Given the magnitudes of the coefficients on the interaction terms, we interpret these estimates to suggest relatively little change in the costs F_0 and an increase in the costs of re-entering foreign markets F_R. In column (3) we include the results from estimating the specification in column (2) where we additionally include interactions of the variables in X_{it} with the indicator $Post_{98}$.

We come to similar conclusions when considering alternative approaches. These include using different definitions of the post-period indicator function $Post_{98}$, only considering plants with 350 or more employees, dropping the computer and semiconductor industries, using different covariates in the term X_{it}, estimating productivity with the approach of Wooldridge (2005), using current values of plant-specific characteristics in the vector X_{it}, and adding the variable "Last exported three years ago" and its interaction with $Post_{98}$.

In these baseline estimations, we make no restrictions on entry or exit into the sample. Estimations using a balanced panel were also robust to these alternative estimation approaches. This is reassuring not only for the validity of our approach here but also for our estimations below as well as our structural estimations, where we are constrained to use a balanced panel approach. The same is true using an approach where we allow entry but drop plants that exit the sample. In a similar vein, we performed similar estimations to those described above but restricted to the industries considered for our structural estimations. We come to similar conclusions here as well, suggesting that the industries we chose to focus on are broadly representative of overall trends.

The estimations in columns (1)-(2) have the advantage that they make few parametric restrictions. They potentially suffer from three particular concerns, however. The first two are initial conditions bias and Nickell bias, although the length of the panel ($T = 20$) is likely to significantly attenuate these concerns. To address these concerns we estimate the specification in (4) with a random effects dynamic probit estimator that uses the Gaussian-Hermite

quadrature methods of Butler and Moffitt (1982) and bounds the predicted probabilities between zero and one. This has the limitation that it specifies a parametric distribution for the firm effect μ_i and only includes one lag of the dependent variable. It also requires using a balanced panel. The robustness to different restrictions on entry and exit in our fixed effects estimations is above reassuring on this score.

Instead of considering the whole panel at once, given the structure of the estimator we instead choose to estimate the model in a later period and earlier period and compare the results. We create two balanced panels covering 1987-1997 and 1995-2006, similar to our approach using MCMC methods in the next section. The problem of initial conditions is dealt with using the approach of Heckman (1981b). Plant employment, wages, the fraction of non-production workers, and total factor productivity two years prior to the start of the sample, along with a set of 2-digit SIC industry dummies, are used in the initial conditions equation. Although not yet disclosed from the US Census, we find little change in state dependence in the earlier and later parts of the sample.

The third concern with both of these estimators is that they assume that the error term is serially correlated. If there are persistent unobserved shocks to p_{it}^*, this could bias our estimates of α_1 and α_2. In order to address all three of these concerns, we turn to a simulated maximum likelihood estimator based on the GHK algorithm of Geweke, Hajivassiliou, and Keane. This dynamic random effects approach makes parametric assumptions on the form of the serial correlation in the error term, which in turn determines the likelihood function. It then uses the property that the likelihood of a sequence of outcomes can be written as the product of recursively defined conditional probabilities. The problem of initial conditions is dealt with as above. The results have not yet been disclosed from the US Census but we find similar levels of state dependence across the two different panels here as well.

While our estimations using the ASM allow us to estimate equation (4) controlling for a number of different producer characteristics, they do not consider what markets to which plants were exporting. We next turn to a similar analysis using the LFTTD. We estimate a variant of equation (4) country by country, where the dependent variable is whether firm i exported to the country in consideration in year t. Similar to the analysis above, for each country we create a set of balanced panels of firms 1992–1999 and 2000–2006. We consider the dynamic panel data probit estimator using the approach of Butler and Moffitt (1982) with no additional firm level controls. In Figure 5 we take the two estimates of the coefficient on y_{it-1} and plot them for each country in Euclidean space. The coefficient in the earlier period is indicated on the x axis and the coefficient in the later period is plotted on the y axis. We include the 45° line in the figure to indicate how the coefficients relate to one another across the two different panels. The estimates for each country are indicated by a

three digit country code. We find that the results cluster around the 45° line, suggesting that barriers to entry have not declined significantly. Notably, for the ten countries that accounted for roughly half of the rise of exporting in Table 1, eight show increases in state dependence and the declines for the other two are relatively small. A similar picture emerges when looking at simple persistence levels by regressing the firm's current export status on its lagged export status with a linear probability model, although the magnitudes of partial effects are naturally different.

3.2 MCMC Estimations

3.2.1 Model and Estimation Approach

In this section, we turn to a structural approach to address how the costs of entering foreign markets have evolved. The extra structure afforded by the model allows us to provide numerical estimates of the costs of entering foreign markets in different time periods. Specifically, we use the estimation methodology developed by Das, Roberts, and Tybout (2007) to look at the average level of foreign market entry costs facing plants over the 1987–1997 and 1995–2006 periods. Comparing these cost estimates across the two panels will then give us a sense of how they have changed. The model utilizes information on both costs and revenues to identify demand parameters and we thus focus on estimating it using our plant level data. In addition to addressing the question of the determinants of the rise in exporting, our results contribute to the emerging literature on estimating the magnitude of these barriers. Indeed, these costs have not been estimated with panel data outside of Colombia and Chile.

Here we lay out the basics of the theory underlying the estimation approach. At the heart of the model is a binary choice decision of whether or not the export. Here the net potential profits from exporting are given by

$$u(\cdot) = \begin{cases} \pi^*_{it}(e_t, x_{it}, z_i) + \varepsilon_{1it} & \text{if } y_{it} = 1 \text{ and } y_{it-1} = 1 \\ \pi^*_{it}(e_t, x_{it}, z_i) - \gamma_s(z_i) + \varepsilon_{2it} & \text{if } y_{it} = 1 \text{ and } y_{it-1} = 0 \\ 0 & \text{if } y_{it} = 0 \end{cases} \tag{5}$$

The variable y_{it} is an indicator for whether plant i exported in year t. π^*_{it} are the gross potential export profits for plant i in year t and are a function of the exchange rate e_t, a set of serially correlated shocks x_{it}, and time invariant plant characteristics z_i. The shocks

x_{it} are identified using data on domestic revenues, foreign revenues, and total costs. The error terms ε_{jit} are serially uncorrelated, normally distributed with mean zero and variance $\sigma^2_{\varepsilon j}$, and are uncorrelated with v_{it} and e_t for each $j = 1, 2$. The plant's potential net export profits depend on its prior export status, since we assume that sunk costs $\gamma_s(z_i)$ have to be paid if the plant did not export in the previous year. The level of these costs γ_s is allowed to vary across the different types of plants in our sample, although computational constraints limit us to simply considering the costs for larger plants relative to smaller plants. It is these costs γ_s that we are most interested in estimating.

In each period t, the plant observes the values of e_t, x_{it}, ε_{jit}, and z_i and forms its expectations about the future using the fact that it knows the processes by which these terms evolve. The plant then determines the decision rule of whether or not to export $y_{it} = y(e_t, x_{it}, z_i, \varepsilon_{jit}, y_{it-1} \mid \theta)$ which maximizes its net discounted expected profit stream over a 30 year horizon. Formally, we have the Bellman equation

$$V_{it} = \max_{y_{it} \in \{0,1\}} \{u(e_t, x_{it}, z_i, \varepsilon_{jit}, y_{it-1}, y_{it} \mid \theta) + \delta E_t V_{it+1}\} \tag{6}$$

where

$$E_t V_{it+1} = \int_{e'} \int_{x'} \int_{\varepsilon'} V_{it+1} \cdot f_e(e' \mid e_t, \theta) \cdot f_x(x' \mid x_t, \theta) \cdot f_\varepsilon(\varepsilon' \mid \varepsilon_t, \theta) \, d\varepsilon' dx' de' \tag{7}$$

and θ is the full parameter vector.

The decision rule of whether or not to export can be written as a binary choice problem $y_{it} = I(y^*_{it} > 0)$. Here $I(\cdot)$ is an indicator function and y^*_{it} is a comparison of the benefits from exporting and from not exporting

$$y^*_{it} = u(e_t, x_{it}, z_i, \varepsilon_{it}, 1, y_{it-1} \mid \theta) + \delta \Delta E_t V_{it+1}(e_t, x_{it}, z_i \mid \theta) \tag{8}$$

where

$$\Delta E_t V_{it+1}(e_t, x_{it}, z_i \mid \theta) = E_t[V_{it+1} \mid y_{it} = 1] - E_t[V_{it+1} \mid y_{it} = 0] \tag{9}$$

The first term in (8) reflects the direct benefits today from exporting, whereas the second term reflects the option value of being an exporter tomorrow. Given that we have multiple state variables, the Rust (1997) random grid algorithm is used in implementing the dynamic programming estimations.

Estimating the likelihood function $L(D \mid \theta)$ that results from the model with classical methods presents two problems. The first is that in order to account for plant heterogeneity, it allows for a different foreign demand elasticity for each plant $\eta = \{\eta_i\}_{i=1}^n$, creating an

incidental parameters problem. The likelihood is also highly nonstandard and unlikely to be globally concave in θ. To circumvent these issues, we use a Bayesian approach and write the posterior distribution of the parameters with $P(\theta \mid D) \propto q(\theta) L(D \mid \theta)$, where $q(\theta)$ gives our prior beliefs about the parameters. To characterize the posterior distribution $P(\theta \mid D)$, we then use the random walk Metropolis–Hastings algorithm. This algorithm essentially allows us to estimate $E(\theta \mid D)$ by performing Monte Carlo integration using a Markov chain.

With a few exceptions, we choose the prior distribution of the parameters $q(\theta)$ to be as diffuse to let the data speak for itself. We list the priors for the most important parameters in our model in Table 3 and these priors are held fixed across each of our estimations. We restrict the priors on the root of the AR(1) processes in the model to be distributed uniformly on $(-1, 1)$ in order to ensure that they are stationary. To impose non–negativity on the variance parameters, our priors are that they are distributed log normally. For each plant, the prior for the elasticity of demand in the foreign market is given by $\ln(\eta_i - 1) \sim N(2, 1)$. This is consistent with prior literature and ensures that $\eta_i > 1$, which is a necessary condition for the model. We describe further details about our estimation approach in the appendix.

3.2.2 Results

The assumptions of the model make it appropriate to consider different industries separately. At the same time, one of its primary limitations is that estimating it is highly computationally intensive. In choosing which industries to focus on, we used several criteria to narrow down our choices (i) there were enough plants in each panel to allow for identification (ii) the industry was sufficiently export oriented (iii) like the manufacturing sector as a whole, the overall destination composition of industry exports was relatively stable 1987–2006 and (iv) in order to get a broad view, the industries were in different 2 digit SIC sectors. As mentioned above, these criteria led us to consider three particular 1987 SIC industries: Preserved Fruits and Vegetables (SIC 203), Aircraft and Parts (SIC 372), and Measuring and Controlling Devices (SIC 382). In the appendix we list the 4 digit subindustries that comprise these 3 digit sectors. Similar to our approach in the previous section, we use the two panels, 1987–1997 and 1995–2006, and estimate the level of sunk costs γ_s in each period.

Table 8 presents the results for our main sunk cost parameters by industry across the two different time periods. The appendix presents the full estimation results for each industry and time period. For each parameter we report the estimated mean and standard deviation, although median values give similar results. All figures are in 1987 dollars. Despite generally using highly diffuse prior distributions, the posterior distributions for most of our parameters

are fairly concentrated. This suggests that the estimates are primarily informed by the data itself rather than the values that we chose for our priors. Following the recommended strategy for posterior simulation suggested by Gelman et al. (2004) we consider 100,000 draws from the posterior distribution from three separate chains for a total of 300,000 draws to form our estimates. With each chain we use burn in period of 50,000 draws.

Consistent with the results from the previous section, we generally find comparable results for γ_s across the two different time periods. For Preserved Fruits and Vegetables we find modest declines across both plant size categories, for Aircraft and Parts we find increases across both categories, and for Measuring and Controlling Devices we find declines for smaller plants and increases for larger plants. Internal calculations using the elasticity estimates for each plant suggest that the magnitude of the sunk costs are equal to a few years of the average level of exporting profits. Elasticity estimates are also consistent with the values suggested by the literature. In concert with our estimates from Section 3.1, we interpret these results to suggest that declines in these costs are unlikely to have been a major factor for the level of entry that we see in the data.

In thinking about our results more broadly, we believe that there are a number of factors that lively worked to increase as well as decrease these costs. Improvements in logistics technologies have likely worked to lower these costs, for example. At the same time, in what little survey evidence we have on these costs, firms list market research and redesigning their products for foreign markets as two of the primary costs that they face in beginning to sell abroad. With the increasing integration of the world economy, market research costs may have increased substantially due to the need to identify and study competition from a greatly expanded number of source countries. Secondly, while most types of nontariff barriers have decreased in the last 25 years, technical barriers to trade have increased significantly. These include product specification, testing, and information disclosure requirements. These changes are seen in the data on nontariff barriers as well as in the rising concerns of policy makers in recent years, consistent with the overall increase in regulatory protectionism.[4] While beyond the scope of this study, we consider the effects of these factors to be an open area for future research.

[4]For evidence on changes in the technical barriers to trade, see United Nations Conference on Trade and Development (2005), Henson and Wilson (2005), USTR (2011), US Department of Commerce (2004), Maskus, Wilson, and Otsuki (2000), and Beghin (2008). Baldwin (2000) and Sykes (1999) provide discussions of the growth of regulatory protectionism. For survey evidence on the nature of barriers to entry, see the study conducted for the World Bank found in First Washington Associates (1991).

4 Accounting for the Rise in Exporting

While looking at changes in barriers to entry is a natural place to begin in looking at the foreign market entry by firms that we observe, there are a number of factors that can explain these trends. In this section we explore the contribution of these alternative factors. While the determinants of the large changes in firm level exporting have not yet been studied, there is a small but influential literature that looks comprehensively at the factors that have driven the large increase in the volume of worldwide trade over time. Three studies have typically employed ordinary least squares estimation of a gravity equation to study the main determinants of the rise in worldwide trade. We depart from this literature in using econometric decomposition methods developed in labor economics that allow us to explore the contributions of observable as well as unobservable factors. In studying a more recent time period than much of the existing related literature, we also have access to a richer set of information that will allow us to explore the role of factors that have not yet been studied, as well as a larger set of countries.

Decomposing changes in the wage distribution and labor force participation rates have received considerable study and provide a basis for methods to address the causes of the rise of the extensive margin in our case. A canonical method for decomposing changes in the mean of a variable was developed by Oaxaca (1993) and Blinder (1973). We start by noting that the fraction of firms that export is just the unconditional probability of an indicator variable where the expectation is computed across firms i and countries c. With this in mind, the difference in the fraction of U.S. firms that export can be written as

$$\begin{aligned} frac^{06} - frac^{93} &= E\left[y_{ci}^{06}\right] - E\left[y_{ci}^{93}\right] \\ &= E_{X^{06}}\left[E\left[y_{ci}^{06} \mid X_{ci}^{06}\right]\right] - E_{X^{93}}\left[E\left[y_{ci}^{93} \mid X_{ci}^{93}\right]\right] \end{aligned}$$

where E_{X^t} for each year $t \in \{93, 06\}$ is the expectation against the distribution of the determinants of exporting status, X_{ci}^t, in that year. In this expression, the law of iterated expectations allows us to focus on the conditional expectation function (CEF), $E\left[y_{ci}^t \mid X_{ci}^t\right]$, for export participation in each year. We model the CEF for export status as follows

$$y_{ci}^t = \alpha^t + \alpha_i^t + \delta^t Z_c^t + \gamma^t W_{ci}^t + \varepsilon_{ci}^t$$

The matrix X_{ci}^t above collects the covariates which include the constant, α^t, firm fixed-effects, α_i^t, along with the matrix Z_c^t of country specific covariates and W_{ci}^t which contain

observables that differ by firm-country. Including the firm fixed effects will be especially important as they control for changes in productivity, and any other firm specific characteristic, between the two periods. The matrix Z_c^t captures measures that vary by country. These include market size, the number of internet users, distance from the U.S., and dummies for the official language of the country being English, if the country shares a common legal origin with or borders the U.S. We also include trade policy indicators for membership in regional and bilateral trade agreements such as NAFTA or the U.S. - Singapore free trade agreement. The covariate W_{ci}^t is sector level tariff rates charged in country c for the main sector of firm i. We also collect the coefficients for each time period in $\beta^t = \left(\alpha^t, \alpha_i^t, \delta^t, \gamma^t\right)$. Taking differences, rearranging then computing the expectation of the export status model allows us to separate the change in the fraction of firms that export into the sum of three terms

$$\begin{aligned} frac^{06} - frac^{93} &= \underbrace{\left(E_{X^{06}}\left[X_{ci}^{06}\right] - E_{X^{93}}\left[X_{ci}^{93}\right]\right)\beta^{93}}_{endowment} \\ &+ \underbrace{\left(\beta^{06} - \beta^{93}\right)E_{X^{93}}\left[X_{ci}^{93}\right]}_{coefficient} \\ &+ \underbrace{\left(\beta^{06} - \beta^{93}\right)\left(E_{X^{06}}\left[X_{ci}^{06}\right] - E_{X^{93}}\left[X_{ci}^{93}\right]\right)}_{interaction} \end{aligned}$$

This expression is the canonical method for decomposing changes in the mean of a variable first developed by Oaxaca (1993) and Blinder (1973) and used frequently in labor economics. The endowment term gives the change in the outcome due to changes in the average value of covariates. In our case, it allows us to highlight how changes in average foreign market size, average number of internet users in each country or average tariffs affected the fraction of U.S. firms that export holding the relationships between covariates and outcomes fixed at their counterfactual 1993 value implied by β^{93}. The coefficient term gives the change in export participation due to changes in the relationship between the covariates and export status holding the value of the covariates to their average in 1993; $E_{X^{93}}\left[X_{ci}^{93}\right]$. In our case, this also includes changes in average firm characteristics as estimated by the firm fixed effects. Finally, the last term provides the interacted effect, or how changes in the coefficients and the covariates work together to change the outcome variable. The endowment and coefficient terms are pure partial effects since they fully isolate the change in the covariates from the change in the coefficients. The interaction term could reinforce or diminish the effect of specific variables on the overall outcome. For example, if average market size has increased and the coefficient on market size became more positive over time, it would provide

robust evidence that changes in market size are a significant driver of changes in export participation. On the other hand, if a variable has increased but at the same time become less important, the interaction term would serve to diminish the direct endowment effect. We have not been able to disclose final estimates of this decomposition as of yet. Figures 4 and 7, however, present a precursor of these results. As can be seen in Figure 4, the relationship between changes in market size on the x-axis and changes in export participation on the y-axis are strong and positive. As the size of a foreign market increases, the benefit of being an U.S. exporter to that country increases in tandem. Figure 7 similarly shows that growth in the number of internet users is associated with strong increase in the extensive margin for U.S. manufacturing firms. The observed large change in these two determinants of export status can account for a significant portion of the rise in export participation.

The exercise presented above is intuitive and similar decomposition methods have been employed numerous times in labor economics to elucidate sources of the changes in the wage distribution, and to a lesser extent labor force participation rates. Kline (2011) shows that the OB estimator of the counterfactual mean has potent statistical properties to commend it's use. In particular, it is equivalent to a propensity score estimator where the odds of treatment are linear in the covariates. In this framework, it stands in contrast to common propensity score estimators which use logit or probit models to form the odds of treatment. Given the fact that OB decomposition is a type of propensity score, Kline (2011) explains that it is a "doubly robust" estimate of the counterfactual mean of a variable. The concept of a "doubly robust" estimator was presented by Robins, Rotnitzky, and Zhao (1994) who show these are consistent if the propensity score assumption or the model for the outcomes is correct. In addition to this property, OB decomposition is straightforward to apply with many covariates, robust in unbalanced samples, and allows for easy computation of standard errors and diagnostics. Given the estimating equation is correctly specified, it is also unbiased in finite samples. An invaluable resource which discusses decomposition methods in more detail is the recent careful treatment by Fortin, Lemieux, and Firpo (2011).

5 Conclusion

In this study we have documented a significant shift rise in exporting amongst US firms over 1987–2006. In looking at why this occurred we initially considered a natural explanation that has been suggested as a primary cause for similar trends in other countries: declines in the upfront costs of entering foreign markets. Across different approaches to understanding

this issue, we show that reductions in these barriers were unlikely to have played a significant role in these trends. We instead turn to methods from the labor economics literature to decompose the sources of the rise in exporting. While other factors were important, we find significant roles for foreign income growth and improvements in communications technologies in driving these trends.

We close with a discussion of a few areas of research that are likely to be fruitful for future work. Firstly, qualitative evidence on the determinants of export market entry costs would be tremendously valuable. Despite the evidence presented here and their ubiquity in trade models, there is surprisingly little direct survey evidence about these costs. Retrospective research in this area could help us better understand the results presented above. Secondly, an improved understanding of the experiences of other countries would also provide further insight into these questions. As firm level data becomes increasingly available, further analyses on the experiences of firms in other countries would add greatly to our understanding of trends in international trade. Finally, we believe that the decomposition methods that we have used in this paper have significant potential for better understanding other questions in international trade. The literature has benefitted to a large extent from prior attempts to better account for the effects of unobservable factors (e.g. Trefler 1993) and our approach here provides significant promise for future work.

6 References

1. **Amiti, Mary, and Caroline Freund**. 2010. "An Anatomy of China's Export Growth." In *China's Growing Role in World Trade*, edited by R. Feenstra and S.J. Wei, 35-56. Chicago: University of Chicago Press.

2. **Arkolakis, Costas**. 2010. "Market Penetration Costs and the New Consumers Margin in International Trade." *Journal of Political Economy* 118 (6): 1151-99.

3. **Baier, Scott L., and Jeffrey H. Bergstrand.** 2001. "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity." *Journal of International Economics* 53 (1): 1-27.

4. **Baldwin, Richard.** 2000. "Regulatory Protectionism, Developing Nations and a Two-Tier World Trading System." In *Brookings Trade Forum*, edited by S. Collins and D. Rodrik. Washington: Brookings Institution.

5. **Baldwin, Richard, and Paul Krugman.** 1989. "Persistent Trade Effects of Large Exchange Rate Shocks." *Quarterly Journal of Economics* 104 (4): 635-54.

6. **Bartelsman, Eric J., and Wayne Gray.** 1996. "The NBER Manufacturing Productivity Database." NBER Technical Working Paper 205.

7. **Beghin, John C.** 2008. "Nontariff Barriers." In *New Palgrave Dictionary of Economics, 2nd edition*, edited by S.N. Darlauf and L. Blume. New York: Palgrave Macmillan LTD.

8. **Bergoeing, Raphael, Alejandro Micco, and Andrea Repetto.** 2011. "Dissecting the Chilean Export Boom." University of Chile Working Paper 339.

9. **Bernard, Andrew, and J. Bradford Jensen.** 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47 (1): 1-25.

10. **Bernard, Andrew, and J. Bradford Jensen.** 2004a. "Why Some Plants Export." *The Review of Economics and Statistics* 86: 561-69.

11. **Bernard, Andrew, and J. Bradford Jensen.** 2004b. "Entry, Expansion, and Intensity in the U.S. Export Boom, 1987-1992." *Review of International Economics* 12 (4): 662-75.

12. **Bernard, Andrew B., Bradford Jensen, Stephen J. Redding, and Peter K. Schott**. 2007. "Firms in International Trade." Journal of Economic Perspectives, 21(3): 105-130.

13. **Bernard, Andrew, and Joachim Wagner.** 2001. "Export Entry and Exit by German Firms." *Review of World Economics (Weltwirtschaftliches Archiv)* 137: 105-23.

14. **Bernard, Andrew, J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott.** 2007. "The Margins of U.S. Trade." *American Economic Review Papers and Proceedings* 99: 487-93.

15. **Bernard, Andrew B., J. Bradford Jensen, and Peter K. Schott.** 2006. "Trade Costs, Firms and Productivity." *Journal of Monetary Economics* 53 (5): 917-37.

16. **Bernard, Andrew, J. Bradford Jensen, and Peter K. Schott.** 2009. "Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods." In *Producer Dynamics: New Evidence from Micro Data*, edited by T. Dunne, J.B. Jensen and M.J. Roberts, 513-556. Chicago: University of Chicago Press.

17. **Blinder, Alan S**. 1973. "Wage Discrimination: Reduced Form and Structural Estimates." *Journal of Human Resources* 8(4): 436–55.

18. **Blonigen, Bruce A., and Thomas J. Prusa.** 2008. "Antidumping." In *New Palgrave Dictionary of Economics, 2nd edition*, edited by S.N. Darlauf and L. Blume. New York: Palgrave Macmillan LTD.

19. **Broda, Christian, and David E. Weinstein.** 2006. "Globalization and the Gains from Variety." *Quarterly Journal of Economics* 121 (2): 541-85.

20. **Brooks, Stephen, and Gareth Roberts.** 1998. "Convergence Assessment Techniques for Markov Chain Monte Carlo." *Statistics and Computing* 8: 319-35.

21. **Chamberlain, Gary.** 1985. "Heterogeneity, Omitted Variables, Duration Dependence." In *Longitudinal Analysis of Labor Market Data*, edited by J. Heckman and B. Singer, 3-38. Cambridge: Cambridge University Press.

22. **Chaney, Thomas.** 2008. "Distorted Gravity: The Intensive and the Extensive Margins of International Trade." *American Economic Review* 98 (4): 1707-21.

23. **Chow, Gregory C.** 1983. *Econometrics*. New York: McGraw-Hill.

24. **Clerides, Sofronis, Saul Lach, and James Tybout.** 1998. "Is Learning-by-Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico and Morocco." *Quarterly Journal of Economics* 113 (3): 903-47.

25. **Cuñat, Alejandro, and Marco Maffezzoli.** 2007. "Can Comparative Advantage Explain the Growth of U.S. Trade?" *Economic Journal* 117 (520): 583-602.

26. **Das, Sanghamitra, Mark J. Roberts, and James R. Tybout.** 2007. "Market Entry Costs, Producer Heterogeneity, and Export Dynamics." *Econometrica* 75 (3): 837-73.

27. **Debaere, Peter, and Shalah Mostashari.** 2010. "Do Tariffs Matter for the Extensive Margin of International Trade? An Empirical Analysis." *Journal of International Economics* 81 (2): 163-69.

28. **di Giovanni, Julian, and Andrei Levchenko.** 2010. "Firm Entry, Trade, and Welfare in Zipf's World." NBER Working Paper 16313.

29. **Dixit, Avinash.** 1989. "Entry and Exit Decisions Under Uncertainty." *Journal of Political Economy* 97 (3): 620-38.

30. **Eaton, Jonathan, Marcela Eslava, Maurice Kugler, and James R. Tybout.** 2007. "Export Dynamics in Colombia: Firm-Level Evidence." NBER Working Paper 13531.

31. **Eaton, Jonathan, Samuel Kortum, and Francis Kramarz.** 2011. "An Anatomy of International Trade: Evidence from French Firms." *Econometrica* 79 (5): 1453-98.

32. **Evenett, Simon J., and Anthony J. Venables.** 2002. "Export Growth in Developing Countries: Market Entry and Bilateral Trade Flows." London School of Economics, mimeo.

33. **Federal Reserve Bank of New York.** "Industry-Specific Exchange Rates." (accessed: 2010, August 12).

34. **Finger, J. Michael, Francis Ng, and Sonam Wangchuk.** 2001. "Antidumping as Safeguard Policy." World Bank Policy Research Working Paper 2730(1).

35. **First Washington Associates.** 1991. "Export Finance and Promotion Study: PROEXPO/Colombia."

36. **Fortin, Nicole, Thomas Lemieux, and Sergio Firpo**. 2011. "Decomposition Methods in Economics." In *Handbook of Labor Economics*, edited by Orley Ashenfelter and David Card, vol. 4, Chapter 1.

37. **Freund, Caroline, and Diana Weinhold**. 2004. "The Effect of the Internet on International Trade." *Journal of International Economics,* 62(1): 171-189.

38. **Handley, Kyle**. 2014. "Exporting Under Trade Policy Uncertainty: Theory and Evidence." *Journal of International Economics,* 94(1): 50-66.

39. **Handley, Kyle, and Nuno Limao**. 2014. "Policy Uncertainty, Trade and Welfare: Theory and Evidence for China and the U.S." http://terpconnect.umd.edu/~limao/tpu_submitted.pd

40. **Hanson, Gordon, and Chong Xiang.** 2011. "Trade Barriers and Trade Flows with Product Heterogeneity: An Application to U.S. Motion Picture Exports." *Journal of International Economics* 83 (1): 14-26.

41. **Harris, Mark, László Kónya, and László Mátyás.** 2011. "Some Empirical Facts about International Trade Flows." *Review of International Economics.* Unpublished.

42. **Head, Keith, and Thierry Mayer**. 2010. "Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade," in Brakman, Steven and Peter van Bergeijk (eds.), *The Gravity Model in International Trade: Advances and Applications,* Cambridge University Press.

43. **Head, Keith, Thierry Mayer, and John Ries**. 2010. "The Erosion of Colonial Trade Linkages After Independence." *Journal of International Economics,* 81(1): 1-14.

44. **Heckman, James.** 1981a. "Heterogeneity and State Dependence." In *Studies in Labor Markets*, edited by S. Rosen, 91-140. Chicago: University of Chicago Press.

45. **Heckman, James.** 1981b. "The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time – Discrete Data Stochastic Process and Some Monte Carlo Evidence." In *Structural Analysis of Discrete Data and Econometric Applications*, edited by C. Manski and D. McFadden, 179-195. Cambridge: MIT Press.

46. **Henson, Spencer, and John Wilson.** 2005. *The WTO and Technical Barriers To Trade*. Cheltenham: Edward Elgar Publishing Co.

47. **Hummels, David.** 2007. "Transportation Costs and International Trade in the Second Era of Globalization." *Journal of Economic Perspectives* 21 (3): 131-54.

48. **Internet Systems Consortium**. 2013. "ISC Domain Survey." http://www.isc.org/services/survey/

49. **Jacks, David, Christopher Meissner, and Dennis Novy.** 2008. "Trade Costs, 1870-2000." *American Economic Review* 98 (2): 529-34.

50. **Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi**. 2010. "The Worldwide Governance Indicators: Methodology and Analytical Issues." *World Bank Policy Research Working Paper 5430.*

51. **Levinsohn, James, and Amil Petrin.** 2003. "Estimating Production Functions Using Inputs to Control for Unobservables." *Review of Economic Studies* 70 (2): 317-41.

52. **Loretan, Mico.** 2005. "Indexes of the Foreign Exchange Value of the Dollar." Federal Reserve Bulletin Winter: 1-8.

53. **Maskus, Keith, John Wilson, and Tsunehiro Otsuki.** 2000. "Quantifying the Impact of Technical Barriers to Trade." World Bank Policy Research Working Paper 2512.

54. **Melitz, Marc J.** 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 (6): 1695-725.

55. **Oaxaca, Ronald**. 1973. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 14(3): 693–709.

56. **Pierce, Justin, and Peter K. Schott.** 2012. "Concording U.S. Harmonized System Categories Over Time." *Journal of Official Statistics* 28 (1): 53-68.

57. **Roberts, Mark, Theresa A. Sullivan, and James R. Tybout.** 1995. "Micro-Foundations of Export Booms." Washington D.C.: The World Bank, mimeo.

58. **Roberts, Mark, and James R. Tybout.** 1997a. "Directions in Development: What Makes Exports Boom?" Washington, D.C: The World Bank.

59. **Roberts, Mark, and James R. Tybout.** 1997b. "The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs." *American Economic Review* 87 (4): 545-64.

60. **Rust, John.** 1997. "Using Randomization to Break the Curse of Dimensionality." *Econometrica* 65 (3): 487-516.

61. **Sykes, Alan.** 1999. "Regulatory Protectionism and the Law of International Trade." *The University of Chicago Law Review* 66 (1): 1-46.

62. **UNCTAD Secretariat.** 2005. "Methodologies, Classifications, Quantification and Development Impacts of Non-Tariff Barriers." United Nations Conference on Trade and Development Commission Report.

63. **U.S. Census.** 2006. "Statistics for Industry Groups and Industries: 2005." Annual Survey of Manufactures (AS-1).

64. **U.S. Department of Commerce.** 2004. "Measuring Economic Effects of Technical Barriers to Trade on U.S. Exporters." Planning Report 04-3. Washington D.C.: U.S. Government Printing Office.

65. **U.S. International Trade Commission**. 2009. "U.S. Trade Policy since 1934," in *The Economic Effects of Significant U.S. Import Restraints,* Sixth Update, Publication 4094: 59-123.

66. **U.S. Trade Representative.** 2011. "2011 Report on Technical Barriers to Trade."

67. **Whalley, John, and Xin Xian.** 2011. "Regionalization, Changes in Home Bias, and the Growth of World Trade." NBER Working Paper 13023.

68. **Yi, Kei-Mu.** 2003. "Can Vertical Specialization Explain the Growth of World Trade?" *Journal of Political Economy* 111 (1): 52-102.

7 Tables

Table 1: Top Ten Contributors to the Rise in Exporting

Rank	Country	Percentage
1	Mexico	12.0
2	China	11.0
3	India	4.9
4	Brazil	3.7
5	South Korea	3.3
6	United Kingdom	3.1
7	United Arab Emirates	2.9
8	Germany	2.8
9	Malaysia	2.8
10	Australia	2.7

Notes: The table lists the top 10 countries in terms of their contribution to the change in the total number of firm-country exporting pairs from 1993 to 2006.

Table 2: Determinants of Export Status

	Specification		
Variable	(1)	(2)	(3)
Exported last year	0.439***	0.436***	0.431***
	(0.005)	(0.006)	(0.006)
Exported last year * $Post_{98}$		0.005	0.012**
		(0.005)	(0.006)
Last exported two years ago	0.103***	0.14***	0.138***
	(0.007)	(0.009)	(0.009)
Last exported two years ago * $Post_{98}$		-0.091***	-0.087***
		(0.013)	(0.013)
Total Employment	0.031***	0.031***	0.030***
	(0.005)	(0.005)	(0.006)
Wages	0.026***	0.026***	0.039***
	(0.008)	(0.008)	(0.010)
Non-production/Total Employment	-0.021	-0.021	-0.003
	(0.016)	(0.016)	(0.018)
Productivity	0.005***	0.005***	0.007***
	(0.002)	(0.002)	(0.002)
Industry Exchange Rate	0.06*	0.057*	0.031
	(0.31)	(0.032)	(0.044)
Plant Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Interactions between X_{it} and $Post_{98}$	No	No	Yes

Notes: The table presents the results from estimating equation (2) in the text. All estimations include 106,000 observations, rounded to the closest 100 for the purposes of disclosure. The dependent variable is a 0/1 indicator for a given plant's export status in the current year. Standard errors are clustered at the plant level and non-exporting related plant-specific characteristics are lagged by one period in all specifications. The coefficient "Exported last year" is an increasing function of the costs of entering foreign markets anew F_0. The coefficient on "Last exported two years ago" is similarly an increasing function of the difference $F_0 - F_R$, where F_R is the cost of re-entering foreign markets after leaving the foreign market one year ago. $Post_{98}$ is an indicator function for the post-1995 part of the sample. The results suggest a modest decline in F_0 and an increase in F_R. Column (1) presents the results from estimating equation (3) with no interactions and column (2) contains our baseline results. Column (3) reports results from additionally including interactions between the variables in X_{it} and $Post_{98}$. *,**,*** denote significance at the 10%, 5%, and 1% level respectively.

Table 3: Prior Distributions

Parameters	Priors
γ_{s1} (sunk cost, small plants)	$\gamma_{s1} \sim N(0, 20)$
γ_{s2} (sunk cost, large plants)	$\gamma_{s2} \sim N(0, 20)$
κ (mean, ε_1 & ε_2)	$\kappa \sim N(0, 20)$
$\sigma_{\varepsilon 1}$ (st. dev., ε_1)	$\ln(\sigma_{\varepsilon 1}) \sim N(0, 20)$
$\sigma_{\varepsilon 2}$ (st. dev., ε_2)	$\ln(\sigma_{\varepsilon 2}) \sim N(0, 20)$
η_i (demand elasticity)	$\ln(\eta_i - 1) \sim N(2, 1)$

Notes: The table presents the priors used for the central parameters in our structural estimations for each industry. We generally choose diffuse priors to allow the data to speak for itself. Variance parameters have log normal distributions to impose nonnegativity.

Table 4: Structural Estimations

	Panel	
Parameters for Each Industry	1987-1997	1995-2006
Preserved Fruits & Vegetables (203)		
γ_{s1} (sunk cost, small plants)	2.85 (0.80)	2.49 (0.41)
γ_{s2} (sunk cost, large plants)	2.65 (0.74)	2.26 (0.36)
κ (mean of profit shock ε)	-0.14 (0.04)	-0.17 (0.03)
σ_{ε_1} (std. error, ε_1)	1.55 (0.48)	1.17 (0.32)
σ_{ε_2} (std. error, ε_2)	0.90 (0.38)	0.62 (0.38)
η_μ (demand elas., μ across plants)	13.71 (8.81)	12.93 (6.16)
η_σ (demand elas., σ across plants)	11.61 (7.35)	12.59 (6.67)
Aircraft & Parts (372)		
γ_{s1} (sunk cost, small plants)	2.39 (0.62)	2.90 (0.65)
γ_{s2} (sunk cost, large plants)	2.45 (0.65)	2.54 (0.59)
κ (mean of profit shock ε)	-0.24 (0.07)	-0.26 (0.07)
σ_{ε_1} (std. error, ε_1)	1.09 (0.40)	1.11 (0.29)
σ_{ε_2} (std. error, ε_2)	0.85 (0.38)	1.06 (0.40)
η_μ (demand elas., μ across plants)	12.20 (4.82)	11.86 (4.17)
η_σ (demand elas., σ across plants)	12.80 (5.56)	12.16 (4.55)
Measuring & Controlling Devices (382)		
γ_{s1} (sunk cost, small plants)	2.89 (0.98)	2.62 (0.93)
γ_{s2} (sunk cost, large plants)	2.66 (0.89)	3.29 (1.21)
κ (mean of profit shock ε)	-0.56 (0.32)	-0.95 (0.74)
σ_{ε_1} (std. error, ε_1)	1.60 (0.55)	1.35 (0.64)
σ_{ε_2} (std. error, ε_2)	1.12 (0.84)	2.75 (2.17)
η_μ (demand elas., μ across plants)	10.95 (6.39)	10.58 (5.49)
η_σ (demand elas., σ across plants)	7.76 (4.81)	7.85 (4.46)

Notes: The table presents the estimates for the central parameters in our model for each industry over the time periods 1987-1997 and 1995-2006. Means are presented along with standard deviations in parentheses. Median estimates give similar results. Full results for each industry are found in the appendix.

Fig. 1: Industry Decomposition

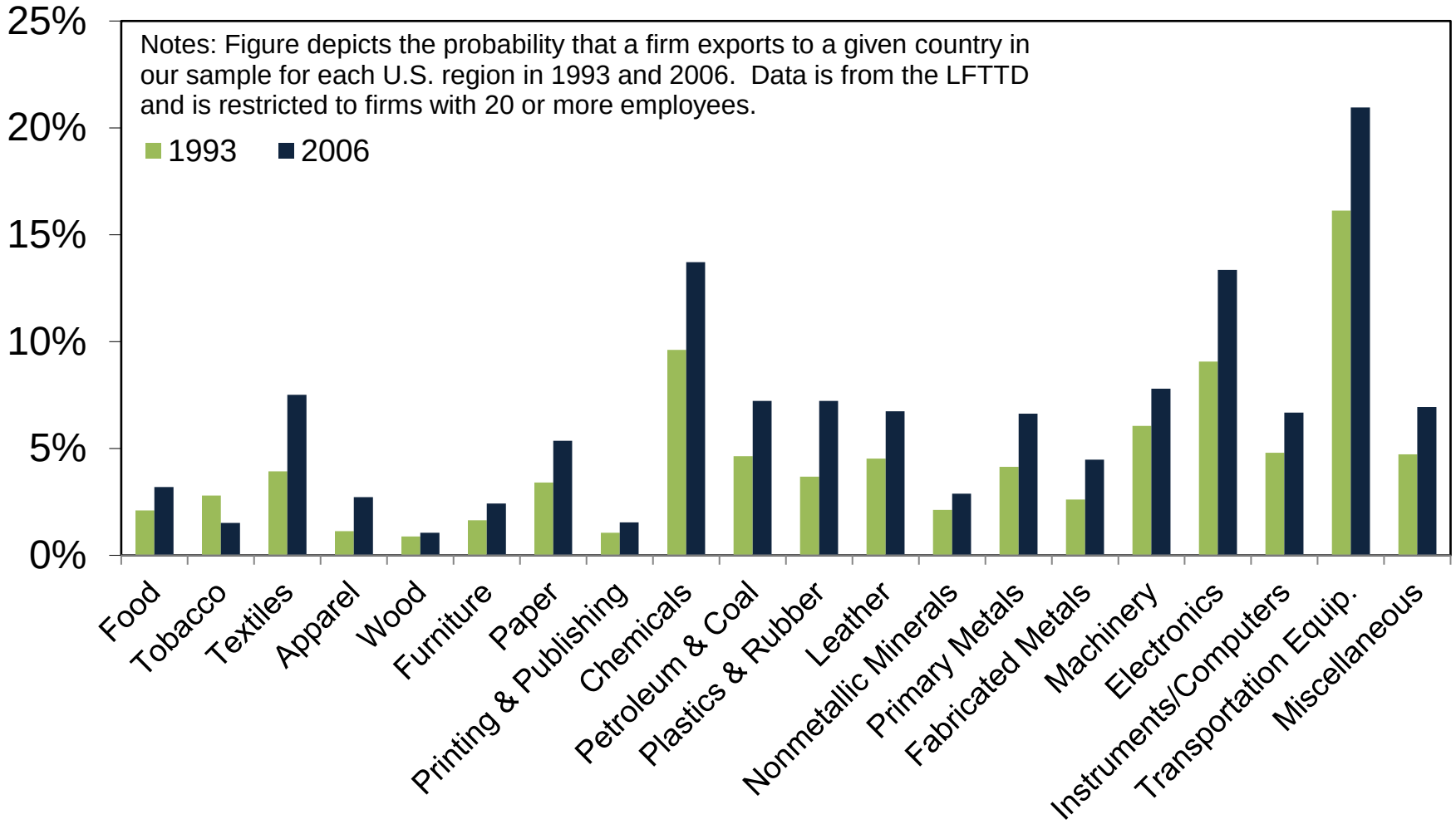


Fig. 2: Region Decomposition

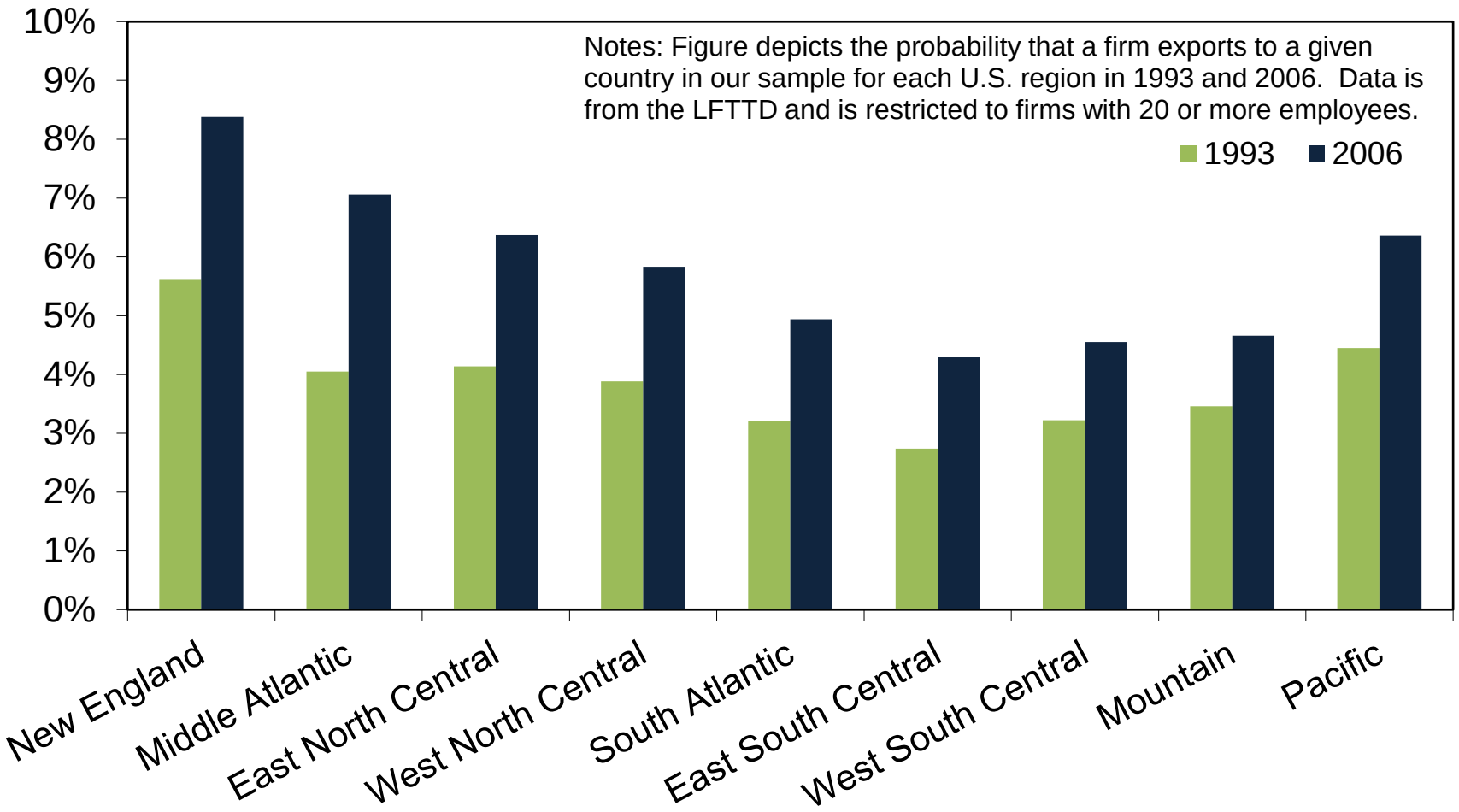


Fig. 3: Percentage of US Manufacturing Plants That Export

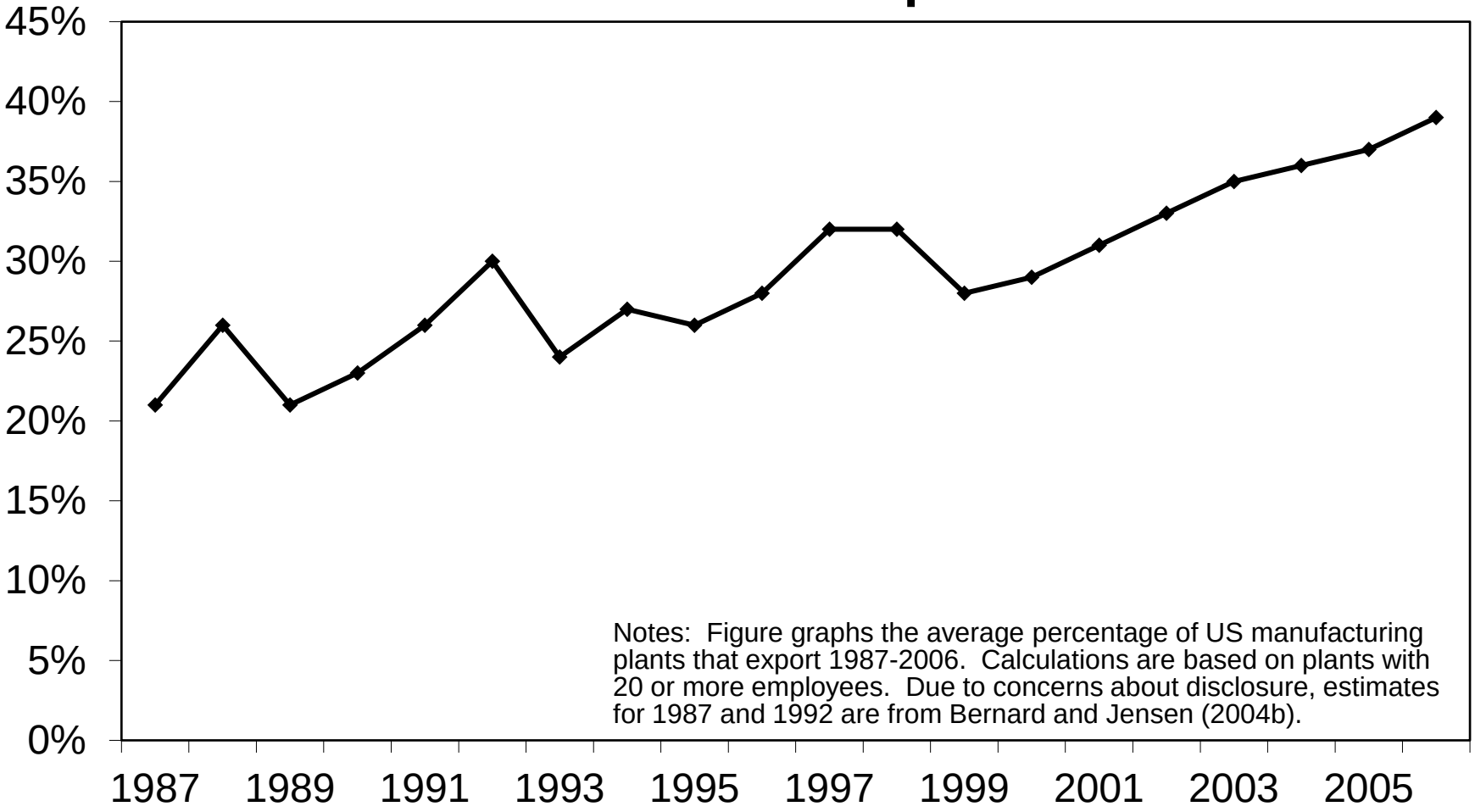


Fig. 4: Market Size and the Rise of Exporting

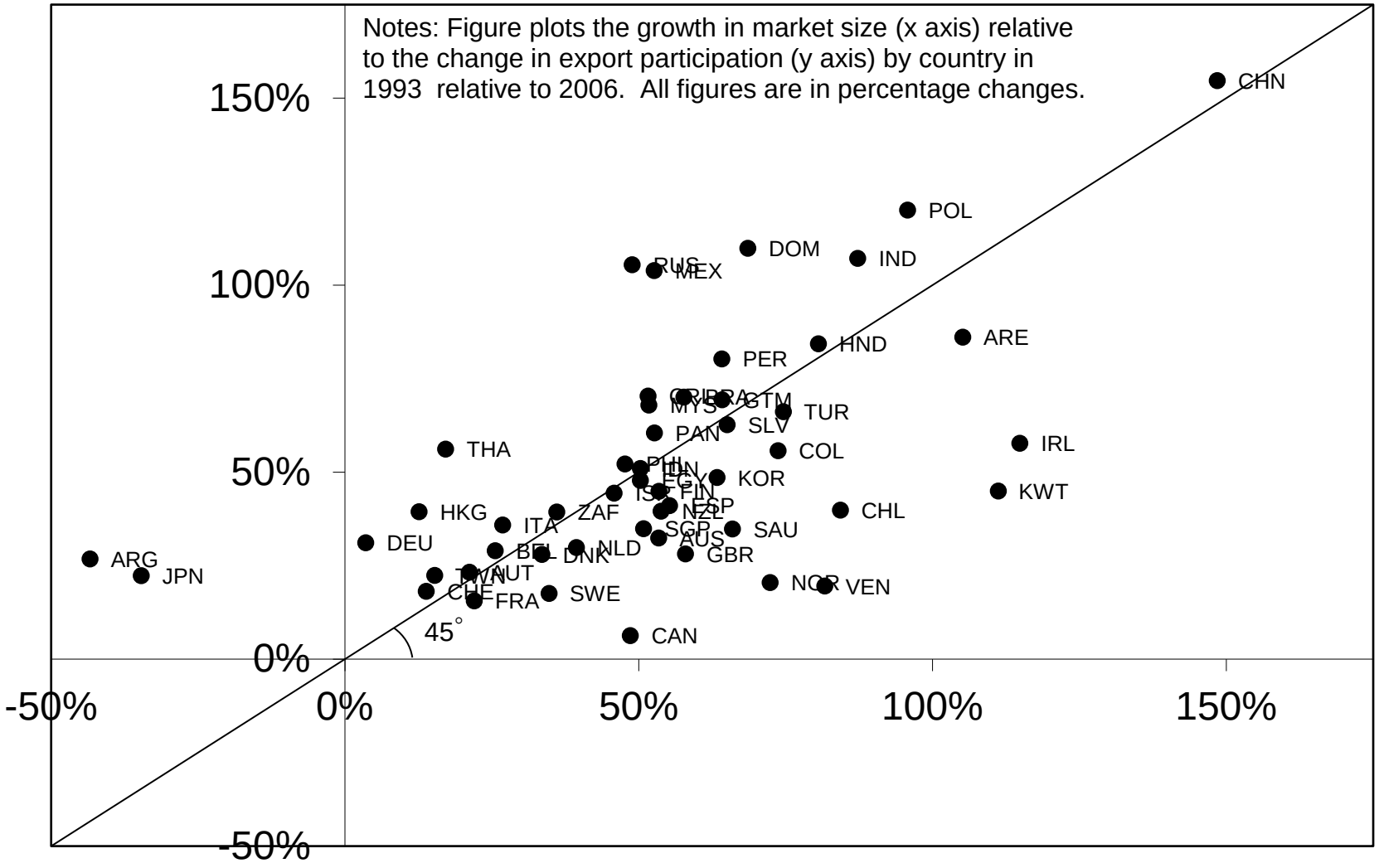


Fig. 5: Changes in Barriers to Entry

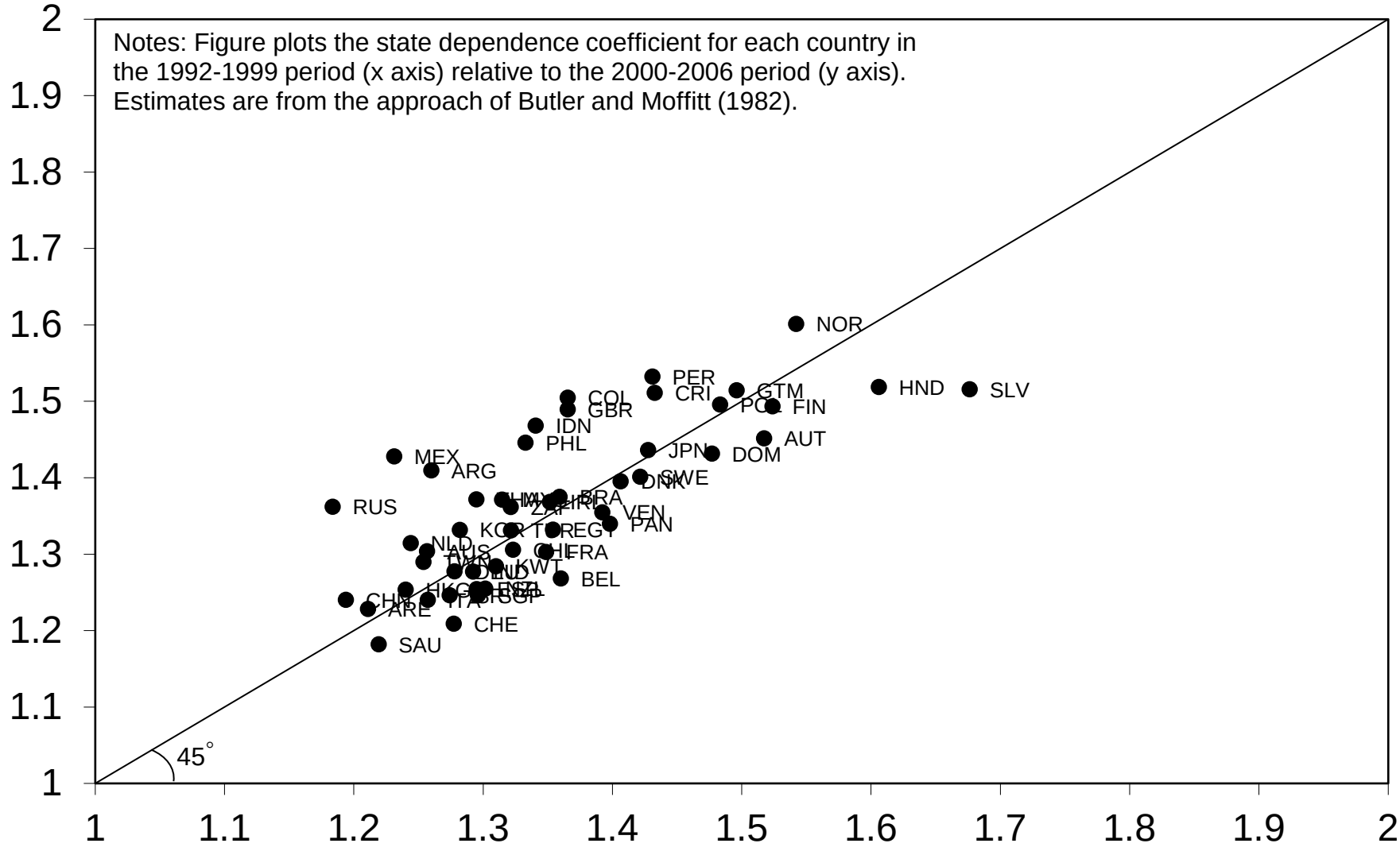


Fig. 6: Export Participation Across Countries

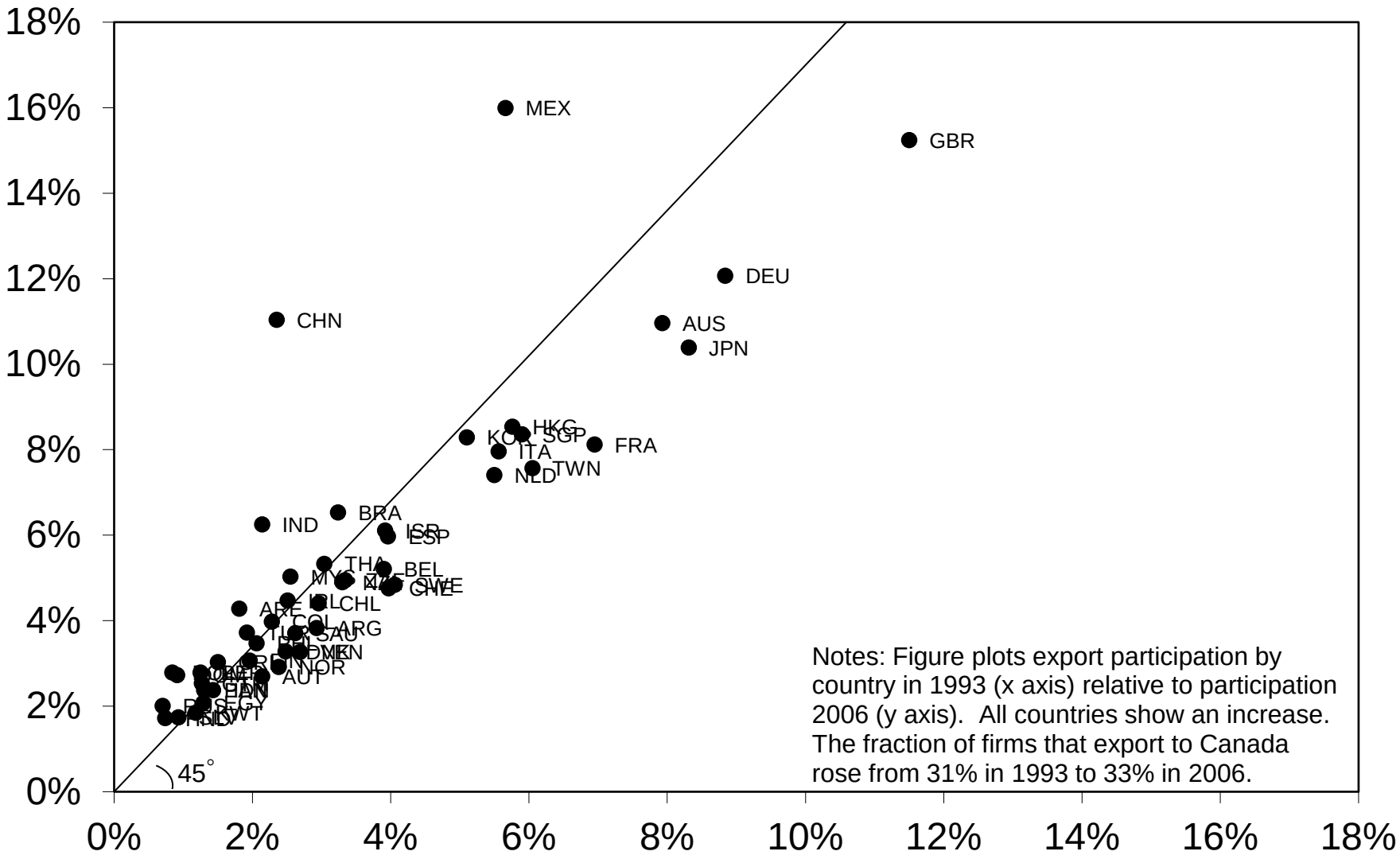
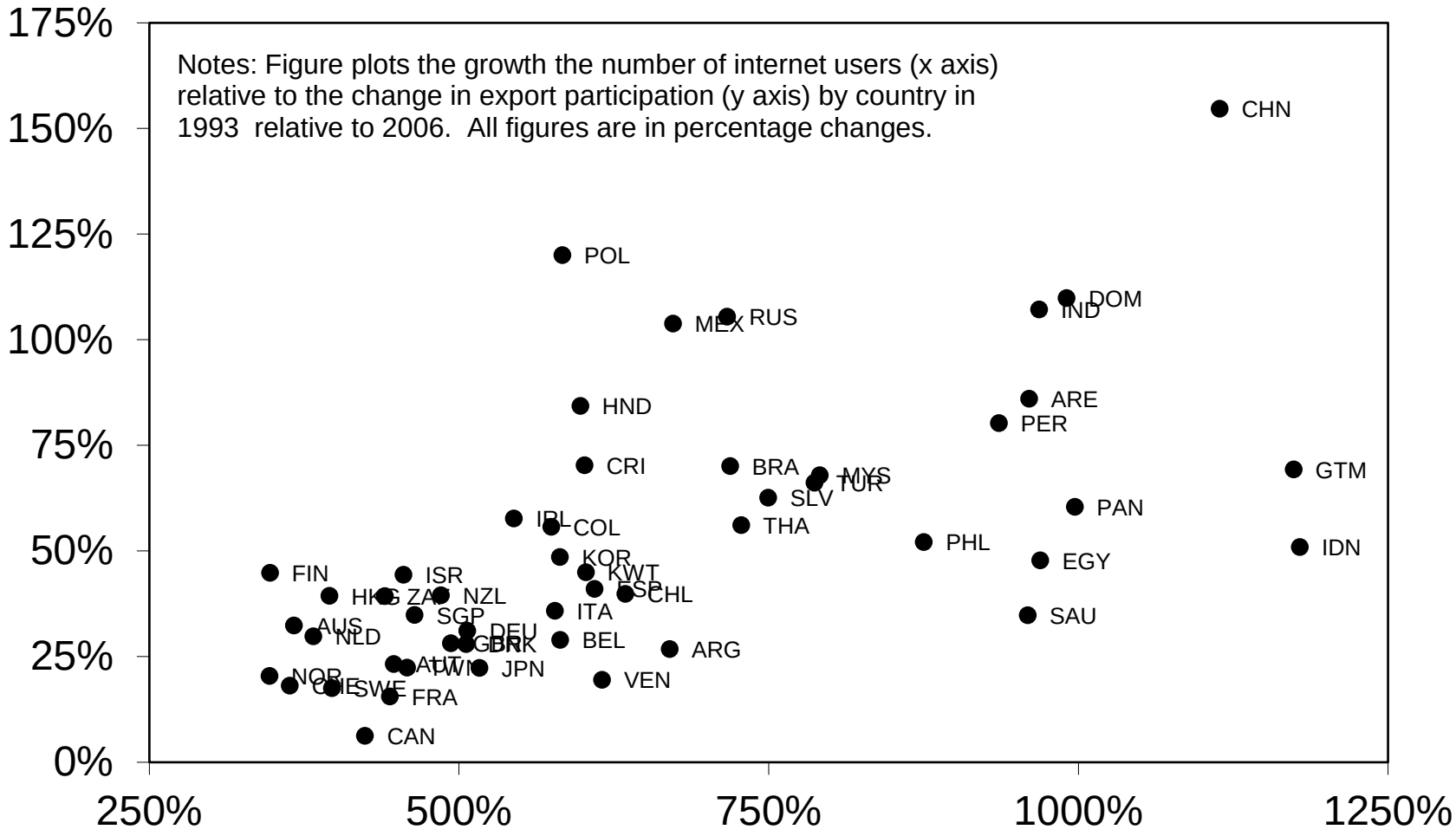


Fig. 7: Internet Users and the Rise of Exporting



Appendix

1 Data Description

Introduction

In this section, we describe additional details about our data sources and the samples used in estimation. In all of our analyses using both the ASM and LBD-LFTTD we drop administrative records, which are essentially imputed data for small employers and new businesses. All establishment-level analyses are done using the identifier lbdnum and all firm-level analyses are done using the firmid identifier. Due to data disclosure concerns, estimates in Figure 3 for 1987 and 1992 are from Bernard and Jensen (2004b).

Due to changes in the sampling frame for the ASM, we needed to make some minor adjustments to the sample. Over the period 1987-1998 plants with more than 250 employees were sampled with certainty in the ASM. In the 1999-2003 ASM this threshold was increased to 500 employees and was further raised to 1000 in the 2004-2008 ASM. In our estimations that span these years, we reweight the plants accordingly. These reweighting adjustments consequently did not end up affecting a large number of plants. As the sampling probability is inversely related to a plant's contribution to output, plants between 250 and 1000 employees are still sampled with a high degree of certainty after 1998, however.

In addition to the data described in the main text, we use data from a number of additional sources. Our data on aggregate industry exports comes from the United Nations' Commodity Trade Statistics Database (Comtrade). Information on price deflators is obtained from the NBER manufacturing productivity database (Bartelsman and Gray, 1996). Exchange rate series are sourced from the International Monetary Fund and the Federal Reserve Bank of New York. In order to construct a plant-specific exchange rate series using the ASM we use a geometric export-weighted average of bilateral real exchange rates where the weights are constructed using 3 digit SIC export data. We follow the aggregation method used by the US Federal Reserve, as detailed in Loretan (2005). We use the same industry-level exchange rate series for both our reduced form estimations and structural analysis.

2 MCMC Estimations

To characterize the time invariant plant characteristics that affect sunk costs and export profits, we let z_i equal an indicator function based on plant size. The threshold for z_i is set to be equal to the median level of sales in 1987, such that half of the plants are considered large in the first panel for each industry. We keep this threshold for the second panel, capturing changes in plant sales. The number of $AR(1)$ processes additively included in the profit function disturbance term is set to two $v_{it} = x_{1it} + x_{2it}$, intuitively reflecting separate cost and demand shock processes. We set the discount rate δ to 0.9. We also do not estimate the parameters for the exchange rate process simultaneously with the rest of the model. Instead, we estimate them separately using export-weighted industry real exchange rates constructed with the same approach as those described in Section 3. We fit each of these series with an $AR(1)$ process from 1972 until the last year of each panel.

In the appendix we describe the priors that we use in our estimations. As mentioned

in the text, we generally use diffuse priors in order to let the data speak for itself. Priors on variance parameters are log normal in order to impose non-negativity and priors on the roots of AR(1) processes are uniform on (-1,1) to impose stationarity. Our prior for the η_i terms is given by $\ln(\eta_i - 1) \sim N(2, 1)$, which implies a mean and standard deviation for η_i of 12.2 and 16 respectively. This ensures that $\eta_i > 1$ and is consistent with the previous literature (see, for example, Goldberg and Knetter 1999). The prior for υ, the parameter that determines the ratio of foreign and domestic demand elasticities is uniform on $[-5, 5]$, which bounds how different the demand structures are in the home and foreign markets. Our estimates for this parameter are all well within this range.

Acceptance rates are kept within the range suggested by the literature and we use a burn-in period of 50k iterations. Starting values are set at \$500k for each chain and these changes are likely to have increased barriers to entry. We looked at a number of diagnostic statistics to check for convergence of each chain. These tests are reviewed at length in Brooks and Roberts (1998). See the appendix for further details about the MCMC estimation methods. For each of these chains, we looked at the results from several different levels of thinning. Here we alternately constructed our estimates by dropping every 2nd, 5th, 10th, 50th, or 100th draw. This standard robustness check for Monte Carlo Markov Chain (MCMC) methods is often used to diagnose a lack of convergence of the chain to the posterior distribution $P(\theta \mid D)$ or slow movement of the chain across the parameter space ("slow mixing"). These different levels of thinning all give comparable results.

3 Extensive Margin Decomposition

3.1 Introduction

We compile a rich dataset of covariates for the top 50 US export destinations, which are listed in Table 1. Our dataset covers the years 1990-2007, and all 459 of the 4-digit SIC 1987 manufacturing industries. We draw country-year level macroeconomic indicators, geographic data, and tariff variables from various institutions including the Centre d'Études Prospectives et d'Informations Internationales (CEPII), Federal Reserve Bank of New York (FRBNY), International Monetary Fund (IMF), and World Bank (WB). Measures of commnication costs and the prevelence of access to the internet come from Federal Communication Comission (FCC) reports and the Internet Systems Consortium (ISC). Energy prices are from the Federal Reserve Bank of St. Louis (FRBSL). Each section below explains in greater detail the sources and definitions of these measures. The data was carefully prepared to ensure accurate and consistent treatment of economic concepts and to handle missing values, peculiar tariff regimes, and trade agreement structures.

3.2 Tariffs

Tariffs faced by US firms are from the World Bank's TRAINS/WITS dataset. WITS (World Integrated Trade Solution) is a World Bank portal that integrates repositories of trade-related data, including UNCTAD-TRAINS. WITS provides a user interface to access import-export and tariff data for individual countries or for user-generated country/product aggregates.

TRAINS (Trade Analysis and Information System) contains data on tariffs and trade flows by importer-exporter pairs. Tariff data include rates for various bilateral agreements as well as most favored nation and preferential regimes. The variables includes in TRAINS are ad valorem-equivalent most favored nation (MFN), preferential (PRF), bound (BND), and effective applied (AHS) tariff rates. These are reported for all US trading partners and SIC 1987 4-digit sectors beginning in 1988.

We restrict the dataset to the top 50 US export destinations, manufactured goods sectors (which correspond to those 4-digit SIC codes beginning with 2 or 3) and the years 1990-2007. European Union (EU) countries are assigned the common EU tariff post-accession so that we retain a balanced set of countries. If a country-year-SIC4 combination is missing a four digit sector tariff observation within a particular year, we instead use the average of the tariff rates for that country-year one SIC digit level higher. We also create an alternative measure using the mode of the tariff rates among the sectors one digit level higher. If the observations are also missing one level higher, we go two levels higher. After this step, if a country is missing all tariff observations in a given year, we use the prior year's value. If the prior value is missing, we use the subsequent year's value.

3.2.1 Tariff Types

As per the WITS documentation, MFN tariffs are those that a country commits to levy on imports from fellow World Trade Organization (WTO) members, unless that country is also party to a preferential trade agreement, such as a customs union or free trade pact. In practice, MFN rates are the highest that WTO members impose on each other.

Preferential agreements are reciprocal arrangements under which all parties agree to impose on each other lower tariffs (even lower than their respective MFN rates). In customs unions and free trade areas, this rate is zero on almost all products. Many countries, especially wealthier ones, also initiate non-reciprocal tariff arrangements with developing countries. Under this regime—called unilateral preferential treatment—exporting countries can have access to various preference programs of a given importer for a given product.

Bound tariffs are commitments to maximum MFN tariff rates for a given class of commodities. When countries join the WTO or WTO members negotiate rates with one another, these upper bounds (rather than the applied rates) are agreed upon. Should a WTO member raise applied tariffs above the bound level for a particular product, other members may take the country to dispute settlement, and ultimately request compensation (via countervailing tariffs) if the offending country does not reduce its applied rate.

Finally, WITS defines the effectively applied tariff as the lowest possible rate that can be applied. That is, an importing country may apply the MFN tariff, rather than a lower preferential rate, "if the product does not meet the [importing] country's rules that determine the [exported] product's country of origin." For reporting purposes, however, the preferential rate (if one exists) is used as the effectively applied tariff; otherwise, the MFN rate is used. Thus the ordering of tariffs for a given product and importer-exporter pair will always follow $BND \geq MFN \geq PRF = AHS$. We keep these measures in percentage points so a 20% tariff is recorded as the number 20.

3.3 Tariff Uncertainty

Uncertainty regarding trade policy and tariff rates has been shown to deter potential exporters from entering new markets in Handley and Nimao (2013). Conversely, policies that reduce such uncertainty have been shown to increase exporter entry Handley (2014). Given these findings, we define three measures of tariff rate uncertainty. The first is taken from Handley (2014) where uncertainty is defined as $U_1 = 1 - \left(\frac{\tau_{BND}}{\tau_{MIN}}\right)^{-\sigma}$, we set $\sigma = 4$ and since we report tariff rates in percent the iceberg equivalent in percent is, $\tau_{BND} = 100 + BND$. The bound tariff rate, BND, is the highest possible legal rate and is the minimum for each country-year-SIC4 of all measures in the dataset after the above preperation. In other words, $MIN = \min\{BND, MFN, PRF, AHS\}$. The second measure is the log percent difference measure between these tariff rates $U_2 = 100 * \log\left(\frac{\tau_{BND}}{\tau_{MIN}}\right)$ in the same units. The third and final measure is Euclidean distance between the two rates $U_3 = \sqrt{(\tau_{BND} - \tau_{MIN})^2}$.

3.4 Gravity Variables

The main variables relating to trade costs come from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) gravity and distance datasets. Head, Mayer, and Ries (2010), hereafter HMR (2010), compile a "square" gravity dataset for all pairs of countries for the period 1948 to 2006, and the CEPII makes this dataset available on its website. All variables are described in the data appendix of their paper, to which one should turn for further details.

We utilize the following CEPII gravity variables: country area (in square kilometers); weighted distance and time zone difference between pairs; and indicators for country pairs that have common currencies, common languages, common legal origins, contiguity, regional trade agreements (NAFTA, FTAs), WTO membership, and colonial and hegemonic relationships (both past and current).

Further, we take advantage of CEPII's distance variables: great circle distance between most populated cities and between capital cities, and weighted distance between most populated cities. For details on how the latter is calculated, see Head and Mayer (2002). Since the data ends in 2006, we extend the only time varying variable, WTO membership status, to 2007 by using the information on US trade agreement participation found in USITC (2009).

3.5 National Accounts and Population

Country-level time series for real GDP (in current local currency and USD), population, and GDP deflator are from the World Bank's World Development Indicators (WDI) dataset. A few countries are missing data in the WDI. In particular, Ireland is missing its GDP deflator from 1990 to 1999; we therefore utilize Ireland's CPI (for all years) instead. Kuwait is also missing the GDP deflator from 1990 to 1991, and we apply the same fix. Furthermore, Kuwaiti population data is missing from 1990 to 1994. As such, we fill in those years' populations using the popoulation measure from the CEPII dataset described above. Taiwan is not included in the WDI but is a major US trading partner. Therefore, the Taiwanese

National Statistical Agency (TNSA) is the source for Taiwan's GDP, population, and GDP deflator.

3.6 Exchange Rates

We use nominal exchange rates (NER) and consumer prices (CPI) from the FRBNY and IMF's International Financial Statistics (IFS) to construct real exchange rates (RER). All Euro Zone countries have synthetic NER defined by their official conversation rate after their accession to the Euro Zone. All exchange rate and CPI measures were collected at the quarterly level and then averaged to form the estimate within each year. We choose the base for CPIs for each country such that the average of the four quarters in the year 2000 equals one. We use data from the FRBNY to construct RER for countries whenever possible and turn to the IFS if the FRBNY data is incomplete for the countries and time periods we need. In particular, inflation during the 1990s left Brazil's CPI and NER at zero in the FRBNY dataset during the early part of our sample. Greater numerical precision was available from the IFS for both the NER and CPI so we use these numbers instead. We compensate for Kuwait's missing nominal exchange rates in 1990 and 1991 by linearly interpolating between the adjacent years. Russia is missing observations before and inlcuding 1992Q1 so the available three quarters to form the 1992 observation. Prior to 1992Q1 Russia was closed so no reliable proxy for exchange rates could be computed. Finally, IFS lacks CPI and GDP deflator data for the United Arab Emirates (ARE), we approximate a price index for ARE using the period-wise average of the CPIs of Kuwait and Saudi Arabia in each quarter.

3.7 International Telecommunication

3.7.1 Voice Call Rates

To construct a proxy for the rate firms face to call trading partners in other counties, we construct revenue per minute using data on telecommunications traffic between the US and its major trading partners from the FCC's annual International Telecommunications Traffic Reports. Section 43.61 of FCC regulations stipulates that every carrier providing international services between any place in the US and any place abroad file traffic and revenue data. This rule applies equally to foreign, private, and non-tariffed carriers. The reports include the total number of minutes provided by all carriers between the US and a given country along with the total revenue from calls on all carriers to that country. We use these two measures to construct revenue per minute. To adjust for idiosyncratic reporting in 1990, total carrier revenue for that year is taken as the sum of retained revenue and payout to foreign carriers.

3.7.2 Internet Availability

The invention of the internet likely increased the ability of US firms, especially less productive ones, to export. As such, we collect two variables that seek to measure the degree of pervasiveness of access to the internet for the countries and years of interest. First, we take the number of internet users and number of internet users per captia from the World

Bank's WDI. Second, we use data from the domain survey conducted by the Internet Software Consortium (ISC). The survey reports the number of hosts/computer systems with each country's ISO code top-level domain, such as .uk for the United Kingdom or .de for Germany, as a proxy for the prevalence of the internet in a given country. A host refers to any computer system connected to the internet (whether through full-time, part-time, direct, or dial-up connections) and a top-level domain name (TLD) is the highest level component of a host's name associated with an IP address. The TLD ends in either an ISO country code (.uk or .de, for example) or one of the generic domains (such as, .com, .org, or .net). The TLD of a given host does not necessarily reflect the physical location of the computer system, but the TLD serves as a valuable proxy for internet availablity in that country. We do not attribute generic domains to any particular country. In preparing these data, we carefully follow Freund and Weinhold (2004) and are able to replicate the number of hosts they report for each country. However, unlike in Freund and Weinhold, we attribute .gb (which was initually used for Great Britain) in addition to .uk to United Kingdom by summing the host numbers of both domain names.

The survey is conducted in each January and July. We define the value in each year as the average of these two months. The ISC did not conduct the survey in January 1999 or July 2003. As such, the annual figures for 1999 and 2003 are equal to the numbers in July 1999 and January 2003, respectively. The total number of host throughout the world is available starting in 1993 but the country specific TLD survey is only available beginning in January 1995. We use the fraction of total hosts registered to each TLD in 1995 to apportion the aggregate number of hosts in 1994 and 1993 to construct a measure in those years. While data for all 50 countries are available beginning January 1995, there are five countries that have zeros for the first few time periods. The following is the list of such countries and the first dates of positive host numbers: El Salvador (January 1996), Honduras (July 1996), Guatemala (January 1996), Domonican Republic (July 1995) and United Arab Emirates (July 1995).

3.8 Institutional Conditions

We use the World Bank's Worldwide Governance Indicators (WGI) to proxy for six aspects of institutional quality. These measures are Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Each measure ranges from -2.5 (weakest) to 2.5 (strongest). We also construct each country's percentile relative to other countries in each year. For a thorough explanation of the methodology used to build the WGI, see Kaufmann, Kraay and Mastruzzi (2010).

Each indicator is intented to capture a concept from political economy. Voice and Accountability measures popular feelings of the degree to which citizens are able to take part in the selection of government. Political Stability and Absence of Violence captures perceptions of the probability of political instability or violence, including terrorism. Government Effectiveness represents perceptions of the quality of public services as well as that of the civil service, and how independent the latter is from political pressures. It also captures the quality of policy development and implementation, as well as the credibility of the government to commit to said policies. Regulatory Quality measures popular perceptions of how

able the government is at formulating and implementing policies and regulations that are conducive to private sector development. Rule of Law captures the extent to which citizens believe their country is shaped by the legal structures, especially when it comes to contracts, property rights, and the justice system in general. Finally, Control of Corruption represents popular opinion on how much public power is expropriated for the benefit of private actors.

3.9 Oil prices

Time series on transportation input prices are drawn from the Federal Reserve Economic Data (FRED) at the FRBSL. These are converted to annual frequency by using the first value for each year. In particular, for oil prices we use Brent and West Texas Intermediate (WTI). We also include kerosene-type jet fuel prices on the US Gulf Coast. The former two are measured in dollars per barrel, and the latter in dollars per gallon.

Table 1: Export Participation by Industry

	Plants that Export (%)			
Industry	1987	1992	1997	2006
Food	15	23	25	30
Tobacco	45	51	47	
(Beverage & Tobacco)				30
Textile Mill Products	16	25	28	
(Textile Mills)				47
(Textile Product Mills)				35
Apparel	5	9	13	19
Wood products	12	18	16	19
Furniture	10	25	24	20
Paper	19	31	32	43
Printing & Publishing	5	10	11	15
Chemicals	40	49	49	63
Petroleum & Coal	22	30	30	37
Plastics & Rubber	26	36	39	51
Leather	19	28	35	47
Nonmetallic Minerals	14	21	20	17
Primary Metals	27	39	39	56
Fabricated Metals	21	31	32	32
Machinery	33	43	41	62
Electronic & Other Electric Equipment	37	46	47	
(Electrical Equipment, etc.)				65
Instruments	48	55	56	
(Computer & Electronic Products)				68
Transportation Equipment	29	40	41	56
Miscellaneous Manufacturing	20	34	36	42
Total	21	30	32	39

Notes: The table lists the percentage of plants that export in each industry using the Census of Manufacturers in 1987, 1992, and 1997 and the Annual Survey of Manufacturers in 2006. Due to concerns about disclosure, the results reported for 1987 and 1992 are from Bernard & Jensen (2004b). The classification system used is 1987 US SIC for 1987-1997 and 2002 NAICS for 2006. Similar to other reported figures, estimates are for plants with 20 or more employees. While somewhat heterogeneous in size and timepaths, these results overall suggest that the trends pictured in Figure 1 were pervasive across industries. See also Figure 2.

Table 2: Export Participation by Region

	Plants that Export (%)			
Region	1987	1992	1997	2006
New England	25	37	37	46
Middle Atlantic	19	29	30	39
East North Central	25	34	35	45
West North Central	23	32	33	41
South Atlantic	18	27	29	36
East South Central	18	27	27	36
West South Central	19	28	28	33
Mountain	18	26	27	30
Pacific	21	31	31	36
Total	21	30	32	39

Notes: The table lists the percentage of plants that export in each US Census geographical division using the Census of Manufacturers in 1987, 1992, and 1997 and the Annual Survey of Manufacturers in 2006. We report the states corresponding to these divisions in Table 3. Similar to other reported figures, estimates are for plants with 20 or more employees. These results suggest the time path of participation rates of each region match the overall trend across these years. Furthermore, these trends also hold across the 50 states. See also Figure 3 and Table 3.

Table 3: Census Division of the States

Census Division	State	Census Division	State
New England	Connecticut	East South Central	Alabama
	Maine		Kentucky
	Massachusetts		Mississippi
	New Hampshire		Tennessee
	Rhode Island		
	Vermont	West South Central	Arkansas
			Louisiana
Middle Atlantic	New Jersey		Oklahoma
	New York		Texas
	Pennsylvania		
		Mountain	Arizona
East North Central	Indiana		Colorado
	Illinois		Idaho
	Michigan		New Mexico
	Ohio		Montana
	Wisconsin		Utah
			Nevada
West North Central	Iowa		Wyoming
	Nebraska		
	Kansas	Pacific	Alaska
	North Dakota		California
	Minnesota		Hawaii
	South Dakota		Oregon
	Missouri		Washington
South Atlantic	Delaware		
	District of Columbia		
	Florida		
	Georgia		
	Maryland		
	North Carolina		
	South Carolina		
	Virginia		
	West Virginia		

Notes: The table lists the states corresponding to the Census Divisions used for our calculations in Figure 3 and Table 2.

Table 4: Destinations of US Manufacturing Exports

	Share of US Exports (%)	
Country	1987	2003
Canada	25.3	19.6
Japan	11.1	7.2
Great Britain	5.8	5.4
Germany	5.4	5.8
France	4.7	3.3
Mexico	3.2	13.9
Korea	3.1	3.2
Australia	2.5	1.9
Taiwan	2.5	2.2
Italy	2.5	1.6
Singapore	2.1	2.5
Netherlands	2.1	2.4
China	1.9	4.1
Hong Kong	1.7	1.7
Venezuela	1.6	.3
Spain	1.4	.9
Saudi Arabia	1.3	.8
Brazil	1.2	1.3
Sweden	1.2	.5
Switzerland	1.1	.8

Notes: The table lists the destination composition of US manufacturing exports by value in 1987 and 2003. Thus, Germany accounted for 5.4% of total US exports in 1987 and 5.8% in 2003. Calculations are done using the UN Commodity Trade and Statistics Database. We present the share for the top 20 destinations in 1987 across the two different years. These countries account for 81.7% of US exports in 1987 and 79.4% in 2003. These figures demonstrate that the composition has remained stable over time. Shares come even closer when excluding Mexico from the analysis. Indeed, the rank correlation amongst the top 40 destinations in 1987 with their respective ordering in 2003 is 88%.

Table 5: Intensive Margin

	Starting			
Continuing	1987	1992	1997	2002
1987	1			
1992	0.75	1		
1997	0.58	0.79	1	
2002	0.46	0.58	0.71	1

Notes: The table lists the percentage of exports in each Census of Manufacturers (CMF) year that came from plants that exported in each of the previous Census years, starting in 1987. Thus only 46% of exports in 2002 came from plants that exported in 1987, 1992, and 1997. Removing any continuous exporting restriction, we find that 57% of trade in 2002 is from plants that export in both 1987 and 2002. Similar to our other figures, estimations are limited to plants with 20 or more employees.

Table 6: SIC 203 Posterior Parameter Distributions (Means & Std Deviations)

	Preserved Fruits & Vegs. (203)	
	1987-1997	1995-2006
	Profits	
ψ_{01} (intercept)	-2.07 (0.21)	-2.08 (0.29)
ψ_{02} (dom. size dummy)	1.04 (0.28)	1.46 (0.38)
ψ_1 (exchange rate)	0.85 (1.49)	-0.70 (0.74)
λ_x^1 (root, first AR)	0.57 (0.08)	0.66 (0.10)
λ_x^2 (root, second AR)	0.64 (0.04)	0.91 (0.02)
$\sigma_{\omega 1}^2$ (variance, first AR)	0.68 (0.07)	0.27 (0.07)
$\sigma_{\omega 2}^2$ (variance, second AR)	0.73 (0.07)	0.43 (0.07)
υ (foreign elas. premium)	0.03 (0.04)	-0.13 (0.04)
λ_ξ (root, measurement error)	0.89 (0.01)	0.84 (0.02)
σ_ξ (std. error, measurement error)	0.23 (0.03)	0.18 (0.02)
	Elasticities of Demand	
η_μ (demand elas., μ across plants)	13.71 (8.81)	12.93 (6.16)
η_σ (demand elas., σ across plants)	11.61 (7.35)	12.59 (6.67)
	Exporting Decision	
γ_{s1} (sunk cost, small plants)	2.85 (0.80)	2.49 (0.41)
γ_{s2} (sunk cost, large plants)	2.65 (0.74)	2.26 (0.36)
κ (mean, ε_1 & ε_2)	-0.14 (0.04)	-0.17 (0.03)
$\sigma_{\varepsilon 1}$ (std. error, ε_1)	1.55 (0.48)	1.17 (0.32)
$\sigma_{\varepsilon 2}$ (std. error, ε_2)	0.90 (0.38)	0.62 (0.38)
	Initial Conditions	
α_0 (intercept)	8.68 (8.58)	-35.38 (16.49)
α_1 (dom. size dummy)	18.23 (20.73)	43.42 (20.58)
α_2 (x_1)	-23.95 (48.44)	17.41 (45.75)
α_3 (x_2)	9.33 (78.54)	-8.26 (61.25)
Observations	$N = 112, T = 11$	$N = XX, T = 12$

Notes: The table presents the results from estimating the structural model presented in Section 4 for the Preserved Fruits and Vegetables industry (SIC 203) over the time periods 1987-1997 and 1995-2006. We find that the average level of sunk costs associated with entering foreign markets facing this industry γ_s declined somewhat over the period from $\sim$ \$2.9 million to $\sim$ \$2.5 million. Mean estimates of foreign demand elasticities are consistent with the findings in the literature.

Table 7: SIC 372 Posterior Parameter Distributions (Means & Std Deviations)

	Aircraft & Parts (372)	
	1987-1997	1995-2006
	Profits	
ψ_{01} (intercept)	-0.36 (0.34)	-0.21 (0.31)
ψ_{02} (dom. size dummy)	2.62 (0.45)	2.81 (0.42)
ψ_1 (exchange rate)	-0.25 (0.97)	0.60 (0.57)
λ_x^1 (root, first AR)	0.31 (0.06)	0.80 (0.09)
λ_x^2 (root, second AR)	0.98 (0.01)	0.96 (0.02)
$\sigma_{\omega 1}^2$ (variance, first AR)	0.65 (0.06)	0.46 (0.10)
$\sigma_{\omega 2}^2$ (variance, second AR)	0.09 (0.04)	0.15 (0.10)
υ (foreign elas. premium)	2.03 (0.40)	1.42 (0.24)
λ_ξ (root, measurement error)	0.98 (0.01)	0.95 (0.01)
σ_ξ (std. error, measurement error)	1.29 (0.29)	0.74 (0.15)
	Elasticities of Demand	
η_μ (demand elas., μ across plants)	12.20 (4.82)	11.86 (4.17)
η_σ (demand elas., σ across plants)	12.80 (5.56)	12.16 (4.55)
	Exporting Decision	
γ_{s1} (sunk cost, small plants)	2.39 (0.62)	2.90 (0.65)
γ_{s2} (sunk cost, large plants)	2.45 (0.65)	2.54 (0.59)
κ (mean, ε_1 & ε_2)	-0.24 (0.07)	-0.26 (0.07)
$\sigma_{\varepsilon 1}$ (std. error, ε_1)	1.09 (0.40)	1.11 (0.29)
$\sigma_{\varepsilon 2}$ (std. error, ε_2)	0.85 (0.38)	1.06 (0.40)
	Initial Conditions	
α_0 (intercept)	45.99 (21.15)	24.97 (16.50)
α_1 (dom. size dummy)	8.04 (25.54)	35.75 (23.54)
α_2 (x_1)	-3.26 (25.49)	-8.34 (52.19)
α_3 (x_2)	38.58 (66.70)	56.54 (34.56)
Observations	$N = 924, T = 11$	$N = XX, T = 12$

Notes: The table presents the results from estimating the structural model presented in Section 4 for the Aircraft and Parts industry (SIC 372) over the time periods 1987-1997 and 1995-2006. We find that the average level of sunk costs associated with entering foreign markets facing this industry γ_s increased slightly over time. Mean estimates of foreign demand elasticities are consistent with the findings in the literature.

Table 8: SIC 382 Posterior Parameter Distributions (Means & Std Deviations)

	Measuring & Controlling Devices (382)	
	1987-1997	1995-2006
	Profits	
ψ_{01} (intercept)	-0.18 (0.17)	0.26 (0.22)
ψ_{02} (dom. size dummy)	0.96 (0.24)	1.53 (0.31)
ψ_1 (exchange rate)	-0.95 (0.63)	0.09 (0.49)
λ_x^1 (root, first AR)	0.12 (0.26)	0.80 (0.20)
λ_x^2 (root, second AR)	0.91 (0.07)	0.92 (0.03)
$\sigma_{\omega 1}^2$ (variance, first AR)	0.19 (0.07)	0.16 (0.06)
$\sigma_{\omega 2}^2$ (variance, second AR)	0.16 (0.06)	0.09 (0.06)
υ (foreign elas. premium)	1.23 (0.16)	0.89 (0.26)
λ_ξ (root, measurement error)	0.97 (0.01)	0.95 (0.02)
σ_ξ (std. error, measurement error)	0.67 (0.11)	0.58 (0.18)
	Elasticities of Demand	
η_μ (demand elas., μ across plants)	10.95 (6.39)	10.58 (5.49)
η_σ (demand elas., σ across plants)	7.76 (4.81)	7.85 (4.46)
	Exporting Decision	
γ_{s1} (sunk cost, small plants)	2.89 (0.98)	2.62 (0.93)
γ_{s2} (sunk cost, large plants)	2.66 (0.89)	3.29 (1.21)
κ (mean, ε_1 & ε_2)	-0.56 (0.32)	-0.95 (0.74)
$\sigma_{\varepsilon 1}$ (std. error, ε_1)	1.60 (0.55)	1.35 (0.64)
$\sigma_{\varepsilon 2}$ (std. error, ε_2)	1.12 (0.84)	2.75 (2.17)
	Initial Conditions	
α_0 (intercept)	43.81 (19.79)	41.79 (24.86)
α_1 (dom. size dummy)	33.54 (23.61)	7.84 (21.88)
α_2 (x_1)	58.63 (26.13)	1.57 (56.36)
α_3 (x_2)	-13.26 (43.48)	41.30 (51.51)
Observations	$N = 1056, T = 11$	$N = XX, T = 12$

Notes: The table presents the results from estimating the structural model presented in Section 4 for the Measuring and Controlling Devices industry (SIC 382) over the time periods 1987-1997 and 1995-2006. We find that the average level of sunk costs associated with entering foreign markets facing this industry γ_s decreased slightly over time. Mean estimates of foreign demand elasticities are consistent with the findings in the literature.

Table 9: Four Digit Subindustries For Structural Estimations

3 Digit SIC Industry	4 Digit SIC Subindustry
Preserved Fruits and Vegetables (203)	Canned specialties (2032)
	Canned fruits and vegetables (2033)
	Dehydrated fruits, vegetables, and soups (2034)
	Pickles, sauces, and salad dressings (2035)
	Frozen fruits and vegetables (2037)
	Frozen specialties, n.e.c. (2038)
Aircraft and Parts (372)	Aircraft (3721)
	Aircraft Engines and Engine Parts (3724)
	Aircraft Parts and Equipment, N.E.C. (3728)
Measuring and Controlling Devices (382)	Laboratory Apparatus and Furniture (3821)
	Environmental Controls (3822)
	Process Control Instruments (3823)
	Fluid Meters and Counting Devices (3824)
	Instruments to Measure Electricity (3825)
	Analytical Instruments (3826)
	Optical Instruments and Lenses (3827)
	Measuring and Controlling Devices, N.E.C. (3829)

Notes: The table lists the 4 digit 1987 SIC industries that compose the 3 digit 1987 SIC industries that we consider for our structural analyses.

Table 10: Evolution of Nontariff Barriers

	Tariff Lines Affected (%)	
Category	1994	2004
Price Control Measures (antidumping, min import prices)	7	2
Finance Measures (foreign exchange regs)	2	2
Automatic Licensing Measures (prior surveillance)	3	2
Quantity Control Measures (quotas, seasonal prohibition)	49	35
Monopolistic Measures (sole importing agency)	1	2
Technical Measures (requirements for testing, disclosing information, packaging, certain product characteristics)	32	59
Number of Countries	52	97
Number of Tariff Lines	97706	545078

Notes: The figures in the table report the percentage of types of goods (tariff lines) that are affected by each nontariff barrier to trade. They are cited from United Nations Conference on Trade and Development (2005) and support the report's contention that the technical barriers to trade have increased substantially over time.

Table 11: Export Participation (%)

Country	1987	2006	Change	Country	1987	2006	Change
Mexico	5.7	16.0	10.3	New Zealand	3.3	4.9	1.6
China	2.4	11.0	8.6	Costa Rica	1.5	3.0	1.5
India	2.1	6.3	4.2	Peru	1.3	2.8	1.5
United Kingdom	11.5	15.2	3.7	Taiwan	6.1	7.6	1.5
Brazil	3.2	6.5	3.3	Chile	3.0	4.4	1.4
Germany	8.8	12.1	3.3	Philippines	2.1	3.5	1.4
South Korea	5.1	8.3	3.2	Belgium	3.9	5.2	1.3
Australia	7.9	11.0	3.1	Russia	0.7	2.0	1.3
Hong Kong	5.8	8.5	2.7	Guatemala	1.3	2.5	1.2
United Arab Emirates	1.8	4.3	2.5	France	7.0	8.1	1.1
Singapore	5.9	8.4	2.5	Saudi Arabia	2.6	3.7	1.1
Malaysia	2.6	5.0	2.4	Panama	1.3	2.4	1.1
Italy	5.6	8.0	2.4	Finland	2.0	3.1	1.1
Thailand	3.0	5.3	2.3	Honduras	0.7	1.7	1.0
Israel	3.9	6.1	2.2	Indonesia	1.4	2.4	1.0
Japan	8.3	10.4	2.1	Argentina	2.9	3.8	0.9
Canada	31.0	33.0	2.0	El Salvador	0.9	1.7	0.8
Poland	0.8	2.8	2.0	Denmark	2.5	3.3	0.8
Spain	4.0	6.0	2.0	Egypt	1.3	2.1	0.8
Ireland	2.5	4.5	2.0	Switzerland	4.0	4.8	0.8
Netherlands	5.5	7.4	1.9	Sweden	4.1	4.8	0.7
Dominican Republic	0.9	2.7	1.8	Kuwait	1.2	1.9	0.7
Turkey	1.9	3.7	1.8	Austria	2.1	2.7	0.6
Colombia	2.3	4.0	1.7	Venezuela	2.7	3.3	0.6
South Africa	3.3	5.0	1.7	Norway	2.4	2.9	0.5
Overall					40.0	48.2	8.2

Notes: Between 1993 and 2006, the number of exporting firms increased by 8.2 percent while the number of U.S. manufacturing firms declined by 10 percent. As such, increases to export participation were driven about equally by increases in the number of exporting firms and by declines in U.S. manufacturing.

Table 12: Contribution to Firm-Country Pairs (%)

Country	1987	2006	Change	Country	1987	2006	Change
Mexico	2.9	5.3	12.0	South Africa	1.7	1.7	1.6
China	1.2	3.7	11.0	New Zealand	1.7	1.6	1.5
India	1.1	2.1	4.9	Philippines	1.0	1.2	1.5
Brazil	1.6	2.2	3.7	Japan	4.2	3.5	1.4
South Korea	2.6	2.8	3.3	Guatemala	0.6	0.9	1.4
United Kingdom	5.8	5.1	3.1	Chile	1.5	1.5	1.4
United Arab Emirates	0.9	1.4	2.9	Panama	0.7	0.8	1.2
Germany	4.5	4.0	2.8	Honduras	0.4	0.6	1.1
Malaysia	1.3	1.7	2.8	Finland	1.0	1.0	1.1
Australia	4.0	3.7	2.7	Belgium	2.0	1.7	1.1
Hong Kong	2.9	2.9	2.7	Taiwan	3.1	2.5	1.0
Thailand	1.5	1.8	2.5	Saudi Arabia	1.3	1.2	1.0
Poland	0.4	0.9	2.3	Indonesia	0.7	0.8	1.0
Singapore	3.0	2.8	2.3	El Salvador	0.5	0.6	0.9
Italy	2.8	2.7	2.2	Egypt	0.7	0.7	0.8
Israel	2.0	2.0	2.2	Argentina	1.5	1.3	0.7
Dominican Republic	0.5	0.9	2.2	Kuwait	0.6	0.6	0.7
Ireland	1.3	1.5	2.1	Denmark	1.3	1.1	0.7
Turkey	1.0	1.2	2.0	France	3.5	2.7	0.5
Spain	2.0	2.0	2.0	Switzerland	2.0	1.6	0.4
Colombia	1.2	1.3	1.8	Austria	1.1	0.9	0.4
Peru	0.6	0.9	1.8	Sweden	2.1	1.6	0.4
Costa Rica	0.8	1.0	1.7	Venezuela	1.4	1.1	0.3
Netherlands	2.8	2.5	1.6	Norway	1.2	1.0	0.3
Russia	0.4	0.7	1.6	Canada	16.0	11.0	-1.9
Total					100	100	100

Notes: High growth countries account for the majority of the increase in firm-country exporting pairs 1993-2006. The first two columns report each country's contribution to the total number of firm-country exporting pairs in that year. The final column reports that country's contribution to the change in the total number of firm-country exporting pairs between these two years.

Table 13: Number of Destinations and Prevalence

Year	1993	2006
Mean	4.9	6.2
St. Dev.	7.4	8.4
Median	2	3
Prevalence	4.0	6.0

Notes: The rows report the average, standard deviation, and median number of destinations served by each U.S. exporter. Additionally, the number of firm-country exporting pairs increased by 36 percent between 1993 and 2006. Prevalence is the unconditional probability that a U.S. firm exports to a top 50 countries.

Table 14: Firm-Country Export Participation by Industry (%)

Industry	1993	2006	Contribution to Change
Food	2.1	3.2	4.9
Tobacco	2.8	1.5	-0.2
Textile Mill Products	3.9	7.5	1.1
Apparel	1.1	2.7	1.2
Wood Products	0.9	1.1	1.4
Furniture	1.6	2.4	0.9
Paper	3.4	5.4	2.2
Printing & Publishing	1.1	1.5	1.3
Chemicals	9.6	13.7	11.1
Petroleum & Coal	4.6	7.2	0.5
Plastics & Rubber	3.7	7.2	12.0
Leather	4.5	6.7	-0.4
Nonmetallic Minerals	2.1	2.9	2.2
Primary Metals	4.1	6.6	3.9
Fabricated Metals	2.6	4.5	14.8
Machinery	6.1	7.8	16.5
Electronic & Other Electric Equipment	9.1	13.4	10.0
Transportation Equipment	4.8	6.7	6.0
Instruments	16.1	21.0	7.7
Miscellaneous Manufacturing	4.7	6.9	3.1
Total			100

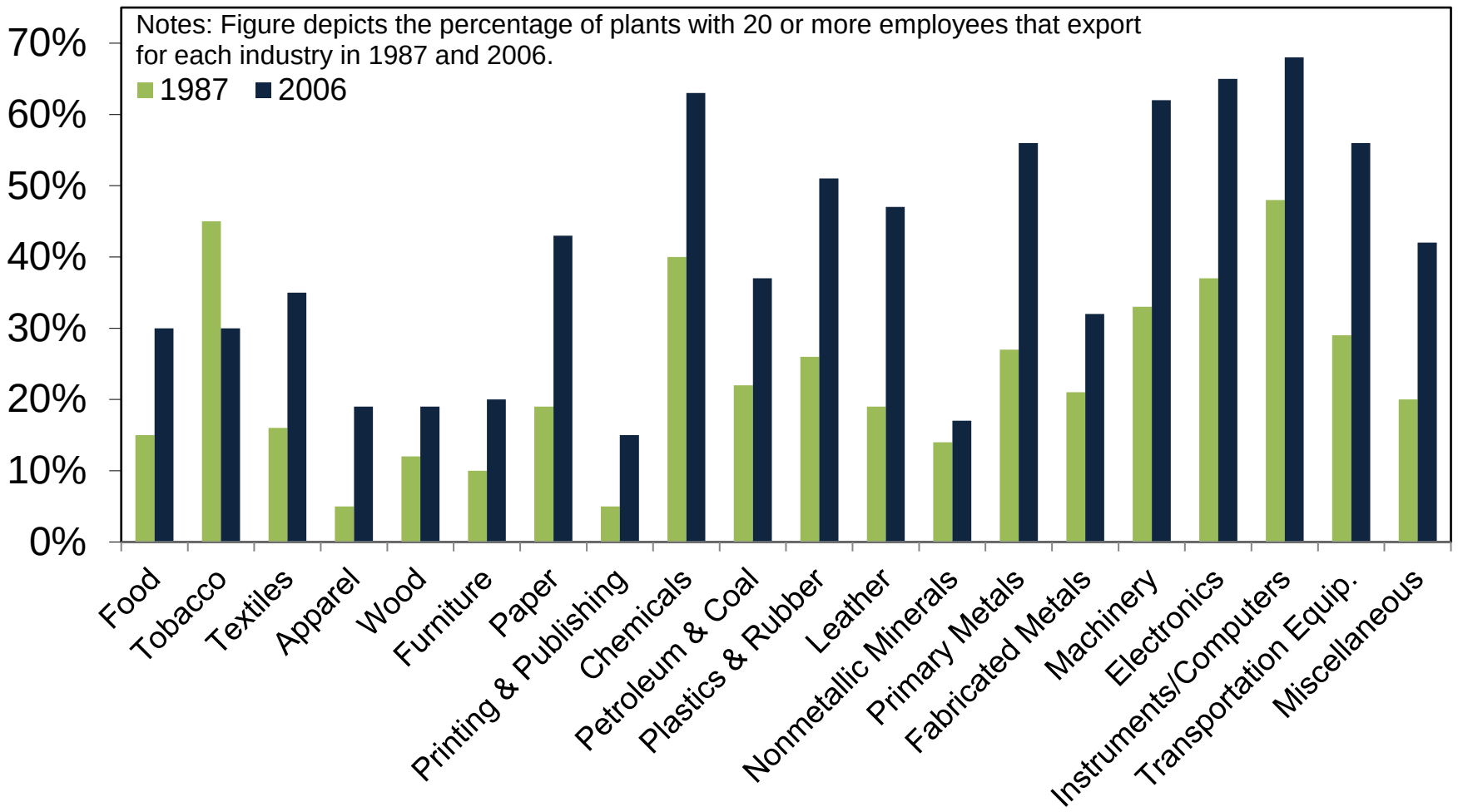
Notes: The first two columns report the fraction of firm-country exporting pairs by industry in each year. The final column reports the industry's contribution to the change in the total number of firm-country exporting pairs between these two years.

Table 15: Firm-Country Export Participation by Region (%)

Region	1993	2006	Contribution to Change
New England	5.6	8.4	5.7
Middle Atlantic	4.1	7.1	15.2
East North Central	4.1	6.4	25.4
West North Centra	3.9	5.8	9.2
South Atlantic	3.2	4.9	10.3
East South Central	2.7	4.3	4.6
West South Central	3.2	4.6	7.4
Mountain	3.5	4.7	4.6
Pacific	4.5	6.4	17.6
Total			100

Notes: The first two columns report the fraction of firm-country exporting pairs by region in each year. The final column reports the region's contribution to the change in the total number of firm-country exporting pairs between these two years.

Appendix Fig. 1: ASM Industry Decomposition



Appendix Fig. 2: ASM Region Decomposition

