The Rise of Exporting By US Firms*

William F. Lincoln
Johns Hopkins University

Andrew H. McCallum
Federal Reserve Board of Governors

March 16, 2015

Abstract

Although a great deal of ink has been spilled over the consequences of globalization, we do not yet fully understand the causes of increased worldwide 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 large roles for foreign income growth, free trade agreements, and the development of the internet 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 U.S. Census Bureau, the Board of Governors of the Federal Reserve, or any other person associated with the Federal Reserve System. 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 Lincoln, Day Manoli, Prachi Mishra, Ryan Monarch, Daniel Murphy, Justin Pierce, Mark Roberts, 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. We thank Alex Avramov, Hannah Kwon, Alejandro Perez-Segura, and Isaac Rabbani for superb research assistance. 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 this growth 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. Interestingly, we find little evidence that this entry into foreign markets was due to significant declines in the barriers to entry that firms face. We instead use a novel approach to decompose increases in exporting and find that growth in foreign income, free trade agreements, and the development of the internet were crucially important drivers of these trends. 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 and the associated increase in the number of varieties of goods traded across countries 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 be beneficial to them. This has been argued to be one of the most important channels for the gains from trade at least since the work of Hicks (1969). Broda and Weinstein (2006), for example, have argued that the impact of the tripling of varieties imported into the United States from 1972 to 2001 had significant effects on welfare. 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 of capital goods from industrialized nations 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 new 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 newly trading with one another or expansions in the volume of goods that were already exported 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 entry into foreign markets was also broad-based; it was experienced across a wide range of firm size categories, industries, and geographic regions of the US. While Mexico and China accounted for significant shares, the rise in exporting was seen 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 to date on changes in variable trade barriers such as tariffs and transportation costs, an analysis of how entry costs have changed over time is lacking. Coupled with the fact that declines in these costs have been previously suggested as a potential cause of extensive margin growth in other countries (Melitz 2003), 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 indicate modest overall changes in up-front costs over time. Taken together, the results from these different approaches suggest that declines in the costs of entering foreign markets are unlikely to have been the driving force behind greater US exporting.

We then turn to an analysis of other potential explanations for the rise of exporting. Borrowing decomposition methods from the labor economics literature that have been used to study the rise of female labor force participation and other related issues, 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, free trade agreements, and the development of the internet were primary drivers. Changes in tariff levels and exchange rates had only a modest effect on these trends. The fall of the Soviet Union also played a small role. Interestingly, as in the review of the gravity equation literature on the volume of trade by Head and Disdier (2008), the effect of distance does not decline significantly over time. These results suggest that the rise in exporting is unlikely to be reversed without significant changes in the global 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 data come from two primary sources, each with its own advantages. The first is the Linked Longitudinal Firm Trade Transaction Database (LFTTD) that was originally constructed by Bernard, Jensen, and Schott (2009). This data set contains records from US Customs and has information on the shipment value, firm identifier, and country of destination associated with all US export transactions. We link these records to the Longitudinal Business Database (LBD) which includes annual employment and payroll of every firm in the US. To focus the analysis and allow for a comparison, we limit the sample to firms with the majority of their employment in the manufacturing sector. This merged database has the advantage of allowing us to follow small 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). Where appropriate, we drop the years 1992 and 1998 due to evidence of especially large measurement error for exports to Canada in these years. In order to focus on better measured data, throughout we focus on firms with 20 or more employees. Firms with 20 or more employed account for the overwhelming majority of both total exports as well as the number of firms exporting. To focus the analysis on countries for which we have information on the factors that drove the rise in exporting in Section 4, we also limit our sample to the top 50 US export destinations. These countries similarly account for the vast majority of the rise of exporting, both in terms of the changes in the number of exporting firms as well as shifts in the volume of exports. In terms of levels, they are responsible for around 95% of total U.S. manufacturing export volume. In all of our analyses, we utilize 2006 as our last sample year to circumvent contamination by the global financial crisis.

Our second primary source of data is the Annual Survey of Manufacturers (ASM), which contains information on the annual 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 set of plants are chosen. 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 estimations 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, 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. Furthermore, we document the rise of exporting by US firms was experienced by establishments of all sized and so this sample is representative of the overall trend.

With these data, we develop a number of new stylized facts regarding the pace and character of the rise of exporting by US firms. 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. As mentioned above, 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%. When considering firms that were in operation in both 1993 and 2006, the rise in exporting was even stronger. This involved a larger increase in the percent of firms exporting overall and a larger increase in the average number of countries to which exporters sold goods. We come to similar conclusions throughout this section when dropping the 20 employee restriction and considering all firms.[1]

At the same time that the fraction of exporting firms was growing, the number of countries to which they sold was also increasing. The average number of destinations for exporting firms grew from 4.94 to 6.22. 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 positive exports. Seen from a perspective that accounts for the overall declines in US manufacturing over the period, we show that the fraction of firms that export to a given country in our sample rose from 4% in 1993 to 6% in 2006.

To get a better sense of these trends, we also looked at how the composition of the destinations of firm shipments 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 degree line to see how the figures compare across the early and late parts of our sample, we find an increase for every single country with some (Mexico and China) larger than others (Egypt and El Salvador). Many of the countries that saw the largest increases in firm participation were those that were already popular export destinations in 1993.

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 exporting firm-country pairs. 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. As a result, the overall destination profile of exporting by US firms did not change significantly overtime. The rank correlation across countries in the beginning and end of our sample is 89%. The set of the most important contributors also includes a variety of economies, from industrialized nations like Great Britain and Germany to fast growing developing economies such as India and China. The top 10 countries also account for nearly half of the rise in exporting. Given that the North American Free Trade Agreement (NAFTA) was signed and passed during these years, it is perhaps not surprising that increases in exporting to Mexico played a significant role. We return to this below in Section 4. With a share of

[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. Taking the 40% figure from 1993 as a baseline, firms that were no longer in the sample in 2006 were only modestly less likely to be exporters. Firms that entered the sample were similarly only slightly more likely to export.

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.

We also looked at the rise of exporting broken down by industry as well as region of the US. In Figure 2 we plot the probability of exporting to a given country in our sample across 2 digit 1987 Standard Industrial Classification (SIC) sectors. We find that the rise of exporting was experienced across all but one sector and across every US region. Given that the classification of sectors changes from SIC to the North American Industry Classification System (NAICS) in 1997, we develop a concordance from NAICS to SIC so our industry definitions remain consistent over time. In columns (1)-(3) of Table 2, we similarly document that the rise in exporting was experienced across regions of the US. 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 looked at how the rise of exporting varied across firms of different sizes. The intuition developed from a number of the recent models of firm heterogeneity and international trade suggest that these trends would primarily be driven by smaller firms. We find that this is in fact not the case. In columns (4)-(6) of Table 2 we look at the change in the probability that a firm exports to a given country in our sample across firm size categories. While there is some variation in the increase across different types of firms, the rise of exporting was felt across each of the categories. Given the relationship between firm size and productivity, this in turn suggests that even the most productive firms began exporting more and that the welfare effects in countries abroad were likely larger than they would have been if these trends were driven by low productivity firms.

While our focus is on changes in the extensive margin of trade, considering the intensive margin is also informative. We find that average real exports across countries increased by 57% from 1993 to 2006. 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 entry costs are high in a particular country, then only the most efficient firms will export there, selling sizable quantities and leading to high exports per firm. These results suggest at the very least that if barriers to entry did in fact decline, their decline was 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 has an earlier start date of 1987, we see even greater entry into foreign markets. In Figure 3, 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. Similar to our firm-level results in the LFTTD, this rise in the percentage of ASM plants exporting was driven both by changes in the raw number of plants exporting as well as declines in the total number of plants. We see similar changes in looking at plants that were present at both the beginning and end of the sample. A significant portion of this growth also occurred between 1987 and 1992, highlighting the benefits of looking at these changes with both the ASM and LFTTD data. In Table 3, we see a similar picture when we look at the rise of exporting across industries and regions at the plant level across 1987 to 2006. We also find similar results both overall as well as across industries and regions when limiting the sample to plants with 10 or more employees or 250 or more employees. These results for plants with 250 or more employees are especially important for our estimation approach in the next section where we are limited to plants of at least this size. Additionally, we find significant increases in exporting 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 these trends that reinforce the findings we present in this section.

3 Barriers to Entry

A natural starting point for better understanding the large scale entry into foreign markets documented above is to examine how barriers to entry have changed over time. As these costs cannot be directly observed, we use models of firm behavior to estimate changes in their magnitude. 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 how these costs have changed 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

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

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, 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 across different countries. 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 have to pay upfront costs to enter. This has a fundamental impact on who exports as well as the dynamics of exporting behavior over time. 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

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

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 ago. The extra benefits that a firm will gain from exporting 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. If there are no costs to entering the foreign market in the model, 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

[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 (4) a function of $F_0 + L$. See Heckman (1981a) and Chamberlain (1985) for discussions of econometric issues relating to identifying true state dependence.

$$p^*_{it} - F_0 \approx \mu_i + X'_{it}\beta + \phi_t + \varepsilon_{it} \tag{3}$$

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 influence p^*_{it} and thus predict export market participation. Unobserved firm-specific factors that influence p^*_{it} are captured in μ_i. Business cycle effects and other time varying factors are absorbed into the year 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. We can thus associate higher or lower levels of state dependence in exporting with corresponding changes in barriers to entry.

As our ASM data give us the longest time horizon and allow us to control for a greater amount of heterogeneity in time-varying producer characteristics, we begin by estimating equation (4) at the plant level over 1989-2006. As a first step, we estimate the specification with a simple fixed effects regression. Table 4 presents the results. Standard errors in parentheses are clustered at the plant level and plant-specific characteristics in X_{it} are lagged by one period throughout in order to avoid issues of simultaneity. These controls include the logarithms of employment, total factor productivity, and average wages as well as ratio of nonproduction worker employment to total employment. Across all of our results, productivity is estimated with the semiparametric approach of Levinsohn and Petrin (2003). We also include an industry-level, trade-weighted exchange rate series constructed using the approach in Loretan (2005). The years 1987 and 1988 are used as pre-sample years.

In column (1) we present our findings from estimating equation (4) as presented above. Controlling for other factors, exporting last year raises a plant's probability of exporting this year 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). Given the magnitudes of the coefficients on the interaction terms, these estimates 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 additionally include interactions of the variables in X_{it} with the indicator $Post_{98}$ and the main results are little changed.

We come to similar conclusions when considering alternative approaches. These include using different years for the post-period (e.g. $Post_{99}$), only considering plants with 350 or more employees, using different covariates in X_{it}, estimating productivity with the approach of Wooldridge (2005), and adding the variable "Last exported three years ago" and its interaction with $Post_{98}$. Simple estimations of the specification in (4) without fixed effects or plant-level controls also suggest little change in state dependence.

In these baseline estimations, we make no restrictions on entry or exit into the sample. Estimations using a balanced panel yield similar results and were also robust to these alternative approaches. This is reassuring not only for the validity of our approach here but also for our estimations below, where we are constrained to use a balanced panel approach. We additionally come to similar conclusions when we allow for entry but drop plants that exit the sample. In a similar vein, we performed estimations like those described above but restricted to the industries considered for our structural estimations in the next section. 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 Table 4 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 ($T = 18$) is likely to significantly attenuate these concerns. To address these issues we estimate the specification in equation (4) with a dynamic random effects probit estimator. This approach uses the Gaussian-Hermite quadrature methods of Butler and Moffitt (1982) and bounds the predicted probabilities between zero and one. It has the limitations, however, 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, although the robustness to different restrictions on entry and exit in our fixed effects estimations above is reassuring on this score.

Instead of considering the whole panel at once, given the structure of the estimator we choose to estimate the model in an earlier period and a later period and compare the level of state dependence. We create two balanced panels covering 1987-1997 and 1995-2006, similar to our approach using Monte Carlo Markov Chain (MCMC) methods in the next section. We deal with the problem of initial conditions by using the approach of Heckman (1981b). In the initial conditions equation we include the logarithms of employment, average real wages, total factor productivity, and the exchange rate, as well as the ratio of nonproduction worker employment to total employment two years prior to the start of the sample. We additionally include a set of 2 digit SIC industry dummies. In columns (1) and (2) of Table 5 we estimate the specification without any plant specific controls. As accounting for firm heterogeneity is important in this context, following Mundlak (1978) in columns (3) and (4) we assume $\mu_i = \bar{X}_i'\alpha + \zeta_i$. Here $\zeta_i \sim iidN\left(0, \sigma_\zeta^2\right)$ and are independent of X_{it} and ε_{it} for all i and t. This independence assumption is a strong one but it will allow us to better account for firm characteristics as a robustness exercise. Specifically, we include time means of the logarithms of employment, average real wages, total factor productivity, and the exchange rate, as well as the ratio of nonproduction worker employment to total employment. The term ζ_i is integrated out using Gaussian-Hermite quadrature.

To calculate the average partial effect (APE) of y_{it-1} on $P\left(y_{it}=1\right)$ across each of the specifications, we calculate $ape_1 = \frac{1}{n}\sum_{i=1}^{n}\Phi\{(\hat{\xi}+\bar{X}_i'\hat{\alpha})(1-\hat{\rho})^{1/2}\}$ and $ape_0 = \frac{1}{n}\sum_{i=1}^{n}\Phi\{(\bar{X}_i'\hat{\alpha})(1-\hat{\rho})^{1/2}\}$, where $\hat{\rho} = \hat{\sigma}_\zeta^2/(\hat{\sigma}_\zeta^2+\hat{\sigma}_\varepsilon^2)$ and $\Phi\left(\cdot\right)$ is the cumulative distribution function of the standard normal distribution. The APE is then given by $ape_1 - ape_0$. The estimates of ρ and the APE are presented below the regression coefficients in each column. Partial effects at the average are calculated with respect to the last year in each panel and the effects tend to be similar across the different years. The APEs increase across the early and later panels with each approach, suggesting a higher level state dependence and corresponding change in barriers to entry.

A concern with both of these estimators is that they assume that the error term is serially uncorrelated. If there are persistent unobserved shocks to p_{it}^*, this could bias our estimates of the level of state dependence. In order to address this concern, in Table 6 we turn to a simulated maximum likelihood estimator based on the GHK algorithm of Geweke, Hajivassiliou, and Keane (see, for example Hyslop 1999). 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. We deal with the problem of initial conditions as above and calculate the average partial effects in the same way. The level of state dependence decreases slightly with the first approach and increases even more modestly when the firm controls are added, suggesting little change in barriers to entry.

While our approach using the ASM allows us to estimate equation (4) controlling for a number of different producer characteristics, it does not consider the markets to which plants were exporting. We next turn to a similar analysis using the LFTTD and estimate a variant of equation (4) across destinations. Similar to the analysis above, for each country we create a set of balanced panels of firms for 1992–1999 and 2000–2006. We consider the dynamic panel data probit estimator of Butler and Moffitt (1982) with no additional firm level controls. The logaritms of firm employment and the average wage in the firm lagged by two years are used in the initial conditions equation along with a set of 2-digit

SIC industry dummies. In Figure 4 we take the estimates of the coefficient on y_{it-1} in the two different panels 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 a 45 degree 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 degree line, suggesting that barriers to entry have not declined significantly. We focus the graph on the relevant parameter space for the purposes of presentation but it should be noted that the percentage change for each coefficient is typically quite small; it is almost always smaller in magnitude than a 5 percent decline and the average is a 1.4 percent increase. 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 including time means of the logarithms of employment and wages using the approach of Mundlak (1978). Simple persistence levels estimated by regressing the firm's current export status on its lagged export status with a linear probability model are also similar across the panels, although the magnitudes of the partial effects are naturally different.[4]

3.2 MCMC Estimations

3.2.1 Model and Estimation Approach

In this section, we turn to a different 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 different 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 where such information is available. In addition to addressing the question

[4] We also considered estimating the parameters using the simulated maximum likelihood approach discussed above. These were computationally infeasible to do for all countries and experimental estimations for the countries that accounted for the largest increases in exporting proved not to be robust. The fact that we come to similar overall conclusions about the change in barriers to entry using the ASM is reassuring on this score.

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 to export. 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 from information on domestic revenues, foreign revenues, and total costs. The error terms ε_{jit} are normally distributed with mean zero and variance $\sigma^2_{\varepsilon j}$, serially uncorrelated, and are uncorrelated with x_{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 factors evolve. The plant then decides whether or not to export $y_{it} = y(e_t, x_{it}, z_i, \varepsilon_{jit}, y_{it-1} \mid \theta)$ based on maximizing 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

$$y_{it}^{*}=u\left(e_{t},x_{it},z_{i},\varepsilon_{it},1,y_{it-1}\mid\theta\right)+\delta\Delta E_{t}V_{it+1}\left(e_{t},x_{it},z_{i}\mid\theta\right) \tag{8}$$

where

$$\Delta E_{t}V_{it+1}\left(e_{t},x_{it},z_{i}\mid\theta\right)=E_{t}\left[V_{it+1}\mid y_{it}=1\right]-E_{t}\left[V_{it+1}\mid y_{it}=0\right] \tag{9}$$

The first term in equation (8) reflects the direct benefits from exporting today, 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.

There are two central problems with estimating the likelihood function $L\left(D\mid\theta\right)$ that results from the model with classical methods. The first is that in order to account for plant heterogeneity, the approach allows for a different foreign demand elasticity for each plant $\eta=\{\eta_i\}_{i=1}^{n}$, creating an incidental parameters problem. Second, the likelihood function 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 $P\left(\theta\mid D\right)\propto q\left(\theta\right)L\left(D\mid\theta\right)$, where $q\left(\theta\right)$ gives our prior beliefs about the parameters. To characterize the posterior distribution $P\left(\theta\mid D\right)$, we then use the random walk Metropolis–Hastings algorithm. This algorithm essentially allows us to estimate $E\left(\theta\mid D\right)$ by performing Monte Carlo integration using a Markov chain.

With a few exceptions, we choose the prior distribution of the parameters $q\left(\theta\right)$ to be diffuse to let the data speak for itself. We list the priors for the most important parameters in our model in Table 7 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 so that they are distributed uniformly on $(-1,1)$. This ensures 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 $\ln\left(\eta_i-1\right)\sim N\left(2,1\right)$. This is consistent with prior literature (see, for example, Goldberg and Knetter 1999) 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 from 1987 to 2006 and (iv) in order to get a broad view, the industries were in different 2 digit SIC sectors. These criteria led us to consider three particular 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 parameter we report the estimated mean and standard deviation. All figures are in 1987 dollars. Despite generally using highly diffuse priors, 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), to construct our estimates we consider 100,000 post-burn draws from the posterior distribution from three separate chains for a total of 300,000 draws. The convergence of each chain is checked using the diagnostic tests reviewed by Brooks and Roberts (1998).

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 is 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 interpreting these results more broadly, there are a number of factors that likely worked to increase as well as decrease these costs. Improvements in logistics technologies could have lowered 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. Additionally, while most types of nontariff barriers have decreased in the last 25 years, technical barriers to trade have increased significantly.[5] While beyond the scope of this study, we consider the effects of these factors to be an open area for future research.

4 Accounting for the Rise in Exporting

While looking at changes in barriers to entry is a natural place to begin in looking at foreign market entry, there are a number of other factors that can explain these trends. In this section, we explore the contribution of these alternative factors with a particular emphasis on those that could raise the profitability of being an exporter. 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 observed increase in the volume of worldwide trade over time. Many of these studies have employed a gravity equation to document the main determinants of greater trade flows (e.g. Baier and Bergstrand 2001). We combine this type of approach with econometric decomposition methods developed in the labor economics literature to study the rise of exporting. This combined methodology allows us to separate out the effects of changes in observed and unobserved factors that contributed to the rise in exporting. Additionally, by considering a more recent time period than much of the existing related literature, we can explore the role of factors that have not yet been studied and consider larger set of countries.

In order to decompose the sources of the rise in exporting, we draw upon the canonical methodology developed by Oaxaca (1973) and Blinder (1973), hereafter referred to as OB. This approach and related methods have been used to understand issues such as the reasons for the rise of female labor force participation and declining rates of membership in labor unions.[6] To our knowledge, however, this technique has not been used to evaluate the sources of changes in the pattern of international trade or firm export decisions over time. The decomposition method is straightforward to apply with many covariates, valid in unbalanced samples, and allows for easy computation of standard errors. Kline (2011) shows that the

[5] 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, Otsuki (2000), and Baldwin (2000). For survey evidence on the nature of barriers to entry, see the study conducted for the World Bank found in First Washington Associates (1991).

[6] See for example Gomulka and Stern (1990), Even and MacPherson (1990), and Fitzenberger et al. (2010). For applications to related types of problems, see Doiron and Riddell (1994), Fairlie (1999), and Schirle (2008).

OB estimator has robust statistical properties to commend its use and Fortin, Lemieux, and Firpo (2011) discuss decomposition methods in further detail. Analogous to understanding the sources of changes in the propensity of women to enter the workforce, it is particularly well suited to looking at changes in the decision of a particular firm to export to a given country. Since it has little precedent for decomposing changes in trade, here we give a brief overview of the approach.

We start by noting that if we take y_{ic}^{t} as an indicator for whether firm i exported to country c in year t, the change in the probability that a firm exports to a given country can be written as

$$prob^{06} - prob^{93} = E\left[y_{ic}^{06}\right] - E\left[y_{ic}^{93}\right]$$

We model export participation in a given year as

$$y_{ic}^{t} = \alpha^{t} + \phi_{i}^{t} + X_{ic}^{t}\beta^{t} + \varepsilon_{ic}^{t}$$

where $t \in [93, 06]$, α^{t} is an overall constant, ϕ_{i}^{t} are firm fixed-effects, the vector X_{ic}^{t} contains observed explanatory variables, and ε_{ic}^{t} is mean zero conditional on the covariates and fixed-effects. By rearranging the predicted probability of exporting in 1993 and 2006, the estimating equation can be decomposed as

$$\begin{aligned}
\widehat{prob}^{06} - \widehat{prob}^{93} &= \hat{\alpha}_0^{06} + \bar{\hat{\phi}}_i^{06} + E\left[X^{06}\right]\hat{\beta}^{06} - \hat{\alpha}_0^{93} - \bar{\hat{\phi}}_i^{93} - E\left[X^{93}\right]\hat{\beta}^{93} \\
&= \left(\hat{\alpha}_0^{06} - \hat{\alpha}_0^{93}\right) + \left(\bar{\hat{\phi}}_i^{06} - \bar{\hat{\phi}}_i^{93}\right) + \bar{X}^{06}\hat{\beta}^{06} - \bar{X}^{93}\hat{\beta}^{93} \\
&= \left(\hat{\alpha}_0^{06} - \hat{\alpha}_0^{93}\right) + \left(\bar{\hat{\phi}}_i^{06} - \bar{\hat{\phi}}_i^{93}\right) + \bar{X}^{06}\hat{\beta}^{06} - \bar{X}^{06}\hat{\beta}^{93} + \bar{X}^{06}\hat{\beta}^{93} - \bar{X}^{93}\hat{\beta}^{93} \\
&= \underbrace{\left(\bar{X}^{06} - \bar{X}^{93}\right)\hat{\beta}^{93}}_{\text{explained by observables}} + \\
&\quad \underbrace{\left(\hat{\alpha}_0^{06} - \hat{\alpha}_0^{93}\right) + \left(\bar{\hat{\phi}}_i^{06} - \bar{\hat{\phi}}_i^{93}\right) + \bar{X}^{06}\left(\hat{\beta}_0^{06} - \hat{\beta}_0^{93}\right)}_{\text{unexplained by observables}}
\end{aligned}$$

The first term in the last expression gives the change in the outcome due to changes in the average value of the observable covariates. It weights these changes by keeping the estimated marginal effects $\hat{\beta}$ fixed at their counterfactual 1993 value. The second term gives the change in export participation due to changes in the estimated marginal effects, holding the value of the covariates to their average in 2006. Using this approach allows us to estimate the contribution of each factor to the rise in the estimated probability of exporting.

Considering the decomposition in this way, where we hold the marginal effects fixed at those estimated for 1993, ensures that the estimates are not affected by subsequent within-sample developments. It should be noted, however, that if we were to pursue the decomposition by adding and subtracting $\bar{X}^{93}\hat{\beta}^{06}$, we would end up weighting the changes in the observable factors by the estimated marginal effects in 2006. We return to these issues below.

We draw upon a number of data sources to examine the factors that drove the rise in exporting. Foreign GDP data are sourced from the World Bank's World Development Indicators. "Gravity" variables on country distance, time zone difference, and indicators for common currency, common language, common legal origins, contiguity, regional trade agreements, and colonial relationships are sourced from the Centre d'Études Prospectives et d'Informations Internationales (CEPII). Countries that share a common language with the US are those where the official language is English. Britain, Spain, France, and the Philippines are all coded as having had colonial relationship with the US. Panama defines the US dollar as legal tender and as such is the only country in our data set that shares a common currency with the US. Measures of the number of internet users are also from the World Development Indicators data set and information on the number of internet hosts is from the Internet Software Consortium. Sectoral tariff data is from the World Bank's TRAINS data base. We describe our development of this data in further detail in the appendix.

Before beginning on a formal analysis, it is instructive to simply look at how much each of these factors changed over the course of our sample period. In Table 9, we look at how each of the variables we include in our estimations changed across the 50 countries in our sample. The average number of internet users per country grew dramatically on average from 80 thousand per country to 16 million per country. The US consummated 9 new regional trade agreements between 1993 and 2006. Average market size grew from 409 billion to 558 billion in 2000 dollars. Tariffs measured using a value added equivalent fell somewhat. They declined from an average of 13.69 percent to 7.37 percent, a large percentage decrease but a relatively modest absolute change. The real exchange rate also experienced relatively small shifts. We come to similar conclusions when weighting these changes across countries by their popularity as an export destination at the beginning of our sample in 1993. While firm responsiveness to these changes might differ for each factor, they are suggestive of our conclusions below.

As discussed above in Section 2, given that the North American Free Trade Agreement (NAFTA) was signed and passed during these years it is perhaps not surprising that increases in exporting to Mexico played a significant role in these trends. In Figure 5 we plot the number of firms exporting to Mexico in our sample year by year. In order to focus on percentage changes as well as avoid concerns about disclosure, we normalize the number of firms exporting to Mexico in 1994 to 1 when NAFTA was signed and the figures for all other years are presented in relation to this base year. Interestingly, the response was not immediate in the first couple years after the agreement was signed. There was large scale entry in the following years, however, such that the number of firms exporting there had more than doubled by 2000. While there were clearly other developments going on at the same time, this is strong evidence that the NAFTA had a significant effect on exporting to Mexico.

Another notable feature of Figure 1 and Table 1 from Section 2 is that many of the countries that contributed the most to the rise in exporting also experienced rapid economic growth. While China and India are notable examples, Mexico, Brazil, and Korea also experienced significant growth over this time period. Figure 6 plots for each country in our sample the log ratio of the probability of exporting to a given country in 2006 relative to 1993 against the log of the ratio of real GDP in 2006 relative to 1993. The relationship between changes in market size on the x-axis and changes in export participation on the y-axis is strong and positive. This reflects the fact that as the size of a foreign market increases, the benefit of being a US exporter to that country increases in tandem. These findings anticipate the results in Section 4 where we find that foreign economic growth was a primary driver of the rise in exporting.

Along with the relationship between exporting and growth in market size, Figure 7 highlights a second driver of greater export participation. Similar to market size, growth in the number of internet users is associated with a strong increase in the extensive margin for US manufacturing firms. As above, for each country in our sample the log ratio of the probability of exporting to a given country in 2006 relative to 1993 against the log of the ratio of the number of internet users in 2006 relative to 1993. The development of the internet is likely to have had effects on trade through a number of channels, such as making communication costs less expensive. The large observed change in these two determinants of export status can account for a significant portion of the observed rise in export participation.

Motivated by the long literature on estimating gravity equations for the volume of trade, our baseline specification for the probability that a firm exports to a given country for each year is

$$
\begin{aligned}
\Pr\left[y_{ic}^t = 1 \mid X_{ic}^t, \alpha^t, \phi_i^t\right] &= E\left[y_{ic}^t \mid X_{ic}^t, \alpha^t, \phi_i^t\right] \\
&= \alpha^t + \phi_i^t + \beta_1^t \ln\left(\text{InternetUsers}_c^t\right) + \beta_2^t \text{RTA}_c^t + \\
&\quad \beta_3^t \ln\left(\text{MarketSize}_c^t\right) + \beta_4^t \ln\left(\text{Tariffs}_{ic}^t\right) + \beta_5^t \ln\left(\text{RER}_c^t\right) + \\
&\quad \beta_6^t \ln\left(\text{Distance}_c\right) + \beta_7^t \text{Contiguous}_c + \beta_8^t \text{Language}_c + \\
&\quad \beta_9^t \text{Legal}_c + \beta_{10}^t \text{Currency}_c + \beta_{11}^t \text{Landlocked}_c + \\
&\quad \beta_{12}^t \text{Colony}_c + \beta_{13}^t \text{TimeDiff}_c
\end{aligned}
$$

where ϕ_i^t are a set of firm fixed effects. It is worth discussing both the strengths and weaknesses of this approach. By including firm fixed effects we can control for a wide variety of producer characteristics that have been shown to be important in determining export participation, such as productivity, firm size, sector, and geographic location. Since each regression uses a cross section in each year, the effects of these characteristics are also allowed to differ between 1993 and 2006. At the same time, firm fixed effects preclude us from identifying the contribution that changes in firm characteristics had on the rise of US exporting. This leads us to focus on the contribution of developments in foreign markets. In particular, while they control non-parametrically for changes in the distribution of US firm productivity growth in the 1990s, we are unable to disentangle those effects from any other changes in firm characteristics. Our approach includes many of the factors that have been found to affect trade flows in the gravity equation literature. It does suffer, however, from some of the same limitations as these studies. In particular, there may be omitted factors for which we have not adequately controlled. As we model the choice of a individual firm to export to a particular country, however, the issue of reverse causality is not nearly as much of a concern as it may be in studies of the determinants of trade volume flows.

Table 8 presents regression results from several different specifications. One thing to note about our estimations is that the coefficients stay relatively stable over time. Two exceptions stand out, however. First, the marginal effect of free trade agreements is much higher in 1993 relative to 2006. This leads to a larger estimated contribution for these agreements than if we were to consider a different decomposition approach, such as using the coefficients from 2006 to weight the change in the number of trade agreements to which the US is party.

This difference in the coefficient estimates is likely due to several factors. In 1993, the US only had free trade agreements with two countries in our sample, Canada and Israel. These agreements had been signed several years earlier, in 1988 and 1985 respectively, and thus there was time for their effects to be fully felt by the beginning of our sample. In 2006, the

US had agreements with 9 additional countries in our sample (Australia, Costa Rica, Chile, The Dominican Republic, El Salvador, Guatemala, Honduras, Mexico, and Singapore). With the exception of Mexico, however, all of these agreements were signed in 2004 or afterward. Their full effects are thus unlikely to have been felt by the end of our sample in 2006. We do see, however, a noticeable acceleration of entry into many of these markets even ahead of the agreements, in contrast to the experience with Mexico and NAFTA. This may be due to different expectations about the probability of the agreements ultimately being ratified. The estimated effects for free trade agreements in 2006 are thus smaller than in 1993. The second main change in magnitude is the coefficient on the number of internet users. Between 1993 and 2006, the importance of the internet, increases. These changes could potentially reflect communication network effects, in which as the network grows its importance rises even faster. They could also indicate an increasing reliance on this new technology as it supplanted outdated modes of communication.

In looking at the decomposition results, we focus on how much each factor contributed to the overall change predicted by the observables. While serving as important controls in our estimations, the gravity variables such as distance and the indicator for colonial relationship play no role in these changes since they are held fixed through the estimations. We find that the development of the internet explains 47 percent of the increase predicted by the observables, free trade agreements explain 33 percent, changes in market size explain 17 percent, declines in tariffs explain 2 percent, and real exchange rates essentially none of the change. If we were to pursue the composition differently by weighting the changes in the observables by the estimated marginal effects in 2006 $\hat{\beta}^{06}$, the estimated impact of the development of the internet increases substantially, free trade agreements and foreign economic growth are still of significant importance, and the contribution of changes in overall tariffs and the real exchange rate are still small.

5 Conclusion

In this study we have documented a significant rise in exporting amongst US firms over 1987–2006. In looking at the reasons for these trends 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, free trade agreements, and the development of the internet in driving these changes.

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 also help us better understand the results presented above. Secondly, as firm level data becomes increasingly available further analyses on the experiences of firms in other countries would add greatly to our understanding of the growth of exporting worldwide. 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.

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

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

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

10. **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.

11. **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.

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

13. **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.

14. **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.

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

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

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

18. **Butler, J.S., and Robert Moffitt**. 1982. "A Computationally Efficient Quadrature Procedure for the One-Factor Multinomial Probit Model." *Econometrica* 50 (3): 761-764.

19. **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.

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

21. **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.

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

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

24. **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): 163-9.

25. **Disdier, Anne-Célia, and Keith Head**. 2008. "The Ouzzling Persistence of the Distance Effect on Bilateral Trade." *The Review of Economics and Statistics* 90 (1): 37-48.

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

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

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

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

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

31. **Feenstra, Robert C.** 2014. "Restoring the Product Variety and Pro-competitive Gains from Trade with Heterogeneous Firms and Bounded Productivity." NBER Working Paper 19833.

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

33. **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.

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

35. **Geweke, John**. 1991. "Efficient Simulation from the Multivariate Normal and Student-t Distributions Subject to Linear Constraints and the Evaluation of Constraint Probabilities." In *Computing Science and Statistics: Proceedings of the 23rd Symposium on the Interface*, 571-578. Fairfax, Virginia: Interface Foundation of North America, Inc.

36. **Hajivassiliou, Vassilis, Daniel McFadden, and Paul Ruud.** 1996. "Simulation of Multivariate Normal Rectangle Probabilities and their Derivatives Theoretical and Computational Results." *Journal of Econometrics* 72 (1): 85-134.

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

38. **Handley, Kyle, and Nuno Limao**. 2014. "Policy Uncertainty, Trade and Welfare: Theory and Evidence for China and the U.S." NBER Working Paper 19376.

39. **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.

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

41. **Head, Keith, and Thierry Mayer**. 2010. "Illusory Border Effects: Distance Mismeasurement Inflates Estimates of Home Bias in Trade." Center for Economic Policy Research Working Paper 2002-01.

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

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

44. **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.

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

46. **Hicks, John R**..1969. *A Theory of Economic History.* Oxford: Oxford University Press.

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

48. **Hyslop, Dean**. 1999. "State Dependence, Serial Correlation and Heterogeneity in Intertemporal Labor Force Participation of Married Women." *Econometrica* 67 (6): 1255-1294.

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

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

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

52. **Keane, Michael**. 1994. "A Computationally Practical Simulation Estimator for Panel Data." *Econometrica* 62 (1): 95-116.

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

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

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

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

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

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

62. **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.

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

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

65. **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 Countries that Contributed to the Rise in Exporting

Rank	Country	Percentage
1	Mexico	12.1
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 pairs with exports from 1993 to 2006.

Table 2: Probability of Exporting to a Given Country

Region	1993	2006	Employees	1987	2006
New England	5.6	8.4	20-49	1.4	2.6
Middle Atlantic	4.1	7.1	50-149	3.6	5.9
East North Central	4.1	6.4	150-249	7.5	10.7
West North Central	3.9	5.8	250-499	10.3	14.8
South Atlantic	3.2	4.9	500-999	15.6	22.9
East South Central	2.7	4.3	1000+	36.1	41.9
West South Central	3.2	4.6			
Mountain	3.5	4.7	Total	3.96	6.00
Pacific	4.5	6.4			
Total	3.96	6.00			

Notes: Estimations are for firms with 20 or more employees. Increases in exporting are found across regions as well as firm size categories.

Table 3: Percentage of Plants that Export by Industry and Region

Industry	1987	2006	Region	1987	2006
Food	15	30	New England	25	46
Beverage & Tobacco	45	30	Middle Atlantic	19	39
Textile Mill Products	16		East North Central	25	45
(Textile Mills)		47	West North Central	23	41
(Textile Product Mills)		35	South Atlantic	18	36
Apparel	5	19	East South Central	18	36
Wood products	12	19	West South Central	19	33
Furniture	10	20	Mountain	18	30
Paper	19	43	Pacific	21	36
Printing & Publishing	5	15			
Chemicals	40	63	Total	21	39
Petroleum & Coal	22	37			
Plastics & Rubber	26	51			
Leather	19	47			
Nonmetallic Minerals	14	17			
Primary Metals	27	56			
Fabricated Metals	21	32			
Machinery	33	62			
Electrical Equipment	37	65			
Instruments/Computer & Electronic Products	48	68			
Transportation Equipment	29	56			
Misc. Manufacturing	20	42			
Total	21	39			

Notes: The table lists the percentage of plants that export in each industry and region using the CMF in 1987 and the ASM in 2006. Due to concerns about disclosure, the industry results reported for 1987 are from Bernard and Jensen (2004b) and we report the results for 1987 in 2 digit 1987 SIC codes and the results for 2006 in 3 digit 2002 NAICS codes. These industry codes match well at this level of aggregation. Estimations are for plants with 20 or more employees. Increases ion exporting are found across industries as well as regions.

Table 4: Fixed Effects Estimations

	Specification		
Variable	Unaltered (1)	Baseline (2)	Additional Interactions (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***	0.140***	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)
Nonproduction/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
	(0.031)	(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 plant-specific characteristics not related to exporting are lagged by one period in all specifications. The coefficient on "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 $Post_{98}$. The results with *,**, and *** denote significance at the 10%, 5%, and 1% level respectively.

Table 5: Butler-Moffitt Estimations

	Specification			
	Early	Later	Early	Later
Variable	(1)	(2)	(3)	(4)
Exported last year	1.476	1.792	1.424	1.771
	(0.022)	(0.026)	(0.021)	(0.026)
Total Employment			0.152	0.139
			(0.023)	(0.028)
Wages			0.963	0.704
			(0.049)	(0.059)
Non-production/			-0.033	-0.250
Total Employment			(0.088)	(0.107)
Productivity			0.023	0.006
			(0.007)	(0.009)
Industry Exchange Rate			-0.738	-1.116
			(0.444)	(0.291)
$\rho = \sigma_\zeta^2/(\sigma_\zeta^2 + \sigma_\varepsilon^2)$	0.381	0.379	0.363	0.373
	(0.011)	(0.014)	(0.011)	(0.014)
Average Partial Effect	0.418	0.463	0.394	0.453

Notes: The table presents the results from estimating equation (4) in the text with the dynamic random effects estimator of Butler and Moffitt (1982). 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. Year effects are included in each specification. The coefficient on "Exported last year" is an increasing function of the costs of entering foreign markets anew F_0. The results with *,**, and *** denote significance at the 10%, 5%, and 1% level respectively.

Table 6: Simulated Maximum Likelihood Estimations

	Specification			
	Early	Later	Early	Later
Variable	(1)	(2)	(3)	(4)
Exported last year	2.020	2.129	1.912	2.111
	(0.028)	(0.034)	(0.027)	(0.035)
Total Employment			0.110	0.110
			(0.017)	(0.024)
Wages			0.663	0.544
			(0.038)	(0.049)
Non-production/			-0.093	-0.182
Total Employment			(0.067)	(0.090)
Productivity			0.015	0.003
			(0.006)	(0.007)
Industry Exchange Rate			-0.543	-0.904
			(0.327)	(0.250)
AR(1) Coefficient	-0.337	-0.229	-0.316	-0.226
	(0.011)	(0.015)	(0.012)	(0.016)
$\rho = \sigma_\zeta^2/(\sigma_\zeta^2 + \sigma_\varepsilon^2)$	0.190	0.277	0.210	0.266
	(0.016)	(0.020)	(0.015)	(0.019)
Average Partial Effect	0.619	0.586	0.574	0.578

Notes: The table presents the results from estimating equation (4) in the text with a simulated maximum likelihood estimator using the GHK algorithm. 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. Year effects are included in each specification. The coefficient on "Exported last year" is an increasing function of the costs of entering foreign markets anew F_0. The results with *,**, and *** denote significance at the 10%, 5%, and 1% level respectively.

Table 7: 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)	$\ln(\sigma_{\varepsilon 1}) \sim N(0, 2)$
$\sigma_{\varepsilon 2}$ (st. dev., ε_2)	$\ln(\sigma_{\varepsilon 2}) \sim N(0, 2)$
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. The same priors are used 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. The prior on the elasticity parameters are consistent with those found in the literature (e.g. Goldberg and Knetter 1999).

Table 8: Monte Carlo Markov Chain Estimations

	Panel	
Parameters for Each Industry	1987-1997	1995-2006
Preserved Fruits & Vegetables (SIC 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 (SIC 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 (SIC 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.

Table 9: Factors Affecting Export Participation

Variable	Mean 1993	Mean 2006
Internet Users (m)	0.08	16.18
Trade Agreement (pct)	4.00	22.00
Market Size (bn 2000 USD)	408.51	557.90
Tariffs (VAE)	13.69	7.37
Real Exchange Rate (NCU/USD)	241.87	257.53
Distance (thousands of km)	8.71	8.71
Contiguous (pct)	4.00	4.00
Common Language (pct)	22.00	22.00
Common Legal Origin (pct)	28.00	28.00
Common Currency (pct)	2.00	2.00
Landlocked (pct)	4.00	4.00
Colonial Relationship (pct)	8.00	8.00
Time Difference (hours)	6.93	6.93

Notes: The table gives summary statistics on the variables in our regressions that affected the rise in export participation in 1993 and 2006. The real exchange rate is calculated with respect to 2000 US dollars. For variables that are binary indicators, we list the percentage of the 50 countries in our sample for which they equal one.

Table 10: Blinder-Oaxaca Estimations

	Specification					
	(1)		(2)		(3)	
Variable	1993	2006	1993	2006	1993	2006
Internet Users					0.28***	0.89***
					(0.005)	(0.021)
Trade Agreement					7.00***	2.10***
					(0.066)	(0.036)
Market Size	1.89***	2.53***	1.59***	2.02***	1.25***	1.56***
	(0.013)	(0.016)	(0.013)	(0.017)	(0.012)	(0.027)
Tariffs	-3.19***	-7.29***	-4.31***	-1.16***	-1.15***	-1.33***
	(0.076)	(0.169)	(0.077)	(0.146)	(0.075)	(0.158)
Real Exchange Rate	-0.40***	-0.38***	-0.03***	-0.02***	-0.08***	-0.10***
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Distance	-3.62***	-4.15***	-2.96***	-2.62***	-1.51***	-1.91***
	(0.026)	(0.032)	(0.028)	(0.033)	(0.033)	(0.046)
Contiguity			7.52***	11.74***	5.33***	10.12***
			(0.081)	(0.109)	(0.076)	(0.109)
Common Language			2.50***	2.59***	0.67***	2.12***
			(0.029)	(0.038)	(0.028)	(0.039)
Common Legal Origin			2.19***	2.14***	2.14***	2.30***
			(0.026)	(0.034)	(0.027)	(0.035)
Common Currency			1.19***	1.83***	1.69***	3.12***
			(0.036)	(0.050)	(0.038)	(0.059)
Landlocked			-0.38***	-1.05***	-0.60***	-0.25***
			(0.036)	(0.045)	(0.036)	(0.044)
Colonial Relationship			0.04	-0.22***	1.03***	0.13***
			(0.033)	(0.041)	(0.034)	(0.042)
Time Difference					-0.21***	-0.09***
					(0.005)	(0.007)

Notes: The table presents the results from estimating equation (4) in the text. All estimations include firm fixed effecst. There are 4,085,000 observations and 81,700 firms in 1993 and 3,665,000 observations and 73,300 firms in 2006 (both rounded to the closest 100 for the purposes of disclosure). The dependent variable is a 0/1 indicator for a firm's export status to a given country in the specified year y_{ic}^t. Standard errors are clustered at the firm level. The results with *,** , and *** denote significance at the 10%, 5%, and 1% level respectively.

Fig. 1: Export Participation Across Countries

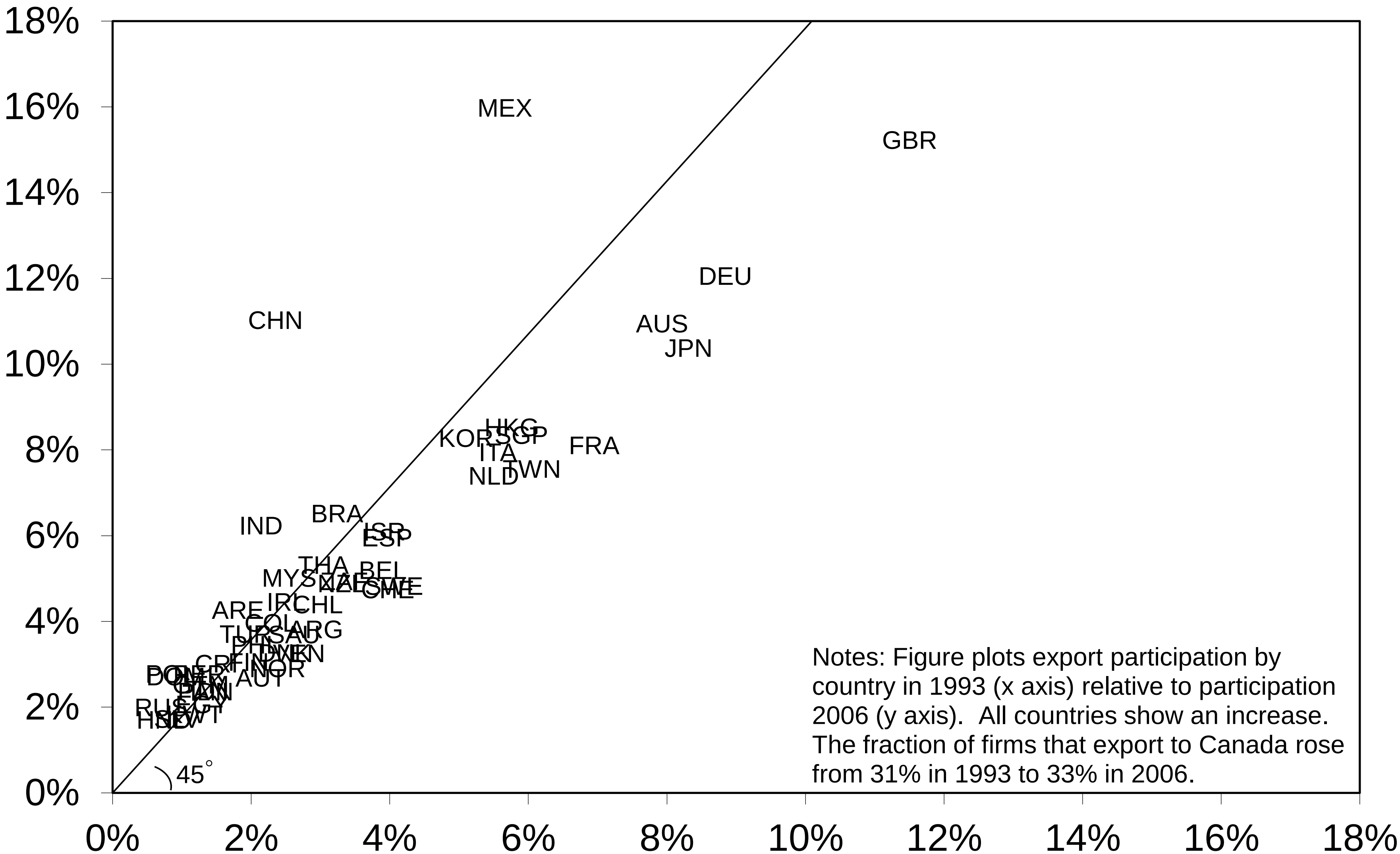

Fig. 2: Industry Decomposition

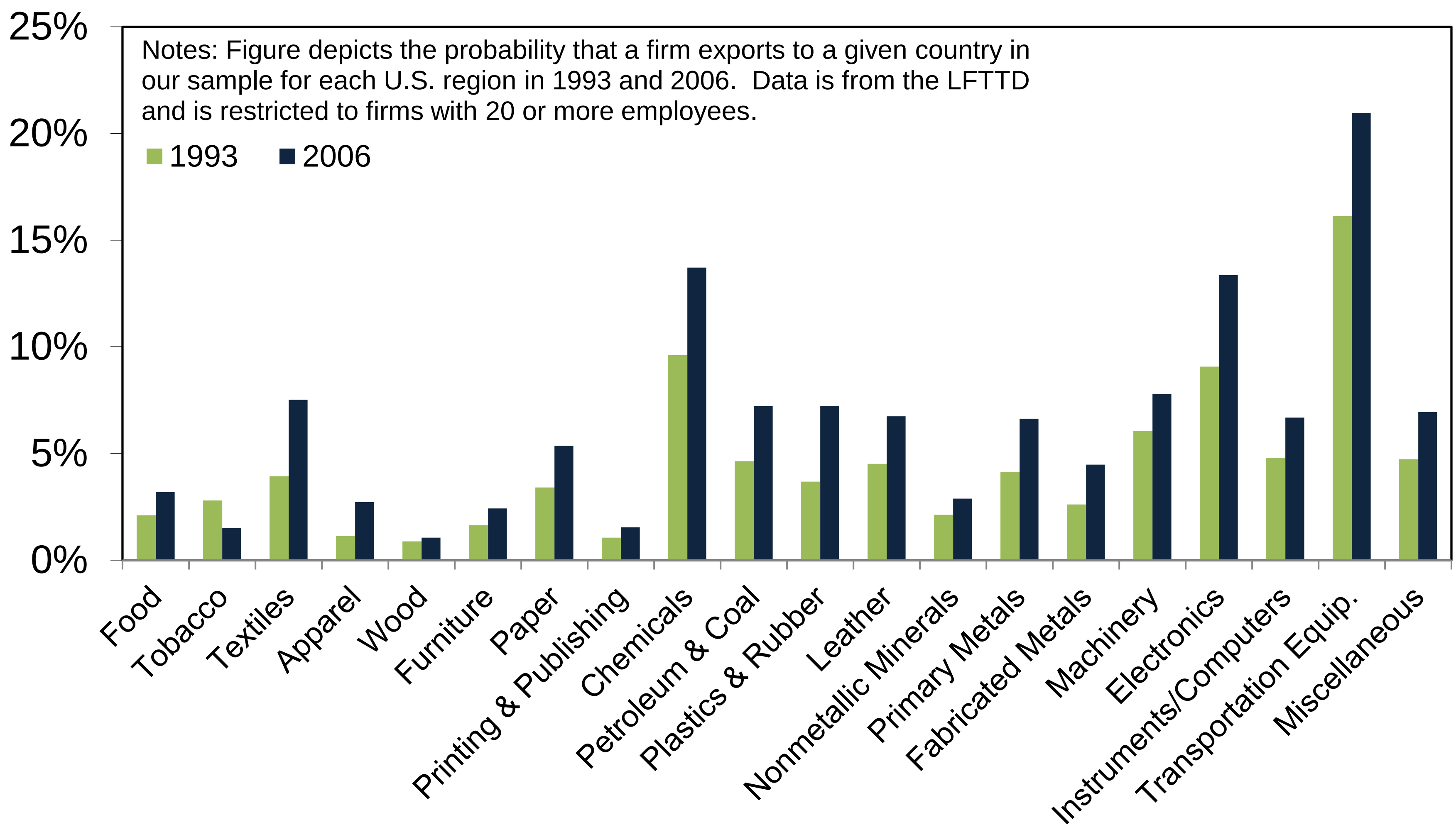

Fig. 3: Percentage of US Manufacturing Plants That Export

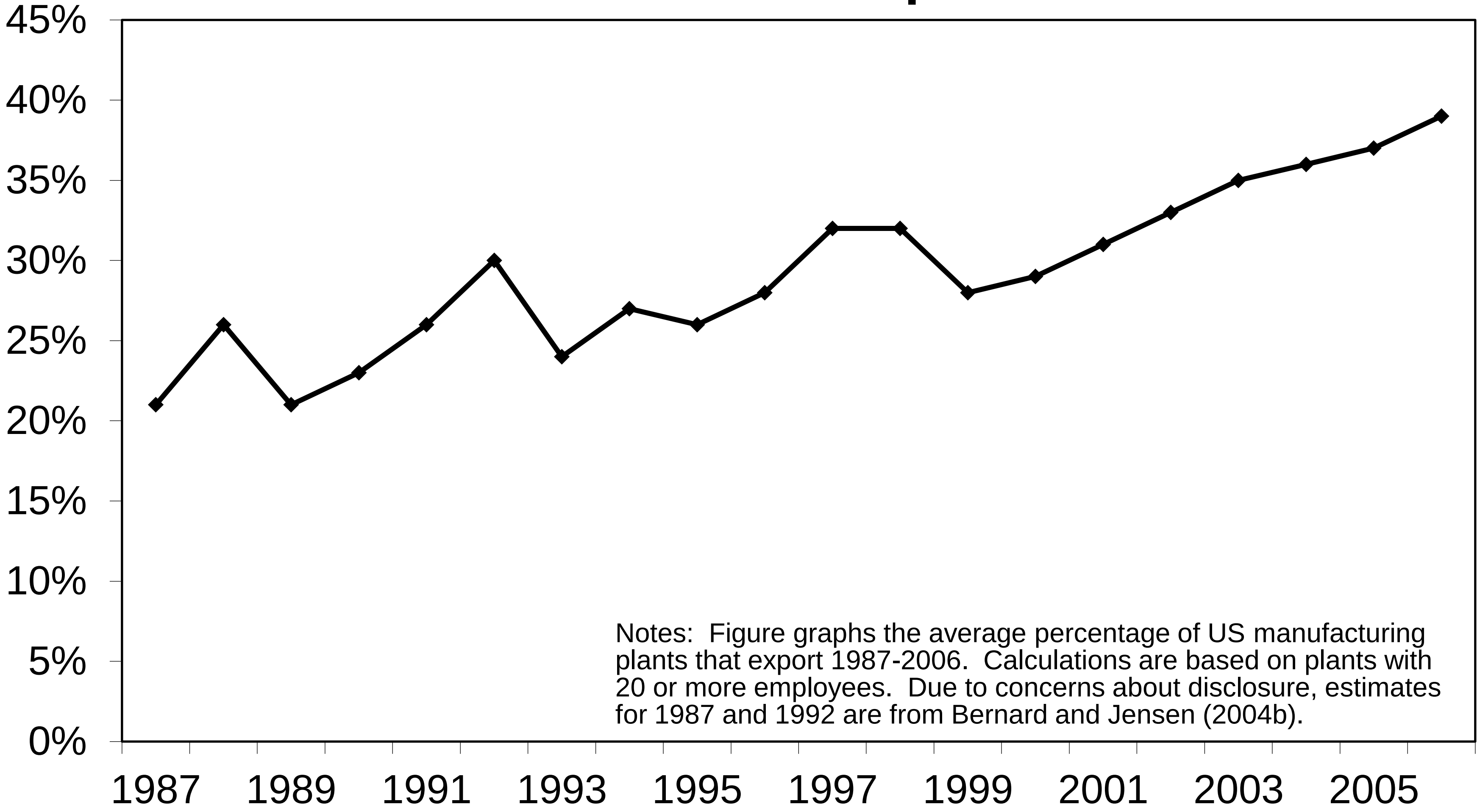

Fig. 4: Changes in Barriers to Entry

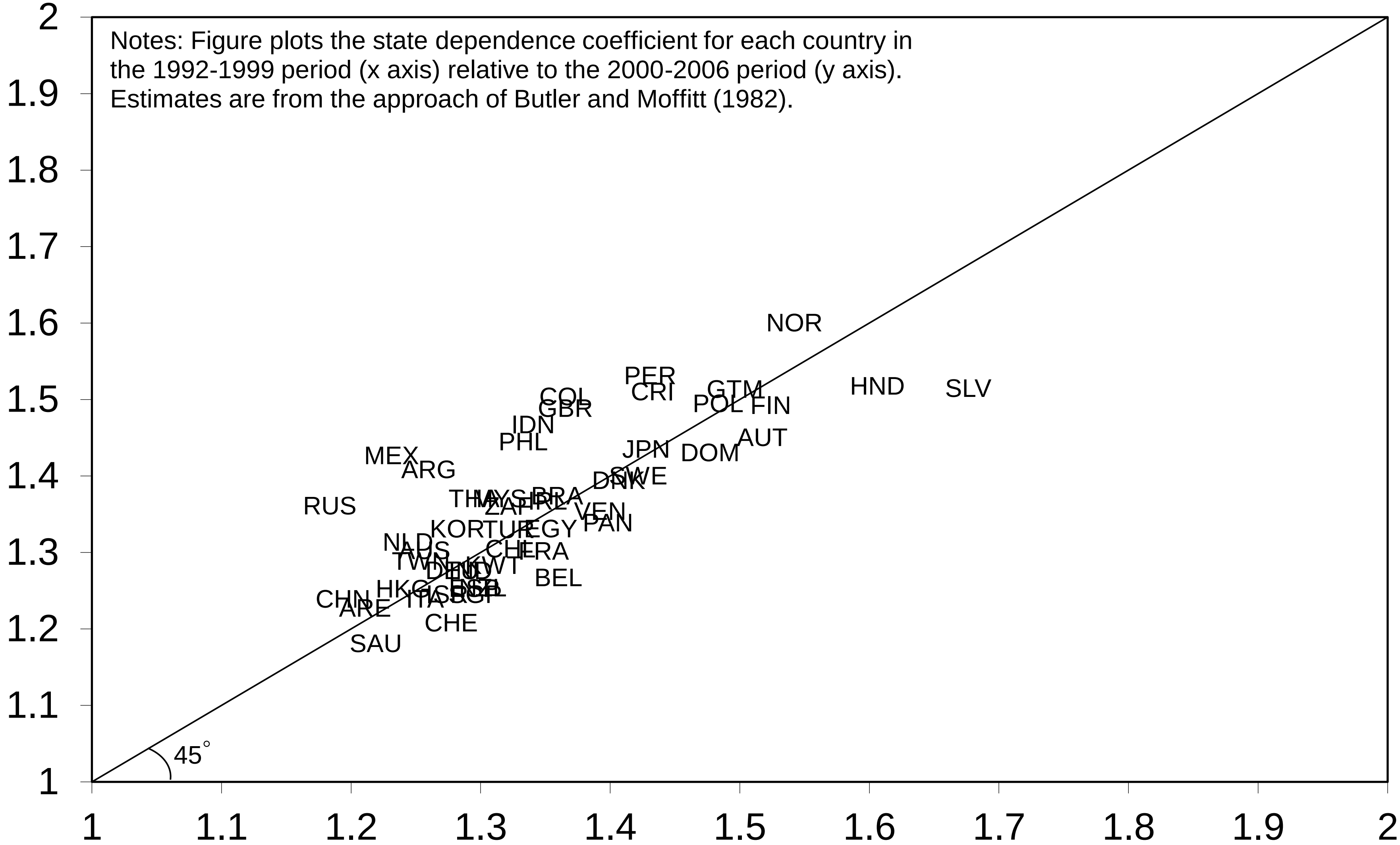

Fig. 5: Number of Firms Exporting To Mexico

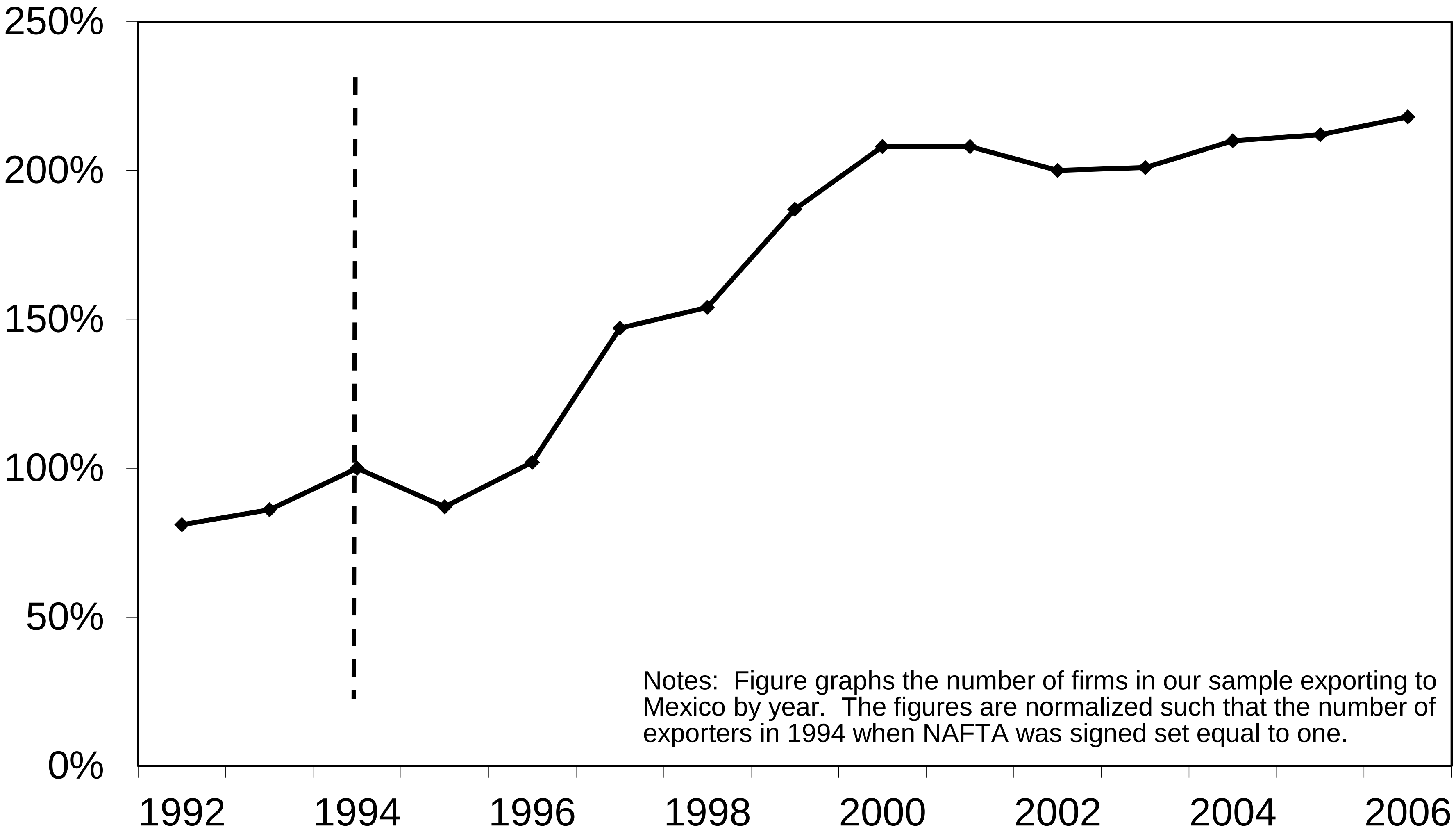

Fig. 6: Market Size and the Rise of Exporting

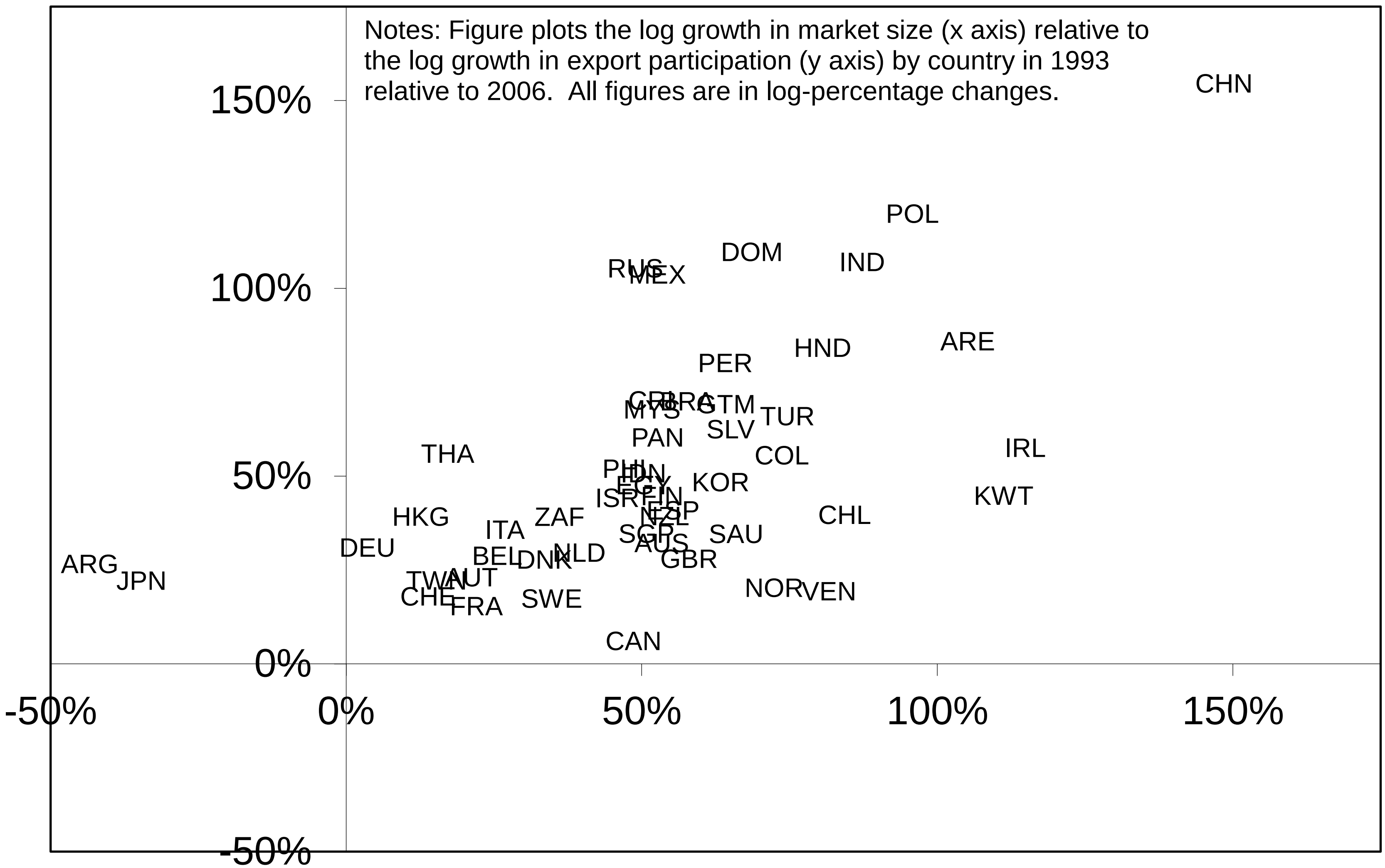

Fig. 7: Internet Use and the Rise of Exporting