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# Export growth and firm survival☆

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## HIGHLIGHTS

- Effect of change in aggregate exports on survival probability.
- Plant-level data from Chile are used.
- Increase in aggregate exports decreases the probability of survival of exporters.
- Increase in aggregate exports does not affect the probability of survival of non-exporters.
- This result may be due to the fact that exporters and non-exporters use factors of production in different proportions.

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## ABSTRACT

This paper uses plant-level data from Chile to show that an increase in sector-wide exports decreases the survival probability of exporters, but not that of non-exporters. We argue that this result can be explained by the fact that exporters and non-exporters use factors of production in different intensities.



## 1. Introduction

Trade models with firm heterogeneity in total factor productivity (TFP) predict that trade liberalization forces the least productive non-exporters to exit the market. This follows from the assumption that there is only one factor of production (e.g., Melitz, 2003), or that all firms in a sector produce with the same factor intensities (e.g., Bernard et al., 2007). Thus, rising factor market competition due to trade liberalization increases per-unit costs of all firms by the same proportion, and the sector's least productive firms cease production.

At the same time, empirical evidence suggests that exporters are also more skilled labor intensive than non-exporters even within narrowly defined sectors (e.g., Bernard and Jensen, 1999). In addition, exporters tend to produce a higher quality version of their good for exports, at least in developing countries.[1] More recent

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[1] See Keesing and Lall (1992) and Hallak and Sivadasan (2011) for firm-level evidence and Schott (2004) for sector-level evidence. Fajgelbaum et al. (2011),

contributions build on this evidence and allow also for heterogeneity in factor intensities (Harrigan and Resheff, 2011; Vannoorenberghe, 2011). Still, by assuming that skill intensity and TFP are strongly positively correlated, the theoretical predictions of these models concerning firm selection closely resemble those of Melitz (2003). Emami Namini et al. (2012) consider instead a more general setting in which heterogeneity in TFP and in factor intensities are not necessarily correlated, and can thus separately highlight the effects of the latter on the firm selection process that follows a trade liberalization. Importantly, they show that rising sector-wide exports increase competition for those factors (e.g., skilled labor), which are used intensively by exporters, negatively affecting their profits. For some of the exporters this effect may completely offset the benefits of serving a foreign market, and if the exported (high quality) version of their good cannot be sold domestically at a profit, some of them are forced to exit. The survival of non-exporters, which produce with different factor intensities, is instead unaffected.

The goal of this paper is to empirically assess the role of heterogeneity in factor intensities on firm survival. To this end we use data from Chile covering the years 1990–1999, a period during which the country signed several free trade agreements, which significantly reduced the trade barriers faced by Chilean exporters.[2]

## 2. Data and methodology

The manufacturing plant-level data come from the Annual Survey of Manufacturing Industries carried out by the National Institute of Statistics of Chile and cover the universe of manufacturing plants with 10 or more workers for the period 1990–1999. The data set includes information on sales, value added, employment, wages, exports, imports of intermediate inputs, industry affiliation (ISIC Rev. 2), and other plants' characteristics. Each plant has a unique identifier which allows us to track plant exit. Table 1 shows the number of plants, exporters and non-exporters in the data set. Table 2 presents descriptive statistics for exporters, non-exporters and the entire sample and simple correlation coefficients among the variables of interest. Exporting plants are larger and more productive,[3] are more likely to use imported intermediate inputs and to be foreign owned. Importantly, they are also more skill intensive than non-exporters,[4] and as argued by Schott (2004) this is likely to be due to the fact that exporters tend to sell higher quality products than their non-exporting counterparts.[5]

To analyze how export growth affects survival we estimate the following probit model:

$$\Pr(S_{ij,t+\tau}=1) = \Phi\left[\beta_1 \log(\mathrm{Exp}_{jt}) + \beta_2 \log(\mathrm{Exp}_{jt}) \times X_{ij,t} + \lambda' \Omega_{ijt} + \delta_j + \delta_t\right], \quad (1)$$

**Table 1**
Number of plants by export status.

| | Exporters | Non-exporters | Total | % of exporters |
|---|---|---|---|---|
| 1990 | 708 | 3202 | 3910 | 18.1 |
| 1991 | 857 | 3243 | 4100 | 20.9 |
| 1992 | 920 | 3348 | 4268 | 21.6 |
| 1993 | 1007 | 3397 | 4404 | 22.9 |
| 1994 | 1054 | 3388 | 4442 | 23.7 |
| 1995 | 1071 | 3367 | 4438 | 24.1 |
| 1996 | 1060 | 3346 | 4406 | 24.1 |
| 1997 | 970 | 2821 | 3791 | 25.6 |
| 1998 | 911 | 2647 | 3558 | 25.6 |
| 1999 | 774 | 2384 | 3158 | 24.5 |
| Average 1990–99 | 933 | 3114 | 4048 | 23.1 |

where $S_{ij,t+\tau}$ is equal to 1 if plant $i$ from sector $j$ survived between year $t$ and year $t+\tau$. $\Phi$ is the standard normal distribution function, $\mathrm{Exp}_{jt}$ measures the exports of sector $j$ in year $t$ and $X_{ij,t}$ is a dummy variable which equals one if plant $i$ exported in year $t$.[6] $\Omega_{ijt}$ is a vector of plant characteristics that includes size (log of employment), TFP (in logs), age (in logs), skill intensity (the share of skilled labor wages in the total wage bill), and dummy variables for plants that import intermediate inputs, have foreign ownership, and those that use foreign technology licenses.[7] $\delta_t$ is a year fixed effect that controls for unobserved heterogeneity over time, and $\delta_j$ is a 3-digit sector fixed effect that is included in some specifications to control for unobserved heterogeneity at the sector level. All specifications include a measure of multinational corporations' presence (the share of foreign-owned plants in value added in each sector and year).[8] Some specifications also include a measure of the size of the sector (either total employment or total value added) to control for the potential effect of market competition on survival, and the Herfindahl index to control for the role of market concentration.

A negative sign for $\beta_2$ would suggest that an exporter is less likely to survive $\tau$ periods ahead if sector-wide exports increase. The analysis focuses on three-year survival rates ($\tau = 3$), but we have also considered one- and five-year survival rates obtaining similar results.

## 3. Empirical analysis

Table 3 presents the results of estimating Eq. (1). We start by including only year fixed effects in columns (1)–(4), and thus exploit the variation across sectors. In columns (5)–(8) we introduce sector fixed effects. Our results are remarkably robust across specifications. Consistent with previous studies,[9] larger, older, more productive plants, those that use imported intermediate inputs and those who use foreign technology licenses are more likely to survive. Plants with foreign ownership are more likely to exit, consistent with the findings of Alvarez and Görg (2009). As in Bernard et al. (2006), skill intensity is negatively correlated with plant survival. The proxy for the presence of multinational corporations in the sector has a positive significant effect only in the specifications without sector fixed effects. Market size does not appear to have an independent effect on survival. Columns (4) and (8) include also

Hallak and Sivadasan (2011) and Kugler and Verhoogen (2012) also develop theoretical models that can rationalize this choice.

2 During the 1990s Chile signed free trade agreements with Canada, Central America, Mercosur and Mexico. It also signed partial free trade agreements with Argentina, Bolivia, Colombia, Ecuador and Venezuela.

3 We measure TFP as the residual of a regression that estimates a Cobb–Douglas production function for each 3-digit sector using the method proposed by Olley and Pakes (1996) and later modified by Levinsohn and Petrin (2003), which corrects for the simultaneity bias associated with the fact that productivity is not observed by the econometrician, but it may be observed by the firm. In some cases, the production functions were estimated at the 2-digit level due to the small number of observations for some sectors at the 3-digit level of disaggregation. We estimated the production function separately for exporters and non-exporters to account for the fact that these two types of firms may produce with different factor intensities.

4 Notice that, while there is substantial heterogeneity in skill-intensity among exporting firms, both those exporters that survive and those that do not are significantly more skilled labor intensive than non-exporters. These statistics are available on request.

5 Kugler and Verhoogen (2012) point also to a quality story providing evidence that exporting firms tend to purchase higher quality intermediate goods, which are used to produce higher quality final products.

6 Since the manufacturing data set includes only plants with at least 10 workers, we use customs data to measure the exports of each sector. Using export data reported by the plants leads to virtually identical results.

7 We have included foreign ownership as a control variable since it is typically found to impact a single plant's survival probability; see, e.g., Bernard and Jensen (2007) or Alvarez and Görg (2009).

8 As a robustness check, the analysis also uses inflows of FDI at the 2-digit level. The results are not significantly affected when this alternative measure is used.

9 E.g., Dunne et al. (1989), Salvanes and Tveteras (2004) and López (2006).