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# Dynamics of export market entry and exit

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# Dynamics of export market entry and exit\*

## Abstract

We examine the process of internationalisation of firms, contributing to the knowledge on the factors behind a successful entry and operation in the export markets using duration analysis. Rich longitudinal micro-level data on Finnish manufacturing plants allow an in-depth analysis of the life cycle of exporting plants over a time span of up to 25 years. In the first part of the analysis, we focus on the factors that explain the duration of time until entering plants start to export. The second part of the study concentrates on the duration of time until exit from the export markets. Our special focus is on the effects of foreign ownership, human capital and industry spillovers on export market entry and exit.

**JEL Classification:** F14, F23, L25.

**Keywords:** exports, foreign ownership, productivity, human capital, duration analysis.

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## 1. Introduction

Recent decades of rapid globalisation and technological change have increased the need for a deeper understanding of the process of internationalisation. Export markets offer firms with growth potential an important channel for expansion. In the face of increasing competition, further pressure is put to firm productivity and efficient use of resources. According to recent heterogeneous firm trade models<sup>1</sup>, the exposure to trade may enhance the growth opportunities of some firms, while simultaneously contributing to the downsizing of other firms in the same industry. Differences in the firms' reactions may be explained by the differences in the underlying characteristics of the firms.

Melitz (2003) develops a dynamic industry model with heterogeneous firms and monopolistic competition. The model includes sunk costs related both to entering the industry and to entering the export market. Through higher profit opportunities and increased entry, exposure to trade increases the efficiency (or productivity) thresholds required for exporting and surviving, thus forcing the least efficient firms to exit. The export market selection effect and the domestic market selection effect both lead to the reallocation of market shares towards the more efficient firms increasing the average productivity in the industry.

Following increased availability of firm- and plant-level data sets, there has been an upsurge in empirical analyses of exporting that partly predates the theoretical work.<sup>2</sup> The key issue has been the connection of exporting and firm performance and related to this, the determinants of entry and exit in export markets. The motivation for most of the studies has been to examine whether high-productivity firms are selected to exporting or whether there is learning-by-exporting, i.e. exporting leads to higher productivity<sup>3</sup>. They have found that exporters tend to be larger, more productive, and more capital- and technology-intensive. Furthermore, they pay higher wages and supply products of higher quality.

However, the direction of causality between exporting and good performance is less clear. There is evidence that good plants have a higher probability of becoming exporters. Most of the evidence supports the selectivity view of exports rather than learning-by-exporting, as

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<sup>1</sup> E.g. Bernard et al. (2003), Melitz (2003), Yeaple (2005), Bernard, Redding, and Schott (2007).

<sup>2</sup> For example, Wagner (2007) summarizes evidence from 45 different studies on exporting and productivity.

<sup>3</sup> See e.g. Greenaway and Kneller (2007a), Lopez (2005), Tybout (2003), and Wagner (2007), for surveys of the issues.

exporting shows little evidence of boosting firm productivity. In some studies, however, support is found for the learning effects.<sup>4</sup> Bernard and Jensen (1999) also find that exporting has positive effects on the probability of survival and employment growth.

Importantly, there is much persistence in exporting. Many studies have found that sunk entry costs and prior export experience are important in explaining plant's exporting status (e.g., Das et al., 2007; Roberts & Tybout, 1997). Being an exporter in the previous period has typically a statistically and economically highly significant effect on the probability of currently being an exporter.

The pre-export development of firms has not received as much attention as export entry. Bernard and Jensen (1999) find that in the years preceding entry into export markets the growth rates of employment and shipments of future exporters are higher than those of non-exporters. Lopez (2005) reviews evidence of conscious self-selection to exporting, which can take place through investments in new technology or R&D. In Alvarez and Lopez (2005) this is tested by explaining the probability of a plant to start exporting (given that it did not export in the previous year) by lagged investments. In another kind of analysis of the pre-export phase Fafchamps et al. (2007) test two alternative models of learning to export, productivity learning and market learning, using duration analysis. They find evidence on market learning, whereby firms learn to design products that appeal to foreign consumers.

The purpose of this paper is to contribute to the knowledge on the factors behind a successful entry and operation in the export markets by analysing how long it takes for new plants to start exporting and for how long exporting lasts once it has started. Our approach contrasts with the earlier studies on export entry and exit, which have examined switches between exporting and non-exporting, but not the determinants of the length of exporting spells. Rich longitudinal micro-level data on Finnish firms and plants allow an in-depth analysis of the life cycle of exporting plants over a time span of up to 25 years. The Finnish economy has undergone dramatic changes during this period, including a period of deep recession at the

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<sup>4</sup> Greenaway & Kneller (2007b) find that industry differences are important in determining whether learning by exporting plays a central role in productivity development. Some studies have also found export learning in young plants or during the first years of export activity (Lopez, 2005). Girma et al. (2004) find, using matching techniques, support both for the selectivity effects and for a further boost to productivity from exports. The work on export exit by Girma et al. (2003), on the other hand, shows that export exits may have short-run negative productivity effects, but longer-run negative effects on output and employment.

beginning of 1990s and profound plant- and sector-level structural changes in the business sector. Furthermore, the competitive environment has changed considerably due to the liberalisation of financial markets and international trade, as well as the EU membership in 1995. In this changing business environment, we are able to shed light on questions concerning the background characteristics of those plants that export, the timing of start-up in export markets and the duration of exporting. Unique linked employer-employee data allow us to include information on the employees of each plant in the analysis to account for human capital. Furthermore, we are able to study the effects of foreign ownership and the spillover effects from other exporting plants.

We will proceed as follows. In Section 2 of the paper we explain our econometric approach and in Section 3 the data set that we are using. Section 4 presents results on export market entry and exit. Section 5 concludes the paper.

## **2. The econometric approach**

Most of the studies that analyse export market participation model this as a discrete choice. A firm exports in period  $t$  if the expected benefits from exporting exceed the sunk entry cost, which are incurred if the firm does not export in  $t-1$ . Similarly, the firm does not export in period  $t$  if the expected benefits are too low, taking into account exit cost which is incurred if the firm exports in  $t-1$ . In this kind of studies the interest is in the sequence of 1's (exports) and 0's (does not export) for the firms in the data set. Since structural modelling of the dynamic decision problem is fairly complicated, the studies (except for Das et al., 2007) use a reduced form approach. They either estimate the participation using probit with random effects to account for firm-specific time-invariant differences in the propensity to export (e.g. Roberts and Tybout, 1997), or model the participation decision jointly with a (continuous) productivity equation (e.g. Clerides, Lach, and Tybout, 1998)<sup>5</sup>. Since there is state dependence, i.e. export participation depends on past export status, these studies pay attention to the initial condition by also modelling the probability of exporting in the initial year of the panel. A simpler approach, taken by Bernard and Jensen (1999, 2004) is to use a linear

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<sup>5</sup> For other examples and variants of the analysis, see van Biesebroeck (2005) and Campa (2004), among others.

probability model with differencing to remove individual effects and GMM estimation to account for the lagged dependent variable.

The export market entry and exit studies essentially take a stock sample of existing plants or firms and study their subsequent entry and exit behaviour. We take a different approach: we use flow data of plants that enter our data set (as explained below, entry is defined as passing a lower size limit) and then model the duration until they start to export for the first time. Then, using data on plants that start exporting, we model the duration of export activity until exit from the export market. The only other study that we are aware of which uses duration analysis for analysing exports is Fafchamps et al. (2007). They have data on separate products and they study the duration until start of exporting for new products, given the possible previous export experience for other products. They do not model the duration from the birth of the firm until first export activity, but simply regress the share of production that goes to exports on firm age.<sup>6</sup>

Following the earlier literature (Roberts and Tybout, 1997, Clerides et al., 1998), the plant chooses a sequence of export market participation decisions. In period  $t$  the exporting profits are

$$\pi_t \mathbf{1}(X_t > 0) - F_{EN} \mathbf{1}(X_t > 0) \mathbf{1}(X_{t-1} = 0) - F_{EX} \mathbf{1}(X_t = 0) \mathbf{1}(X_{t-1} > 0) \quad (1)$$

where  $\pi_t$  measures the difference in profits when the plant exports compared to the situation that it does not export,  $F_{EN}$  and  $F_{EX}$  are export entry and exit costs, respectively,  $X_t$  is exports, and  $\mathbf{1}(\cdot)$  is an indicator function. To simplify things, we assume that past export history does not matter beyond period  $t-1$ . Following from Bellman's equation (Roberts and Tybout, 1997) the plant will export in period  $t$  if

$$\pi_t + \delta [E_t(V_{t+1} | X_t > 0) - E_t(V_{t+1} | X_t = 0)] \geq F_{EN} - (F_{EN} + F_{EX}) \mathbf{1}(X_{t-1} > 0) \quad (2)$$

where  $V_{t+1}$  is the maximized expected present value of future payoffs and  $\delta$  is the discount rate. Our emphasis is in the first decision to start exporting and hence the plant has no export history, i.e.  $X_{t-1} = 0$ . In the first period  $t^*$  when export is observed it therefore has to hold that

$$\pi_{t^*} + \delta [E_{t^*}(V_{t^*+1} | X_{t^*} > 0) - E_{t^*}(V_{t^*+1} | X_{t^*} = 0)] \geq F_{EN} \quad (3)$$

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<sup>6</sup> Besedeš and Prusa (2006a,b) have examined the duration of imports to the U.S., and hence indirectly the duration of exports of other countries. However, their analysis deals with products by country of origin, and not with plants or firms.

In the extreme case, of course, a plant enters and starts to export in the same period. The purpose of our analysis is to model  $t^*$ , the duration from entry at time  $t=1$  until exporting starts.

Once the plant has entered the export market, it will exit in period  $t^{**}$  if the condition

$$\pi_{t^{**}} + \delta [E_{t^{**}}(V_{t^{**}+1} | X_{t^{**}} > 0) - E_{t^{**}}(V_{t^{**}+1} | X_{t^{**}} = 0)] < -F_{EX} \quad (4)$$

holds, i.e. if the losses from staying in the export market exceed the exit cost. The analysis of duration of export activity starts from the period  $t^*$  when the plant enters the export market ((3) holds for the first time). The firms can then either continue exporting or exit at period  $t^{**}$  when (4) holds for the first time after  $t^*$ . The exit can take the form of either exit only from exports but continued activity in the home market, or complete shutdown of activities.

To illustrate the process leading to exports, we can make specific assumptions about revenues and costs. At time  $t=1$  the plant enters, after which there is in each time period learning which leads to lowering of production costs. If the firm enters the export market, it sells  $D_t$  domestically and exports  $X_t$ , and receives corresponding revenues  $R^D(D_t, z_t^D, t)$  and  $R^X(X_t, z_t^D, t)$ .  $z_t^D$  includes demand shift factors, e.g. business cycle variables, that affect the revenues. Time  $t$  is included in export revenues to describe “demand learning” through which revenues increase over time. For example, through learning the plant may get a better price for its product in the export market. The rate of learning can be assumed to depend on the firm’s policies, including investments in physical and human capital. The cost function is  $C(X_t + D_t, z_t^C, t)$ , where  $z_t^C$  includes cost shift factors, e.g. shocks to input prices. Time  $t$  is included in the cost function to account for “production learning” through which costs decrease over time. For example, the costs can decrease over time according to  $C(., t) = c.(1 + \delta e^{-\eta})$ . This implies that the firm enters with costs  $c.(1 + \delta)$  and over time the costs fall to  $c(.)$ . Again, the rate of this learning may depend on the firm’s own efforts.

The plant’s profits with exports are

$$\pi_t^X = R^X(X_t, z_t^X, t) + R^D(D_t, z_t^D) - C(X_t + D_t, z_t^C, t) \quad (5)$$

and without exports the profits are

$$\pi_t^D = R^D(D_t', z_t^D) - C(D_t', z_t^C, t) \quad (6)$$

Where  $D_t'$  denotes domestic sales when there is no exporting. It follows that the profit difference between exporting and not exporting is



$$\pi_t = R^X(X_t, z_t^X, t) + R^D(D_t, z_t^D) - R^D(D_t', z_t^D) + C(D_t', z_t^C, t) - C(X_t + D_t, z_t^C, t) \quad (7)$$

The attractiveness of both exporting and producing to the home market, compared to only domestic sales depends on the domestic and export revenues, economies of scale in production, and the state of the learning processes. The plant can start with a low value of (7) (and the present value of future profits  $V$ ), but over time exporting becomes more profitable through the learning effects and/or there are favourable shocks to demand or costs.<sup>7</sup> The plant will start exporting at time  $t^*$  when condition (3) holds for the first time. It is also possible to influence the timing of entry into export market (i.e. to engage in conscious self-selection to exporting), for example by investing in human capital of the employees. Exit from the export market may result from unfavourable shocks to export revenues or costs, especially when combined with possible slowing down of the rate of learning.

In the econometric analysis we approximate the equations (3) and (4) by linear functions of the explanatory variables. A discrete-time model of export duration is preferred because the annual nature of the data causes interval-censoring. A flexible, non-parametric specification of the baseline hazard is used in the estimation. This means including duration dummies for each interval in the estimation. We use a discrete-time proportional hazard duration model, where the discrete interval hazard rate follows a complementary log-log distribution (e.g. Prentice and Gloeckler, 1978):

$$h_{it} = \text{prob}(T_i < t+1 | T_i \geq t) = 1 - \exp[-\exp(\beta' x_{it} + \gamma_t)] \quad (8)$$

where  $\gamma_t$  is the baseline hazard.  $T_i$  refers here to  $t^*$  in case of duration until exporting and to  $t^{**}$  in case of duration until exit. This specification also allows us to control for plant-level unobserved heterogeneity. To account for unobserved heterogeneity, we include normally distributed random effects in the model

$$h_{it} = 1 - \exp[-\exp(\beta' x_{it} + \gamma_t + v_i)] \quad (9)$$

where  $v_i \sim N(0, \sigma_v^2)$  are the unobserved individual effects.

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<sup>7</sup> Positive domestic demand shocks may make exports relatively less profitable.

### 3. The data

Our data are from various registers maintained by Statistics Finland. The primary data source is a panel data on manufacturing plants based on the Longitudinal Data of Plants in Manufacturing (LDPM), which is available for the period 1974-2005. The LDPM data include information, for example, on plant-level employment, working hours, value added, production, exports, foreign ownership, investments, capital stock and wages. In addition, there is information on industry and region of the plant and the number of plants in the firm. The age information of the plant can be supplemented from the Business Register. There is a break in the LDPM data set between the years 1994-1995, when size threshold for plants increased from 5 to 20 persons (actually, plants belonging to firms with at least 20 employees). Our estimation sample consists of manufacturing plants that reach the 20 employees threshold for the first time during the period 1980-2005. In fact, this group may include both new and continuing establishments that have already been in operation with less than 20 employees. As a result, it is important to control for the age of these plants. In the duration analysis we pool multiple cohorts of new plants over the period 1980-2005.

The Foreign Affiliates Statistics (FATS) 1994-2005 data include information on the ultimate beneficiary owner (UBO) of the plant, including the share of foreign ownership. The Group Register 1995-2005 includes further information on the links between multinational group parents and their daughters. However, there are some problems in the comparability and quality of these data sets. The Finnish Longitudinal Employer-Employee Data (FLEED) 1988-2004 include background information on employees of each plant, which makes it possible to construct variables that describe average characteristics of employees, including education, age, work experience, share of women, etc.

In the first part of the analysis, we focus on the factors that explain the duration of time until these plants start to export. We use 26 cohorts of plants from the years 1980-2005. When the human capital variables are included, the data period is shorter, 1988-2004. An entry event is recorded when the plant has positive exports for the first time after “birth” (as defined by the size threshold). If the plant does not start to export, it becomes censored at the end of the spell. To take into account missing observations, we allow for one-year absence from the

data. A longer absence is considered as “death”. We concentrate on the first spells and do not include a plant again once it has exited the export market for the first time.

The second part of the study concentrates on what happens to the exporters. We follow plants that both start exporting and have at least 20 employees for the first time after 1974, using the 26 cohorts 1980-2005 and controlling for plant age. When the human capital variables are included, the data period is 1988-2004. An exit event is recorded when the plant no longer has positive exports or has less than 20 employees. All observations for the year 2005 are censored, since we do not know what happens to the plants after that year. Again, we allow for one year absence from the export market, but a longer absence is considered as export market exit.

We have several explanatory variables for export entry and exit. To some extent the variables are similar to those used in binary choice export models, but we can exploit the rich employer-employee data set to form variables that describe human capital in the plants.

Plant size accounts for scale effects. For example, Wagner (1995) has found that the impact of firm size on exports is positive but decreasing. We measure plant size by the logarithm of the number of employees. Plant age is an important control variable. Unfortunately, reliable continuous plant age information is only available in the LDPM data from 1975 onwards, whereas for older plants it has to be supplemented from the Business Register, where the quality is not comparable. As an alternative we are able to divide plants into age groups based on ordered plant coding, which is our preferred measure for plant age.

Most of the studies on exporting emphasise the connection to productivity. Since we are concerned with the phase preceding export market entry, our productivity effects are selectivity effects. In the exit models we do not have non-exporters, so there we do not distinguish between higher productivity already before the entry into exports and higher productivity gained during exporting. We measure productivity by the logarithm of value added per hours worked.

Capital intensive plants are likely to have scale economies, which encourage entry into export markets. They may also be less inclined to exit. We measure capital intensity by the logarithm

of capital-labour ratio. Similarly, higher ratio of investments per output may indicate a higher ability to export.

Price-cost margin measures current profitability. Plants with higher profitability without exports are more likely to reach condition (3) early on and exporting plants with high profitability are less likely to face the exit condition (4).<sup>8</sup>

The literature on foreign direct investment emphasises the advantages of multinationals, which may be based on firm-specific assets or joint inputs that can be flexibly used within the firm in different locations, scale effects, or better access to technology. This may be reflected also in the export behaviour of foreign-owned plants. We therefore include an indicator for foreign ownership, which is based on the share of foreign ownership exceeding 50% (direct owner before 1995 and ultimate beneficiary owner (UBO) from 1995 onwards). We expect foreign ownership to shorten the duration until export entry and to decrease the risk of exit from the export market.

It is likely that plants that belong to multi-unit firms enter export markets earlier, but may be more likely to exit early if the firm can switch export activities from one plant to another. We therefore include an indicator for plants that are part of a multiplant firm.

The effects of human capital on exporting behaviour have received less attention due to lack of suitable data. For example, in many studies of exports wages are used for measuring the “quality” of the labour input. Roper et al. (2006) have found that larger, externally-owned plants with higher skill levels have the highest export propensities. On the other hand, there is also evidence on the important role of innovative capabilities in export behaviour (Basile, 2001; Roper and Love, 2002). We measure workforce skills and innovative capabilities by two variables, the share of highly educated employees (those with a university degree) and the share of employees with a technical education. As an alternative measure, we use average education years, which is obtained by converting degrees to years with standard graduation times.

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<sup>8</sup> Due to some extreme outliers the mean value of the price-cost margin for non-exporters and for all plants are negative (Table 1).

We have two additional variables that measure labour quality, average age and average tenure of employees. Plants that have an old work force may be less innovative and can have old equipment, since typically the age of plant and age of employees are correlated. We therefore expect age to be negatively correlated with export entry and positively with exit. On the other hand, tenure can to some extent compensate for the age effects, if there are plant-specific skills. However, very long tenure can have same kind of effects as age. In addition, we control the share of female employees.

Spillovers from other firms have been investigated in some studies. We include as a spillover measure the employment share of other plants in the industry which are engaged in export activity. The other exporters likely act as examples for new plants that have aspirations to start exporting. On the other hand, the spillover effect on the survival as an exporter is most likely smaller or non-existent, since a mere example of the others may not help in adverse times.

To control for general cyclical effects we include growth of real GDP as an explanatory variable. All of the explanatory variables described above are time-varying covariates in the duration models (8) and (9). In addition, we have indicators for industry (23 2-digit SIC 1995 industries) and region (20 NUTS3 regions). The industry indicators take into account differences in product heterogeneity for which we do not have a good measure. For example, Besedeš and Prusa have found that the hazard rate of imports to the U.S. (and hence the hazard of exports of the countries of origin) is higher for homogeneous goods than for differentiated products.

Table 1 gives more precise variable definitions and descriptive statistics for all manufacturing plants having at least 20 employees. A simple comparison of mean characteristics of exporting plants and non-exporters shows that exporters are on average larger, older, more productive, more capital-intensive and more likely to be foreign-owned. In terms of the work force, exporters have somewhat more experienced and better educated personnel than those plants that do not export.

TABLE 1 HERE

## 4. Estimation results

### 4.1. Export entry

Figure 1 shows Kaplan-Meier survival estimates for export market entry, where survival is defined as not entering the export market. Almost half of the plants start to export in the same year as they appear in our data ( $t=1$ ). This may indicate that at least for some of the plants the sunk entry cost is relatively low. The share of instant exporters corresponds to the overall share of exporters in plants with more than 20 employees. In fact, in the previous year these plants may have already been exporters below the size threshold. In the estimations this can at least partly be controlled by taking into account plant age. In addition, we are able to do some other sensitivity checks. Otherwise, the decline in the survival function is quite modest and stabilises for longer durations, where the number of observations is fewer. When the survival functions are graphed separately according to foreign ownership (Figure 2), it becomes evident that foreign-owned plants are more likely to enter the export market. However, further analysis is needed in order to control for other factors affecting export entry.

FIGURES 1 AND 2 HERE

The estimation results for the export entry models are reported in Table 2. Plant size is consistently positively related to the probability of starting to export. According to model 3, a 10% increase in size increases the chances of export market entry by around 4%. In the first column we include plant age as a continuous variable, whereas in the other models age is accounted for by the more reliable age group dummy variables, higher group number indicating a later cohort, i.e. younger plants. Age seems to decrease the probability of entering, except in the last three columns, where employee characteristics are included. This is most likely caused by the fact that plant age is correlated with average employee age and tenure. More productive plants are more likely to enter the export market and capital intensity is positively related to export entry, but this effect is no longer significant when the employee characteristics are included. These findings correspond to the earlier literature on export entry.

TABLE 2 HERE

The positive productivity effect supports the selectivity view of export entry. This can be illustrated by studying the development of productivity of the plants after their birth and before they start to export. Figure 3 shows for each period after birth the average productivity of three groups of plants: those that start to export in that period (entries), those that are not yet exporters but will eventually start to export (future entries), and those that will never become exporters or are right censored in our data (other). Plants are dropped after entry, so the number of plants falls with analysis time. At the beginning the plants entering the export market have higher productivity than the other two groups. After the first years, all plants seem to experience a gain in productivity, but it is still the current or future export entrants that have the highest productivity. This may be a result of conscious self-selection if the productivity gain is a result of the plants' policies. Especially the average productivity of export entrants varies. This variation can be interpreted to reflect variations in the composition of the group of entrants. Among the entrants there are both high productivity plants and plants, which have somewhat lower productivity, but have experienced e.g. a positive demand shock.

FIGURE 3 HERE

Among the other plant characteristics only foreign ownership obtains a significant coefficient.<sup>9</sup> The indicator of foreign owned plants has a positive coefficient, but its interaction with plant size a negative one. Since plant size has separately a positive impact, this means that foreign ownership increases the probability of starting to export especially for the smaller plants. This can more clearly be seen in Figure 4, where predicted survival functions are plotted for combinations of foreign ownership and two plant size groups (up to 50 employees, over 50 employees).

FIGURE 4 HERE

Since the effect of foreign ownership may also depend on other plant characteristics, we also tested its interactions with plant age, labour productivity and education. According to the

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<sup>9</sup> An indicator for belonging to a multinational group (available only from 1997 onwards) is non-significant both in export entry and exit models.

results (not shown), the interactions with plant age and labour productivity were statistically insignificant. By contrast, the interactions with the variables describing the educational level of the work force were negative indicating that foreign ownership increases the likelihood of export entry more for plants with less highly-educated employees.

There is indication of a positive spillover effect, as the share of other exporters in the same industry obtains a positive coefficient. This finding is robust to measuring the share of other exporters by output or the number of plants instead of employment. We have also experimented with the share of other exporters in the same region (NUTS 4), which turns out to have a statistically significant, positive effect on export entry as well. However, the example of other exporters in the same field of production seems to be more important than regional influences. Further, the indicator variables (not reported in the table) show that there are statistically significant differences in the probability of export entry between different industries and regions. Using more detailed industry (3-digit SIC 1995) and region dummies (NUTS 4) in the basic estimations yields very similar results.

Among the employee characteristics variables there is evidence that employee tenure has a negative and education a positive impact on export market entry. The effect of education is very similar regardless of the way we measure education, i.e. by mean schooling years or the share of highly educated.

The duration dummies (not reported in the table) show a non-monotonic, negative pattern of duration dependence, i.e. controlling for observable plant characteristics the hazard of entering the export market declines over time. After those more likely to start exporting have done so, the remaining group of plants have such characteristics that they are unlikely to start exporting.

To take into account the fact that our models may exclude some important explanatory variables describing plant-level heterogeneity, like unobserved motives for export entry, we also estimate the models with random effects (columns 4 and 7 of Table 2). This yields results that do not differ much from the corresponding estimates without unobserved heterogeneity accounted for.



## 4.2. Export exit

The second part of the analysis concentrates on the factors explaining export market exit. Descriptive analysis (Figures 5 and 6) shows that approximately 25 percent of plants that start exporting exit already after the first year. The decline in the cumulative proportion of survivors becomes more modest after approximately the first 5 years in the export market, which may be seen as the most critical period for new exporters. In contrast to export entry, there is not much difference between foreign-owned and domestic plants in the cumulative probabilities of exiting the export market when other factors are not accounted for.

FIGURES 5 AND 6 HERE

The estimates for the export exit models are presented in Table 3. Many of the effects are consistent with the results on entry. For example, plant size has a negative impact on exit, whereas it was positively related to entry. Probability of exit increases with plant age, but when age group variables are used the impact is not significant in the oldest age groups. It seems that especially young plants that have accumulated less learning are vulnerable in export markets. Also the impacts of productivity, capital intensity, and foreign ownership are symmetric to the entry results, since these variables increase the probability of entry and decrease that of exit.

TABLE 3 HERE

We illustrate the development of productivity after plant entry into the export market in Figure 7. Average productivity in each period is shown for plants exiting the export market in that period (exits), for plants that will eventually exit (future exits) and for plants that will never stop exporting or are right censored (other). After exit the plants have been dropped from the analysis, so the number of plants falls with analysis time. The group 'other' has clearly the highest productivity level, which moreover increases over time. High initial productivity with high rate of learning by exporting helps these plants survive as exporters. Plants in the group of future exiters have low productivity although it improves over time. The average productivity of current exiters varies more over time, but in most periods they

are drawn from the lower tail of the productivity distribution. This variation may again reflect compositional changes among the exiters, which include both low productivity plants and higher productivity plants with a negative demand shock.

FIGURE 7 HERE

Figure 8 shows clearly the differences between the effects of foreign ownership for small and larger plants. In fact, for small plants with 50 employees or less foreign ownership increases the risk of export exit, whereas for larger plants the risk of failure decreases. This may reflect the higher likelihood of being shut down for small plants acquired by foreign firms. Other interactions of foreign ownership turn out to be statistically insignificant except for labour productivity (results not reported in the table). In this case, foreign ownership has a positive and its interaction with labour productivity a negative effect. Thus, foreign ownership increases the risk of failure less for plants with higher efficiency. In fact, for plants with the highest productivity the risk of failure decreases.

FIGURE 8 HERE

In contrast to the entry models, profitability has a significant effect. Profitable plants are less likely to exit, as expected. Plants belonging to multi-unit firms are more likely to exit. More precisely, the hazard for a multi-unit plant is  $\exp(0.287)=1.33$  times the hazard for a single-unit plant (according to model 3). This can partly be explained by their better possibilities of shifting export production from one plant to another. Furthermore, the chances of shutting down a plant completely are higher in a multi-unit firm than a single-unit firm.

The employment share of other exporters in the same industry has a negative effect on export exit. However, this effect disappears when more detailed (3-digit SIC 1995) industry dummies are included in the estimation (other effects do not change). Regional spillovers do not turn out to be statistically significant (not reported). Thus, in the exit phase, the role of other firms as competitors seems to outweigh the positive spillover effects. Similarly to the spillover effects, the industry indicators are jointly statistically significant, whereas regional indicators are not (based on model 3).

Among the employee characteristics the results are somewhat different from the entry models. Higher average employee age increases exit probability. This corresponds to the effects of plant age. Somewhat surprisingly, plants with a high share of employees with technical education are more likely to exit from the export market. However, this may reflect the higher overall proportion of exporters in high-technology industries. A high share of employees with technical education may also indicate too little emphasis on marketing, which can have a negative impact on survival in the export market.

Similarly to export entry, the duration dummies show a non-monotonic, negative pattern of duration dependence, i.e. the hazard of export market exit declines over time after observable plant characteristics are controlled. Again, random effects estimation does not change the results much even though the likelihood ratio test rejects the null hypothesis of no plant-level unobserved effects.

#### 4.3. Sensitivity analysis

We have performed several sensitivity analyses of the results in addition to those mentioned above. We report on them briefly without showing the results in tables.

There may be spillover especially from other plants of the same firm. We tried including an indicator for plants that belong to a firm that is exporting from at least one other plant. In this case we left out the indicator for plants belonging to multiplant firms, since the plants that are exporting from their other plants are naturally a subset of multiplant firms. Exporting from other plants has a significant positive impact on the probability of starting to export, as expected, whereas the indicator for belonging to multiplant firm was not significant in Table 2. On the other hand, in the exit side the indicator for exports from other plants was not significant, but in Table 3 the multiplant indicator was significantly positive. It seems that there are within-firm spillover effects only in entry to the export market.

The size threshold of 20 employees causes some concern over the coverage and representativeness of the data. However, the distribution of exporters is heavily concentrated on the larger size categories. According to the Business Register, only around 10 per cent of plants with less than 20 employees are exporters. In order to control for possible previous

exports with less than 20 employees, we have excluded from the data those plants that have had exports in two years prior to “birth” (or exceeding the size threshold for the first time). This is only possible for cohorts 1980-1995 for export market entry, which results in a serious drop in the number of observations. Results for export entry are otherwise similar to those presented, but foreign ownership is no longer significant. For export exit, the problem of earlier export experience is not likely to be as severe.

Due to the high share of plants that enter or exit the export market during the first year, we have also tried excluding the one-year observations (with duration = 1) from the estimations. As a consequence, foreign ownership is no longer significant in export entry, but otherwise the results remain similar. Instead of allowing for only one-year absences from the data, we have tested the effect of accepting also two-year absences on the results. However, the results remain practically the same as those presented above.

To reduce possible simultaneity problems, we have also tested using lagged values of foreign ownership and labour productivity as explanatory variables. The one-year lagged variables turn out to be statistically insignificant in the entry estimations, whereas for export exit they correspond to the previous results. To summarise, the results for the exit model may be considered to be more robust than the results for export entry.

Our time period covers a very deep recession in Finland in the early 1990s, which had a great impact on the turnover of firms with a surge of bankruptcies. At the same time, exports to the former Soviet Union collapsed. These events may have an impact on the results. Restricting estimation to the post-recession period left the results on export entry more or less unchanged. In the exit models foreign ownership and share of other exporters in the industry were no longer significant.

The advantage of using the plant-level information is that changes in ownership structure do not affect the plant code, whereas firm codes may change in such occasions. In addition, rich set of information is available at the plant level for a lengthy period of time. The plant-level results can be generalised to the firm level with some caution. The share (of employment) of multi-unit firms in the data is around 9 % (54 %) until 1994 and around 15 % (62 %) after 1994. The shifts in production within multi-unit firms may cause some distortion in the plant-

level results. However, unfortunately corresponding firm-level data on export behaviour are not readily available.

## **5. Conclusions**

We have analysed export market entry and exit from a long-run, dynamic perspective by modelling the duration until exporting and duration until exit from the export market. We have been able to use a rich linked employer-employee data set. Our empirical findings indicate that there is a significant amount of symmetry in the factors affecting export entry and exit in Finnish manufacturing. Larger, younger, more productive and capital-intensive plants are more likely to enter and less likely to exit the export market. Foreign ownership increases the chances of export market entry especially for small plants and plants with less-educated work force. When it comes to export exit, foreign ownership decreases the risk of failure especially for large and more productive plants.

However, human capital in particular has diverse effects on export market entry and exit. Entering plants have more educated but less experienced staff, whereas exiting plants have older and more technically-educated staff. The negative impact of technical education on survival in the export market is interesting, as it can be interpreted to be a sign of too little emphasis on marketing.

Another asymmetry in export entry and exit is in the role of industry spillovers from other exporters. In the entry stage plants seem to gain from the experience of others who are already exporting. However, these spillovers have a smaller role in the survival of exporters.

The fact that observable characteristics of the plants affect the duration until entry into export markets and the duration until exit indicate that by investing in physical and human capital the plants can engage in self-selection. The plants that enter the export market are from the upper tail and the exiting plants from the lower tail of productivity distribution. There are also learning by exporting effects, as the productivity improves after entry into the export market.

Table 1. Variable definitions

Variable	Description	Mean characteristics 1988-2004		
		Non-exporters	Exporters	All plants
Plant size	Log of employment	67.43	139.71	116.36
Plant age	Plant age (qualitative problems for older plants)	20.00	23.73	22.53
Plant age groups	Age groups based on quartiles of ordered plant codes			
Labour productivity	Log of (value added per hours worked)	25.06	31.58	29.47
Capital intensity	Log of (capital-labour ratio)	27.03	36.20	33.29
Investment rate	Gross investments per gross output	0.23	0.06	0.11
Price-cost margin	(Value added - wages - materials) / Value added	-2.96	0.08	-0.90
Multi-unit	Plant belongs to a multi-site firm = 1, else = 0	0.33	0.35	0.34
Foreign ownership	Plant belongs to a firm with a share of foreign ownership exceeding 50% = 1, else = 0	0.05	0.12	0.09
Share of other exporters	Employment share of other exporters in the industry	0.65	0.84	0.78
Share of women	Share of women in the plant	0.35	0.31	0.32
Mean seniority (months)	Average firm-related work experience in the plant (months)	109.46	122.18	118.16
Mean age of employees	Average age of employees in the plant	38.90	39.39	39.23
Share of technically educated	Share of technically educated employees in the plant	0.42	0.46	0.45
Share of highly educated	Share of highly educated (having a degree from tertiary education) employees in the plant	0.17	0.21	0.20
Mean schooling years	Average years of schooling in the plant	11.49	11.72	11.65
Number of observations		16253	34051	50304

Note: All variables may be time-varying.

Table 2. Estimation results for export market entry

ENTRY	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Plant size	0.391 (0.038)***	0.382 (0.039)***	0.414 (0.040)***	0.492 (0.049)***	0.403 (0.063)***	0.404 (0.063)***	0.474 (0.076)***
Plant age	-0.524 (0.039)***						
Plant age group 2		0.591 (0.201)***	0.602 (0.202)***	0.690 (0.220)***	1.093 (0.345)***	1.114 (0.347)***	1.247 (0.382)***
Plant age group 3		0.619 (0.186)***	0.625 (0.186)***	0.708 (0.203)***	1.005 (0.305)***	1.024 (0.306)***	1.136 (0.329)***
Plant age group 4		0.649 (0.183)***	0.650 (0.183)***	0.742 (0.198)***	0.792 (0.293)***	0.803 (0.294)***	0.890 (0.313)***
Plant age group 5 (the youngest)		0.720 (0.185)***	0.716 (0.185)***	0.841 (0.203)***	0.877 (0.286)***	0.893 (0.287)***	1.017 (0.307)***
Labour productivity	0.172 (0.040)***	0.162 (0.039)***	0.164 (0.039)***	0.188 (0.043)***	0.172 (0.065)***	0.156 (0.067)**	0.184 (0.082)**
Capital intensity	0.049 (0.016)***	0.058 (0.016)***	0.058 (0.016)***	0.071 (0.018)***	0.031 (0.024)	0.032 (0.024)	0.040 (0.028)
Investment rate	-0.004 (0.003)	-0.005 (0.003)	-0.005 (0.003)	-0.005 (0.014)	-0.039 (0.162)	-0.049 (0.163)	-0.097 (0.205)
Price-cost margin	0.010 (0.017)	0.008 (0.016)	0.009 (0.017)	0.013 (0.037)	0.037 (0.084)	0.061 (0.102)	0.093 (0.176)
Multi-unit	-0.081 (0.064)	-0.071 (0.065)	-0.080 (0.065)	-0.115 (0.074)	0.024 (0.099)	0.025 (0.100)	0.002 (0.111)
Foreign ownership	0.087 (0.114)	0.086 (0.114)	1.256 (0.495)**	1.427 (0.576)**	1.479 (0.637)**	1.418 (0.643)**	1.639 (0.731)**
Foreign ownership* plant size			-0.286 (0.120)**	-0.321 (0.141)**	-0.336 (0.159)**	-0.325 (0.160)**	-0.378 (0.181)**
Share of other exporters	2.779 (0.215)***	2.758 (0.216)***	2.770 (0.216)***	3.114 (0.241)***	2.970 (0.333)***	2.942 (0.333)***	3.364 (0.365)***
Mean age of employees					0.005 (0.009)	0.001 (0.009)	0.002 (0.011)
Mean seniority					-0.002 (0.001)**	-0.002 (0.001)**	-0.002 (0.001)**
Share of technically educated					0.095 (0.248)	0.329 (0.235)	0.331 (0.268)
Mean schooling years					0.161 (0.035)***		
Share of highly educated						1.114 (0.191)***	1.321 (0.230)***
Share of women					-0.163 (0.223)	-0.153 (0.223)	-0.135 (0.261)
Growth in real GDP	-0.363 (1.164)	-0.441 (1.159)	-0.460 (1.158)	-0.356 (1.220)	0.450 (1.563)	0.472 (1.563)	0.659 (1.693)
Constant	-3.945 (0.248)***	-4.962 (0.298)***	-5.090 (0.304)***	-5.842 (0.364)***	-7.329 (0.687)***	-5.583 (0.584)***	-6.424 (0.698)***
Random effects	NO	NO	NO	YES	NO	NO	YES
Observations	8259	8258	8258	8308	3151	3151	3164
Number of id				3364			1699
Log likelihood	-3567.0	-3557.6	-3554.5	-3546.6	-1544.9	-1539.0	-1534.2
LR test for random effects				15.75***			9.67***

Robust standard errors in parentheses. Significance level: \* 10%; \*\* 5%; \*\*\* 1%. Duration dummies not shown. We also control for industry effects (2-digit SIC 1995), regional effects (NUTS 3) and cohort effects.

Table 3. Estimation results for export market exit

EXIT	(1)	(2)	(3)	(4)	(5)	(6)
Plant size	-0.690 (0.047)***	-0.665 (0.046)***	-0.709 (0.050)***	-0.783 (0.056)***	-0.707 (0.079)***	-0.784 (0.075)***
Plant age	0.007 (0.002)***					
Plant age group 2		-0.020 (0.100)	-0.028 (0.100)	-0.047 (0.115)	-0.003 (0.178)	-0.003 (0.203)
Plant age group 3		-0.115 (0.093)	-0.118 (0.092)	-0.144 (0.106)	-0.048 (0.163)	-0.020 (0.185)
Plant age group 4		-0.207 (0.092)**	-0.211 (0.092)**	-0.266 (0.107)**	-0.293 (0.157)*	-0.348 (0.179)*
Plant age group 5 (the youngest)		-0.274 (0.108)**	-0.283 (0.109)***	-0.347 (0.123)***	-0.389 (0.160)**	-0.457 (0.179)**
Labour productivity	-0.265 (0.049)***	-0.267 (0.048)***	-0.264 (0.048)***	-0.269 (0.052)***	-0.259 (0.094)***	-0.258 (0.100)***
Capital intensity	-0.096 (0.020)***	-0.097 (0.020)***	-0.096 (0.020)***	-0.106 (0.022)***	-0.093 (0.031)***	-0.107 (0.033)***
Investment rate	-0.275 (0.187)	-0.275 (0.188)	-0.276 (0.188)	-0.251 (0.169)	-0.841 (0.497)*	-0.762 (0.406)*
Price-cost margin	-0.355 (0.188)*	-0.365 (0.182)**	-0.376 (0.182)**	-0.382 (0.180)**	-0.276 (0.384)	-0.295 (0.390)
Multi-unit	0.253 (0.058)***	0.274 (0.059)***	0.287 (0.059)***	0.307 (0.066)***	0.341 (0.088)***	0.368 (0.099)***
Foreign ownership	0.131 (0.094)	0.134 (0.094)	-1.301 (0.494)***	-1.324 (0.494)***	-1.412 (0.744)*	-1.506 (0.722)**
Foreign ownership* plant size			0.362 (0.120)***	0.365 (0.119)***	0.323 (0.185)*	0.336 (0.177)*
Share of other exporters	-0.455 (0.178)**	-0.463 (0.179)***	-0.485 (0.177)***	-0.530 (0.200)***	-0.799 (0.285)***	-0.845 (0.311)***
Mean age of employees					0.037 (0.014)***	0.039 (0.013)***
Mean seniority					-0.000 (0.001)	-0.000 (0.001)
Share of technically educated					0.570 (0.279)**	0.659 (0.289)**
Share of highly educated					-0.024 (0.234)	-0.066 (0.241)
Share of women					0.167 (0.252)	0.217 (0.268)
Growth in real GDP	-1.380 (0.929)	-1.383 (0.930)	-1.367 (0.931)	-1.447 (0.918)	0.772 (1.446)	0.777 (1.426)
Constant	2.424 (0.257)***	2.465 (0.268)***	2.629 (0.274)***	2.851 (0.295)***	1.141 (0.669)*	1.154 (0.691)*
Random effects	NO	NO	NO	YES	NO	YES
Observations	15197	15198	15198	15318	6490	6490
Number of id				2911		1588
Log likelihood	-5198.6	-5200.9	-5196.0	-5195.0	-2286.6	-2283.7
LR test for random effects				2.02*		5.78***

Robust standard errors in parentheses. Significance level: \* 10%; \*\* 5%; \*\*\* 1%. Duration dummies not shown. We also control for industry effects (2-digit SIC 1995), regional effects (NUTS 3) and cohort effects.



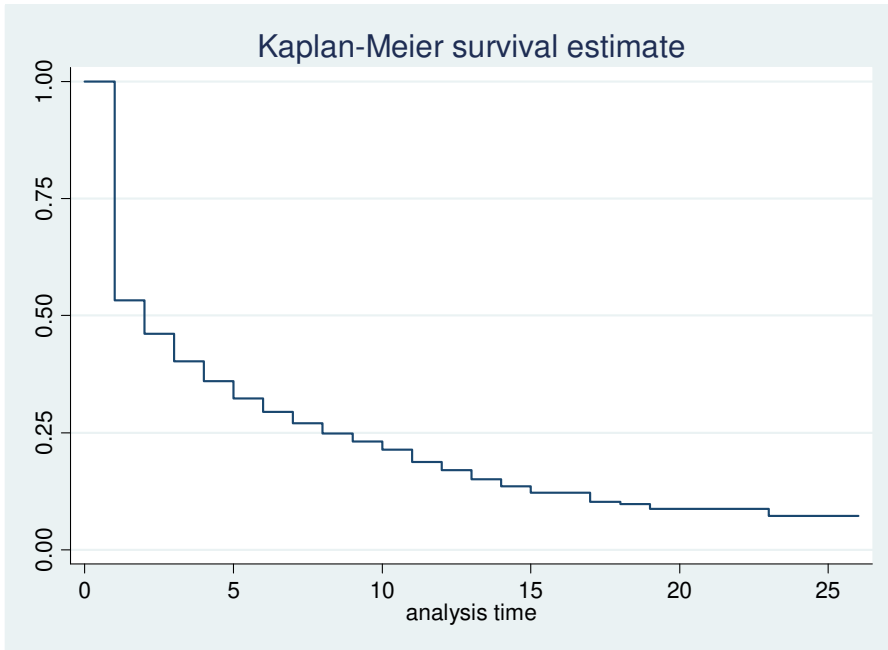


Figure 1: Survival function for export entry

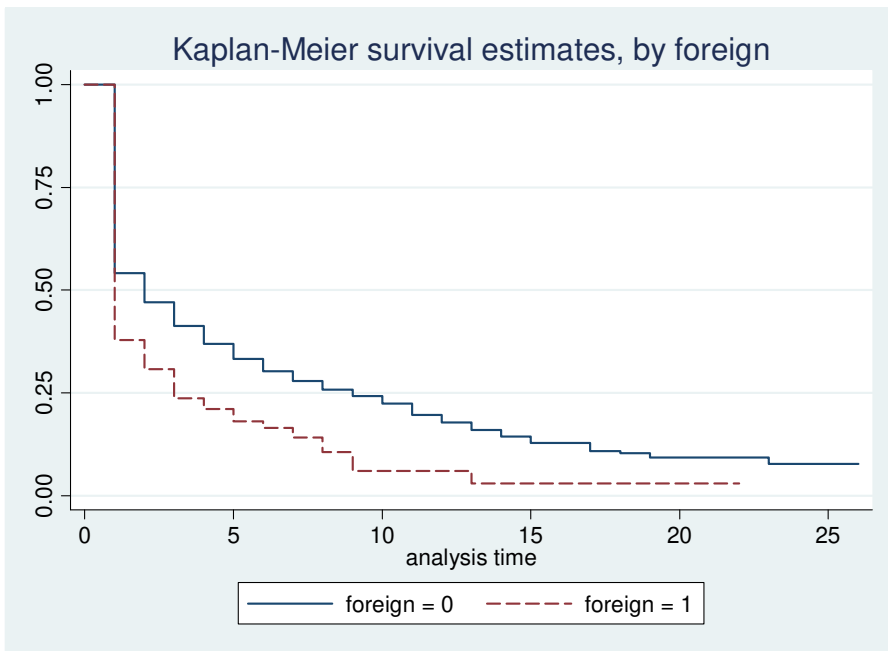


Figure 2: Survival function for export entry by foreign ownership

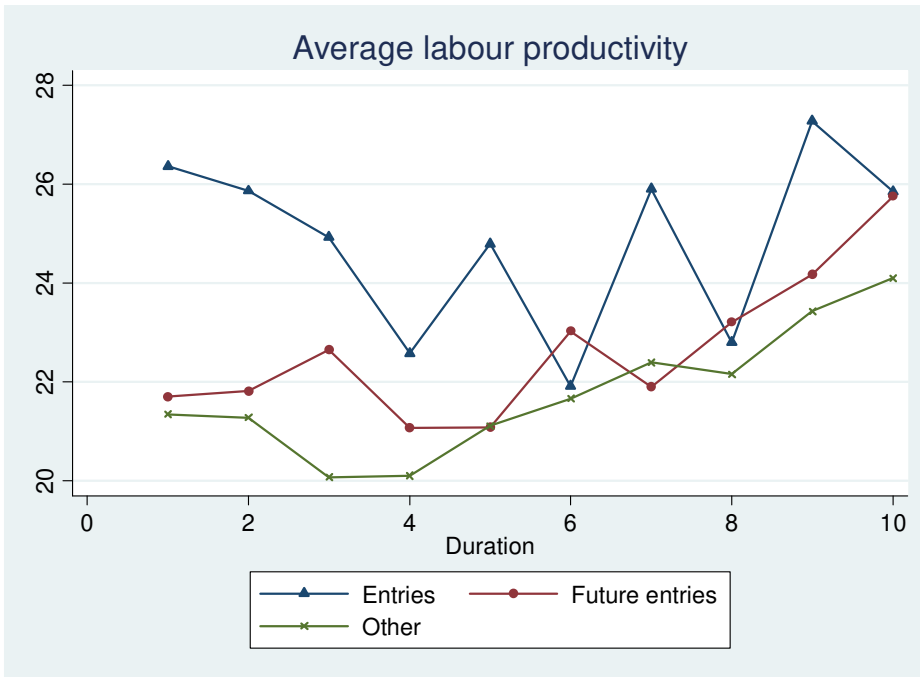


Figure 3: Productivity dynamics between plant birth and export entry

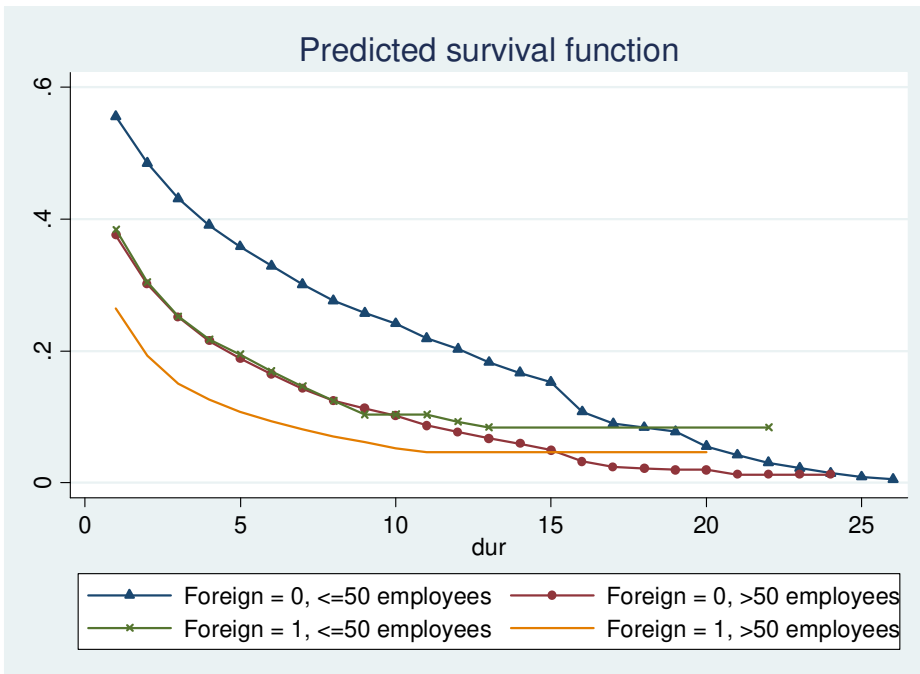


Figure 4: Predicted survival function for export entry by foreign ownership and plant size (based on model 3 in Table 3)

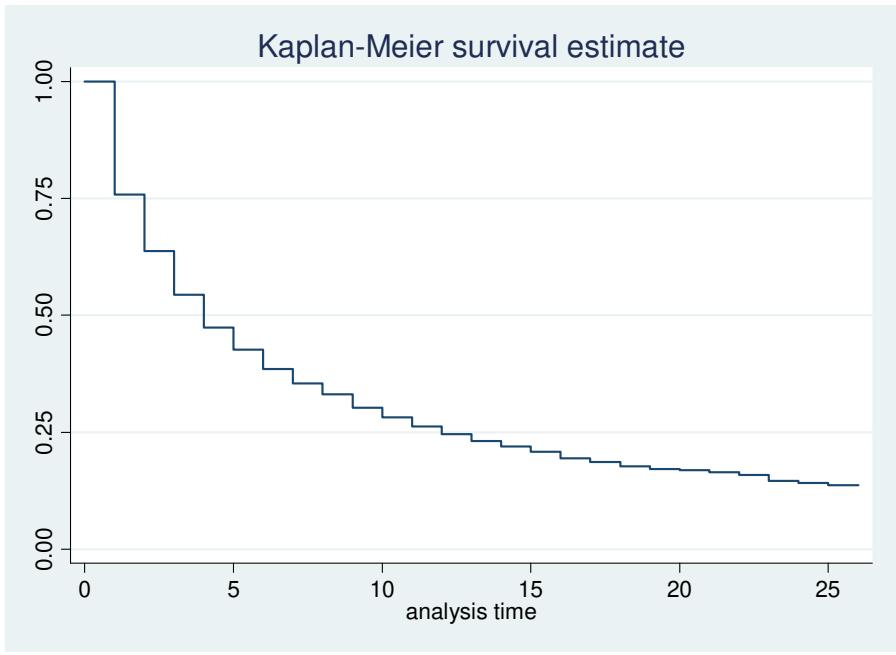


Figure 5: Survival function for export exit

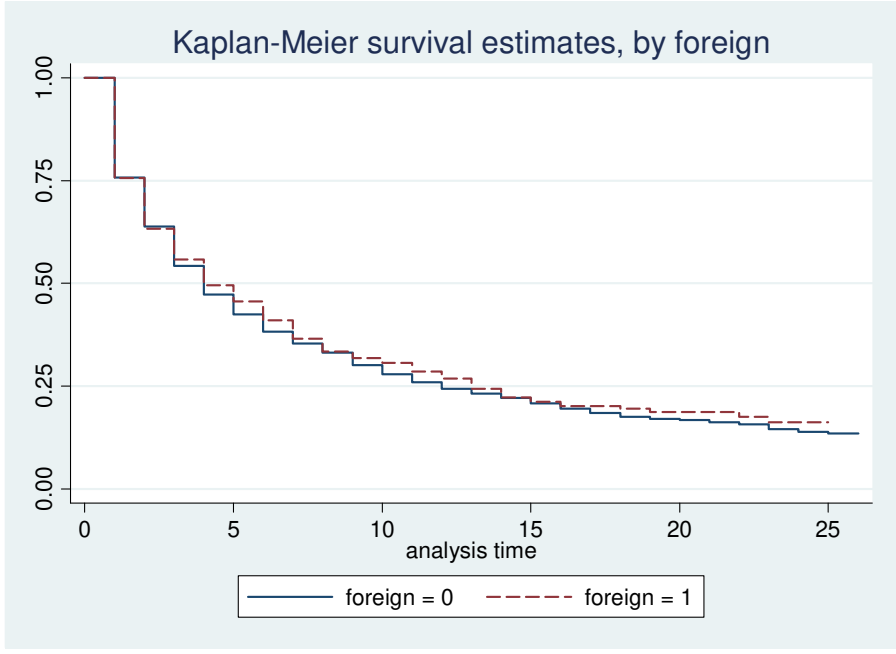


Figure 6: Survival function for export exit by foreign ownership

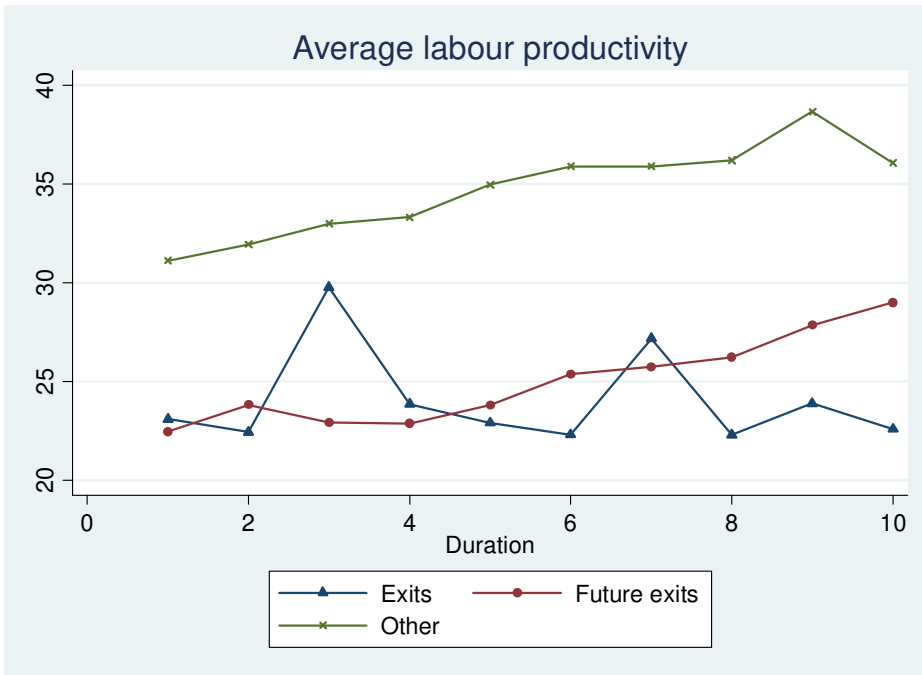


Figure 7: Productivity dynamics between export entry and export exit

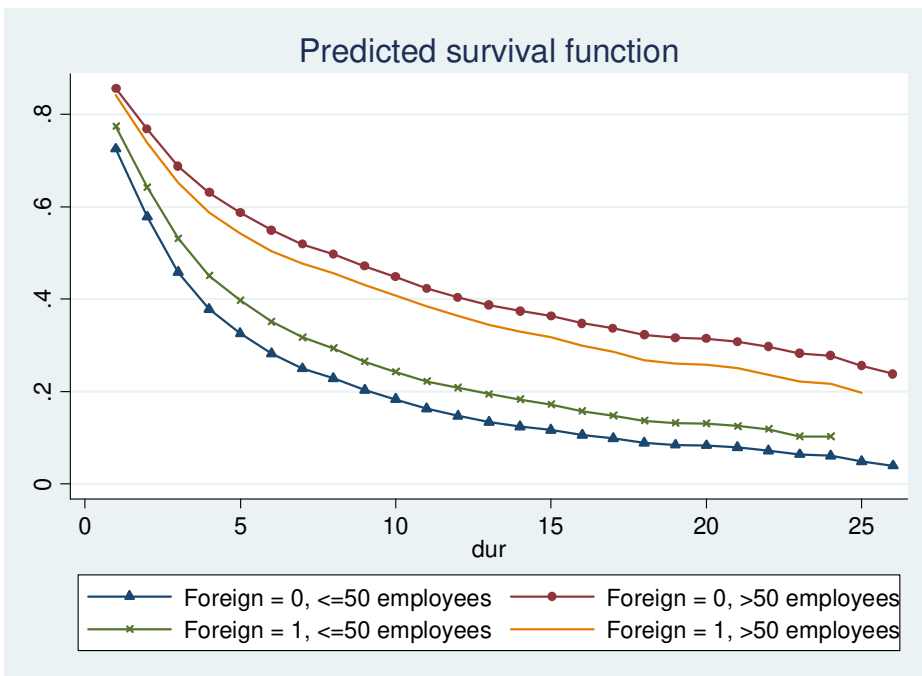


Figure 8: Predicted survival function for export exit by foreign ownership and plant size (based on model 3 in Table 4)

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