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Survival of New Exporters in Developing Countries: Does It Matter How They Diversify?*

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Supervivencia de los nuevos exportadores en países en desarrollo: ¿es importante diversificar? Sobrevivência nos novos exportadores nos países em desenvolvimento: Importa o modo como se diversificam?

Recent studies have shown that developing countries might have significantly better export performance if they were able to increase the duration of their trade relationships. Evidence on duration of these relationships at the firm level is virtually absent. In this paper, we aim at filling this gap in the literature by analyzing what determines export survival using firm-level data for the whole population of Peruvian new exporters over the period 2000–2006. In particular, we address one question: Does it matter how firms diversify? We find that geographical diversification increases the probability of survival in export markets more than product diversification.

Estudios recientes han demostrado que los países en desarrollo pueden exportar con mayor rendimiento si son capaces de aumentar la duración de sus relaciones comerciales. Las evidencias de la duración de este tipo de relaciones a nivel empresarial son prácticamente inexistentes. En este artículo, pretendemos rellenar esta laguna analizando qué determina la supervivencia de las exportaciones mediante datos a nivel empresarial para toda la población de nuevos exportadores peruanos en el periodo 2000–2006. En particular, planteamos una pregunta: ¿es importante cómo diversifican las empresas? Concluimos que la diversificación geográfica aumenta la probabilidad de supervivencia en los mercados de exportación que la diversificación de los productos.

Estudos recentes demonstraram que os países em desenvolvimento podem ter desempenho de exportações significativamente melhores se conseguirem aumentar a duração das suas relações comerciais. São praticamente inexistentes os dados sobre a duração destas relações ao nível da empresa. No presente artigo, pretendemos preencher esta lacuna na literatura analisando o que determina a sobrevivência da exportação usando dados ao nível da empresa para toda a população dos novos exportadores peruanos no período de 2000–2006. Tratamos, em particular, uma questão: Importa o modo como as empresas se diversificam? Concluímos que a diversificação geográfica aumenta mais a probabilidade de sobrevivência nos mercados de exportação que a diversificação do produto.

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1. Introduction

The relevance of both entry and exit of firms in shaping economic performance has been largely recognized in the industrial organization literature. Several papers have characterized the patterns of entry and exit in manufacturing industries and have attempted to identify their main driving forces¹. Firms' decision to enter into foreign markets, its determinants and its implications are also well documented in the international trade literature². However, evidence on the determinants of firms' duration patterns in foreign market is scarce. This is rather surprising given that the length of survival can be considered one of the most comprehensive measures of firm performance (see Stigler, 1958). This paper aims at filling this gap in the empirical trade literature. More precisely, we examine export duration using highly disaggregated export data as well as other relevant firm-level information such as employment for Peruvian exporters over the period 2000-2006 and assess whether the type diversification contributes to explain the survival of trade flows.

The median duration of a Peruvian firm export spell over the period 2000-2006 is just one year. Exit rates from international markets are accordingly substantial. Thus, 54.4% of the approximately 2,100 Peruvian firms that entered into foreign markets in 2005 cease to export in 2006. Besedes and Prusa (2007) suggest that developing countries might have significantly better export performance, i.e., higher export growth if they were able to increase the duration of their trade relationships. In addition, exit from foreign markets may potentially have significant consequences. Thus, Girma et al. (2003) show that such an exit has a weak negative impact on firm's total factor productivity in the year exit takes place and a strong and quite persistent negative effect on firm's employment and output.

The industrial organization literature has established some stylized facts concerning the factors that affect the probability that a firm ceases to operate or exit particular markets. One of these facts is that the probability of exit decreases with the number of products produced and the number of markets served (i.e., if the firm is an exporter) (see, e.g., Bernard and Jensen, 2002; and Bernard and Jensen, 2007). This result can be rationalized in terms of a portfolio argument. If sales of different products (in different markets, domestic vs. foreign) do not perfectly covariate, then variability of sales should be lower for multi-product (exporter) firms and, as a consequence, the expected probability of survival should be higher (see Hirsch and Lev, 1971; Bernard and Jensen, 2002). Moreover, diversified firms are more likely to be more productive (see, e.g., Bernard et al., 2006) and may have access to resources, say, external or internal sources of capital, that can help them to avoid closure in case of a negative shock to one product (market) (see Jovanovic, 1993; Bernard and Jensen, 2007).

In this paper, we investigate whether this also applies to exit from export markets. More precisely, we address one main question: Does it matter whether and how firms diversify their exports to survive in international markets?

1. See, e.g., Dunne et al. (1988), Dunne et al. (1989), Audretsch (1991), Audretsch and Mahmood (1995), Dunne et al. (2005), and Bernard and Jensen (2007).

2. See, e.g., Roberts and Tybout (1997), Clarides et al. (1998), Girma et al. (2004), and Bernard and Jensen (2004).

KEY WORDS

Exports,
Duration, Firms,
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PALABRAS CLAVE

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We apply survival methods to document Peruvian firms' export duration patterns and to assess the role played by diversification in determining these patterns over the period 2000-2006. In doing this, we use a unique firm-level dataset containing data on exports by product and countries, employment, and starting date over this period. Thus, we include relevant time-varying covariates such as size measured by employment, current exports, initial exports, and age group to account for observed firm characteristics that potentially affect the profit stream and henceforth the survival chances. We also control for unobserved heterogeneity.

We contribute to the literature in several ways. First, we provide, to our knowledge for the first time, evidence on export duration patterns at the firm level and explicitly analyze their determinants for a developing country, Peru.³ More specifically, instead of just looking at the link between these characteristics and the intensity of participation in foreign markets as highlighted in theoretical models featuring firm heterogeneity (see, e.g., Melitz, 2003; Melitz and Ottaviano, 2005; and Helpman et al., 2007) and empirical studies testing their main results, we investigate whether there is heterogeneity in export duration patterns and whether and how this is systematically related to specific firm attributes. This might prove to be insightful for future theoretical developments in the international trade literature. Second, even though survival methods have been widely used to examine the life time of firms (see, e.g., Audretsch, 1991; Mata and Portugal, 1995; Klepper, 2002) and have been recently utilized to describe trade duration at the product level (see, e.g. Besedes and Prusa, 2006;

Nitsch, 2007), our paper applies these methods to firm-level trade data. This allows us to account for both whether and when exactly firms exit from export markets, thus controlling for the evolution of the corresponding risk over time. Third, unlike most studies on firm export behavior, we consider the whole population of new exporters and accordingly cover all sectors. This is especially important for developing countries such as Peru where exports of natural resources and their products account for a large fraction of the country's total exports (see Giordano et al., 2006).

We find that both geographical diversification and product diversification of exports increase the chances of surviving in export markets. More specifically, selling to a larger number of countries and, in particular, a more uniform distribution of sales across countries are associated with a larger decrease in the risk of failing abroad than selling a larger number of products or having a more balanced export bundle in terms of goods. Furthermore, older and larger firms as measured in terms of employment as well as in terms of current scale of export operations are more likely to remain active in international markets.

The remainder of the paper is organized as follows: Section 2 explains the empirical methodology, which is essentially based on survival methods. Section 3 describes the dataset and presents some basic preliminary statistical evidence. Section 4 reports the main estimation results, and Section 5 concludes.

3. Álvarez and López (2008) use plant-level data for a sample of Chilean manufacturing firms, but their analysis of the determinants of entry and exit patterns is confined to the sectoral level.

2. Empirical Methodology

We are interested in measuring the duration of firms' exports, i.e., the time elapsed until firms' trade flows are interrupted, and in identifying the factors that affect the risk of these flows to be dropped. When measuring export duration with available data, some problems arise. First, some observations on the duration of trade flows may be right-censored. This is the case when spells are in progress, i.e., we just know the duration from the inception of the spell to the final year of the sample period. Second, spells may be left-censored. In this case, actual duration cannot be determined because the time from the inception of the spell to the first sample year is unknown. In our case, left-censoring would be less a problem because we just focus on new exporters⁴.

Survival analysis methods allow addressing the special problems associated with duration data. These methods take into account the evolution of the exit risk and its determinants over time. They are based on the concept of conditional probabilities (e.g., the probability of an export flow to last 7 years, given that has lasted 6 years) instead of the unconditional probabilities (e.g., the probability of an export flows to last exactly 7 years)⁵.

Formally, let $T \geq 0$ denote the duration of exports, which has some distribution in the population and t a particular value of T . The survivor function $S(t)$ is defined as follows:

$$S(t) = P(T \geq t) = 1 - F(t) \quad (1)$$

The survivor function gives the probability that the duration of the spell T equal or exceeds the value t and, as such, it is the complement of the probability distribution of duration $F(t)$ whose corresponding density function is given by $f(t) = dF(t)/dt$. The distribution of durations can be also characterized in terms of the hazard function. Let $P(t \leq T < t + \Delta t | T \geq t)$ be the probability of an export flow to cease in the interval $[t, t + \Delta t)$ given that it has lasted until time t . The hazard function is obtained by taking the limit of this probability for small Δt (see Kiefer, 1988):

$$\lambda(t) = \lim_{\Delta t \rightarrow 0} P(t \leq T < t + \Delta t | T \geq t) / \Delta t = f(t) / S(t) \quad (2)$$

$\lambda(t)$ is the (instantaneous) rate at which export flows disappear at duration t , given that they last until t .⁶

The explanatory variables can affect the distribution of durations in several ways depending

4. Further, short spells may be underrepresented in the sample, i.e., there may be length-biased sampling (see Kiefer, 1988). This problem is more relevant for duration of unemployment than for that of trade flows because firms do not necessarily export every month.

5. In contrast, traditional cross-section techniques examine the unconditional average probability of occurrence of the event during the sample period (e.g., logit or probit) or the average duration (e.g., OLS) (see Esteve Pérez et al., 2004).

6. The hazard function provides a convenient definition of duration dependence. To see why, this function can be written in the following way: $\lambda(t) = -d \ln S(t) / dt$. If $d \lambda(t) / dt > 0$ at point $t=t^*$, then the probability that a spell end shortly increases as the spell increases in length, i.e., there is positive duration dependence at t^* . In contrast, If $d \lambda(t) / dt < 0$ at point $t=t^*$, then the probability that a exports cease shortly decreases as the spell increases in length, i.e., there is negative duration dependence at t^* .

on the specification used. We adopt here a proportional hazard specification, so that the effect of the regressors consists of multiplying the hazard function itself by a scale factor, i.e., their effect is a parallel shift of the baseline function, which is estimated for all those firms whose export flows survive up to a particular period (see Kiefer, 1988). Formally:

$$\lambda(t) = \lambda_0(t) \exp(x(t)'\beta) \quad (3)$$

where λ_0 is a baseline hazard, which is an unknown, x is a vector of time-varying explanatory variables and β is a vector of parameters, which is also unknown⁷. We estimate this model semi-parametrically using the partial-likelihood approach proposed by Cox (1972). More specifically, the model is estimated maximizing a partial likelihood function with respect to the vector of coefficients β without specifying the form of the baseline hazard function λ_0 . This approach has the advantage of avoiding potential misspecification of this function (see Dolton and von der Klaauw, 1995).

Partial likelihood allows us to easily deal with censoring and ties. Let $t_1 < t_2 < \dots < t_n$ be completed export spells ordered according to their length among n observed survival times. The contribution of the j th shortest duration is

$$\exp(x_j'\beta) / \sum_{i=j}^n \exp(x_i'\beta) \quad (4)$$

The partial likelihood function is obtained multiplying these contributions together for each of the incidences of exit and accordingly the resulting log-likelihood is (see Kiefer, 1988)⁸:

$$L(\beta) = \sum_{i=1}^k \left[x_i'\beta - \ln \left(\sum_{j=i}^n \exp(x_j'\beta) \right) \right] \quad (5)$$

The intuition is that, in absence of information on the baseline hazard, only the order of the durations provides information about the unknown coefficients. Maximization of this log-likelihood function yields estimators of coefficients β with the usual properties of maximum-likelihood estimators (see Audretsch and Mahmood, 1994). The estimated coefficients indicate the relationship between the covariates and the hazard function. Thus, a positive (negative) coefficient increases (reduces) the value of the hazard and it therefore indicates a negative (positive) impact on survival.

Note that an individual whose spell is censored between durations t_j and t_{j+1} appears in the summation in the denominator of the contribution to log-likelihood of (ordered, uncensored) observations 1 through j , but not in any others. On the other hand, censored spells do not enter the numerator of the contribution at all (see Kiefer, 1988). Ties are handled by including a contribution to log-likelihood for each of the tied observations using the same denominator for each (see Breslow, 1974)⁹.

7. λ_0 is the baseline hazard corresponding to $\exp(x'\beta) = 1$, i.e., when the covariates are equal to 0.

8. Note that the baseline hazard is assumed to be the same for all observations, so that, due to the proportional hazard assumption, it cancels out.

9. Formally, in the case of ties, Breslow (1974) proposes to maximize the following log-likelihood: $L(\beta) = \sum_{i=1}^k \left[x_i'\beta - \ln \left(\sum_{j=i}^n \exp(x_j'\beta) \right) \right]$ where m_i is the number of exits occurring at t_i and s_i is the sum of covariates over the m_i observations.

Firms may enter foreign markets some year, exit the following year, re-enter the next one, and so successively. In particular, in our sample, 845 firms entered, exited, and re-entered export markets, and 416 firms entered, exited, re-entered, and exited again. Hence, there are multiple export spells and two or more events of interest occur to the same firm. In these cases, failure times may be correlated within firms. Thus, a first exit from export markets could make more likely to exit again. On the other hand, we can conceivably argue that re-enter international markets reveals certain abilities of the firm that could be associated with lower risks of exit a second time (see Besedes and Prusa, 2006). In this case, the assumption that export durations are independently distributed over time conditional on observed covariates would be violated (see Kovacevic, 2002). These interdependencies should be therefore controlled for. In order to deal with this issue we estimate the model parameters without explicitly modeling their dependencies, and then correct the covariance matrix to account for the within-individual correlation (see Lin and Wei, 1989)¹⁰.

More generally, there may be unobserved firm heterogeneity, i.e., systematic differences may remain in the distribution of durations across units of observation after conditioning on observed explanatory variables¹¹. When this is the case, inferences about duration dependence and the effect of included covariates may be misleading (see Kiefer, 1988). In particular, in the proportional hazard model, ignoring heterogeneity leads to underestimating the proportional effect of the explanatory variables (see van der Berg, 2001). We model the unobserved characteristics as a random effect and assume that it enters multiplicatively on the hazard function (see Clayton and Cuzick, 1985). Formally:

$$\lambda_i(t) = \theta_i \lambda_0(t) \exp(x(t)'\beta) \quad (6)$$

where θ_i is a random variable that is assumed to be independent of $x(t)$. A log-likelihood is obtained by conditioning on the unobserved θ_i and then integrating over its distribution. In this paper, we assume that θ_i follows a gamma distribution with mean equal to one¹². This distribution has the advantage of giving a closed form expression for the likelihood, thus avoiding numerical integration (see Meyer, 1990)¹³.

10. Besedes and Prusa (2006) treat multiple spells as independent and use a dummy to account for higher order spells.

11. Failure to control for firm characteristics shared by export spells precisely results in dependencies among these spells (see Kovacevic, 2002).

12. The distribution of the random effect converges to the gamma distribution for proportional hazard models with unobserved heterogeneity (see Abbring and van der Berg, 2007).

13. The inverse Gaussian distribution also has this property (see Hougaard, 1984).

3. Data, Variables, and Descriptive Statistics

Our dataset consists of two main databases. On the one hand, we have highly disaggregated export data at the firm level over the period 2000-2006. Data cover all new exporters, i.e., firms that registered their first exports from 2000 onwards¹⁴. These data are reported annually at the firm-product-country level. Specifically, each record includes the firm's tax ID, the product code (10-digit HS), the country of destination, and the export value in US dollars. On the other hand, we have data on employment and starting date from the National Tax Agency, SUNAT, for the same period. Firms are also identified by their tax ID in this case, so that the both databases could be easily merged.

These data enable us to construct the following variables which are identified as key determinants of exit in the empirical literature on industrial organization: number of countries in which the firms sell their products, number of products they sell abroad, number of employees, current scale of operations (total current exports), initial scale of operation (total exports in the first year they appear as exporters), and age¹⁵.

Table 1 characterizes Peruvian new exporters in terms of these variables over our sample period. The number of firms entering export markets for the first time has been growing steadily, from 1,359 to 2,132 between 2000 and 2006. In recent year, the average new exporter sells abroad more than 100,000 US dollars, exports around

five products to 1.3 countries. These firms have between 10 and 20 employees and are approximately six years old.

The event of interest of our study is exit from export markets. We define this event as occurring in the year for which there is no register of export activity. Table 2 reports for each year the number as well as the share of firms which having started to export this year do not appear as exporters in the next year and in all subsequent years. We have seen before that the number of newcomers has been rising. This table shows that the number of exiting firms has increased as well. However, the annual export mortality rate has declined in recent years. Thus, while 923 firms out of the 1,546 firms that engaged in international trade in 2002 interrupted cross-border operations in 2003, 1,124 firms out of the 2,132 firms that entered export markets in 2005 ceased to export in 2006, which amounts to a decrease in the exit rate from 59.7% to 54.4%.

Export flow survival patterns can be characterized using the survivor function. This function can be estimated using the Kaplan-Meier or product-limit estimator, which is defined as follows:

$$\hat{S}(t_j) = \prod_{i=1}^j [(n_i - k_i) / n_i] = \prod_{i=1}^j (1 - \hat{\lambda}_i) \quad (7)$$

where n_j is the number of spells neither completed or censored before duration t_j , k_j is the number of completed spells of duration t_j , and $\hat{\lambda}_i$ is the number of exits at duration t_j divided by the number of units of observations at risk of exiting at duration t_j , i.e., the estimated probability of completing a spell at duration t_j , given that the spell has reached duration t_j . Hence, the conditional probability of completing a spell at duration t_j is estimated with the observed

14. These firms do not register any exports back to 1995.

15. In the econometric analysis below, we work with the natural logarithm of these variables, but age, whose influence is captured through binary variables identifying four categories: 1-5 years, 6-10 years, 11-20 years, and more than 20 years. Age cannot enter directly in the Cox specification because it would be collinear with the baseline hazard (see Disney et al., 2003).

relative frequency of completion at duration t_{j16} .

Table 1

Average Peruvian New Exporter						
Year	Number of Firms	Total Exports	Number of Countries	Number of Products	Employment	Age
2000	1,359	87,981.18	1.34	4.16	24.80	6.57
2001	1,456	94,893.43	1.31	4.28	42.06	6.39
2002	1,546	194,991.91	1.29	4.64	16.97	5.77
2003	1,681	70,765.35	1.35	4.96	18.08	6.36
2004	1,811	100,006.26	1.29	4.76	10.78	5.64
2005	2,068	118,632.23	1.30	5.94	17.84	5.46
2006	2,132	129,010.83	1.35	5.53	12.58	7.05

Source: Own elaboration on data provided by PROMPERU and SUNAT.

Table 2

Exit from Export Markets				
Year	Firms Not Exporting the Next Year		Firms Not Exporting the Subsequent Years	
	Exit Rate	Number of Exits	Exit Rate	Number of Exits
2000	0.575	781	0.461	626
2001	0.591	861	0.481	701
2002	0.597	923	0.503	777
2003	0.585	983	0.517	869
2004	0.570	1,032	0.526	952
2005	0.544	1,124	0.544	1,124

Source: Own elaboration on data provided by PROMPERU and SUNAT.

16. It can be shown that this is a maximum-likelihood estimator (see Kiefer, 1988).

The equality of the survivor functions across different groups defined along relevant variables can be formally tested using univariate survival tests, which basically are extensions to censored data of conventional non-parametric rank tests for comparing distributions, e.g., log-rank; Peto-Peto-Prentice; Wilcoxon-Breslow-Gehan; Tarone-Ware; and trend¹⁷. These tests differ in the weight or weighting function used when computing the corresponding test statistics¹⁸. Under the null hypothesis, there are no differences between the survival patterns of the groups at any failure time and these statistics are distributed as a χ^2 with $h-1$ degrees of freedom, where h is the number of groups.

Figures 1 and 2 show the survivor functions for firms with different degrees of export diversification in terms of countries and products, respectively. These figures clearly indicate that diversifying external sales over countries and products increases duration in export markets. The relevant test statistics reported in Table 3 specifically indicate that the differences in survival across firms with different degrees of geographical and product diversification of their external sales are statistically significant. Thus, while less than 50% (less than 50%) of the firms exporting to one country (product) survives from the first to the second year, almost 75% (approximately 50%) of the firms exporting to two countries (products) do. More precisely, the figures suggest that increasing the number of countries served seems to reduce the risk of exiting foreign markets more than increasing the number of products exported.

Figure 3 shows how the other variables relate to survival in export markets. In particular, the upper panel of this figure displays the survivor functions for employment and age categories. Consistent with previous evidence on firm time life, larger and older firms are more likely to survive in export markets. Thus, after six years, more than 50% of the large firms remain in export markets, but less than 20% of the micro firms do. Differences are smaller across age groups, but they are still substantial. While more than 30% of the firms older than 20 years continue operating in export markets after this period, just 20% of the firms created within the last 10 years are able to do so. The bottom panel of Figure 3 reveals how survival patterns change across size categories defined in terms of the level of activity being considered, i.e., across initial and contemporary export value segments (i.e., quintiles). The evidence is also clear in this case. Larger exports, both initial and current, are associated with lower hazards. Note that the differences across these functions are also statistically significant across the relevant tests (see Table 3).

This section has explored unconditional associations between the variables of interest and firm survival patterns in export markets. The next section will assess the impact of these variables in a conditional framework.

17. See Breslow (1970), Wilcoxon (1945), Peto and Peto (1972), Prentice (1978), and Tarone and Ware (1977).

18. The contribution to the test statistics at each failure time is obtained as the weighted standardized sum of the differences between the observed and expected number of exits in each group.

Figura 1

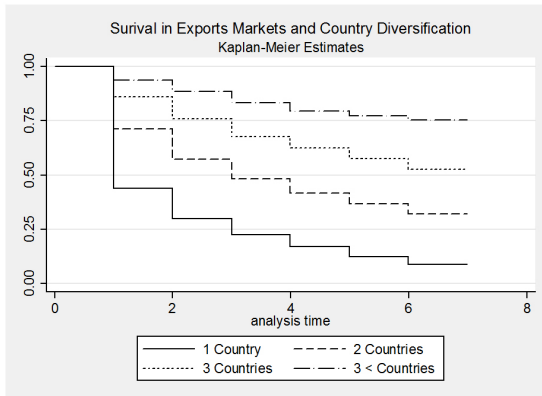
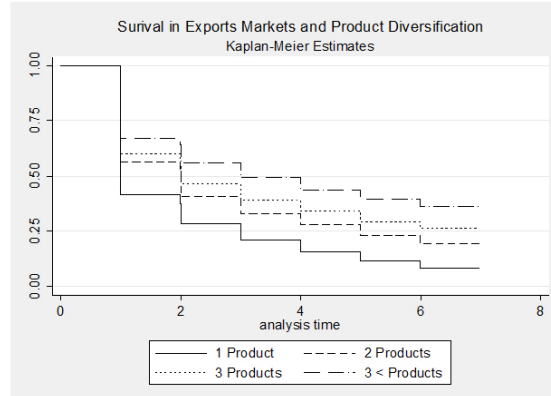
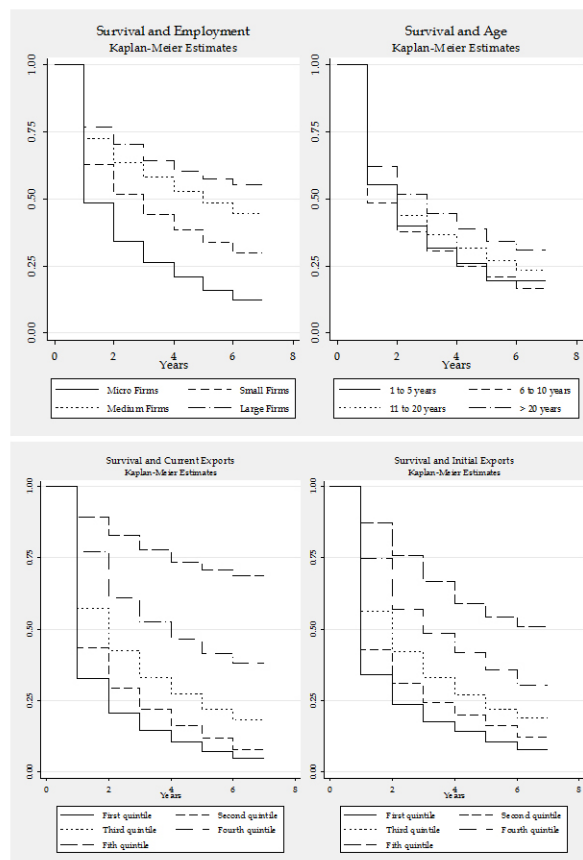


Figura 2



Source: Own elaboration on data provided by PROMPERU and SUNAT.

Figura 3



Source: Own elaboration on data provided by PROMPERU and SUNAT.

Table 3

Variables\Tests	Log-rank	P-P-P	W-B-G	T-W	Trend
Number of Countries	2677.440*** [0.000]	2442.177*** [0.000]	2197.252*** [0.000]	2518.062*** [0.000]	2677.440*** [0.000]
Number of Products	1272.787*** [0.000]	1065.569*** [0.000]	932.079*** [0.000]	1117.094*** [0.000]	1272.787*** [0.000]
Employment	986.363*** [0.000]	801.039*** [0.000]	684.41*** [0.000]	848.297*** [0.000]	986.363*** [0.000]
Age	137.122*** [0.000]	117.79*** [0.000]	107.013*** [0.000]	123.052*** [0.000]	137.122*** [0.000]
Export Initial Value	3171.175*** [0.000]	2855.808*** [0.000]	2569.678*** [0.000]	2951.516*** [0.000]	3171.175*** [0.000]
Export Current Value	1997.007*** [0.000]	2104.982*** [0.000]	2016.305*** [0.000]	2109.180*** [0.000]	1997.007*** [0.000]

Source: Own elaboration on data provided by PROMPERU and SUNAT.

The table reports the test statistics and the corresponding p-values (within brackets) of the long-rank, Peto-Peto-Prentice, Wilcoxon-Breslow-Gehan, Tarone-Ware, and trend tests for each explanatory variable. * significant at 10% level; ** significant at 5% level; *** significant at 1% level.

4. Estimation Results

Table 4 reports hazard ratios for the main covariates obtained with the Cox's proportional hazard model. In this case, estimated coefficients larger than one mean that the variable in question is associated with an increased risk of exiting export markets (i.e., reduces expected duration), whereas the opposite holds when the estimated coefficients are smaller than one.

Geographical and product diversification reduces the probability of exiting international markets. Two main explanations can be postulated for this finding. First, there is a portfolio argument. Specifically, if covariance of firm sales across countries (products) is not perfect, then a larger spread of these sales over countries (products) will be associated with more stable total sales and this can be expected to result in higher likelihood of remaining active, in general, and in international markets, in particular (see Hirsch and Lev, 1971; Bernard and Jensen, 2002). Second, there is an efficiency argument. Heterogeneous firm models highlight that only the more productive firms are able to pay the sunk costs to enter export markets. This has a natural extension into a multi-country (multi-product) setting. Thus, if adding a new destination country (product) requires incurring in specific sunk costs of entry, then trading with a larger number of countries (a larger number of products) will reflect

higher productivity (see Bernard et al., 2006). Diversified, more productive firms are precisely those which are more likely to survive. Moreover, these firms may have access to resources that can reduce the exit probability in case of a negative shock to one country (product) market (see Jovanovic, 1993; Bernard and Jensen, 2007).

Table 4

Baseline Estimates					
Explanatory Variables	(1)	(2)	(3)	(4)	(5)
Number of Countries	0.654*** (0.011)	0.686*** (0.012)	0.690*** (0.012)	0.730*** (0.013)	0.761*** (0.013)
Number of Products	0.987*** (0.002)	0.984*** (0.002)	0.984*** (0.002)	0.986*** (0.002)	0.988*** (0.002)
Employment		0.881*** (0.005)	0.877*** (0.006)	0.886*** (0.006)	0.899*** (0.006)
Age 1: 6 to 10 years			1.140*** (0.023)	1.091*** (0.022)	1.014 (0.019)
Age 2: 11 to 20 years			1.010 (0.025)	0.954* (0.024)	0.919*** (0.023)
Age 3: More than 20 years			1.100*** (0.035)	1.033 (0.033)	0.933** (0.030)
Export Initial Value				0.924*** (0.003)	1.032*** (0.006)
Export Current Value					0.865*** (0.006)
Year Fixed Effects	No	No	No	No	Yes
Frailty	No	No	No	No	No

Source: Own elaboration on data provided by PROMPERU and SUNAT.

The table reports Cox Proportional Hazard estimates (hazard ratios). All variables but age are expressed in natural logarithms. Age 0: 1 to 5 years is the omitted category. Robust standard errors clustered on firms are reported below hazard ratios between parentheses. * significant at 10% level; significant at 5% level; *** significant at 1% level.

More specifically, selling to a larger number of countries diminishes this probability more than selling a larger number of products. This may reflect either that shocks are less correlated across countries for given products than across products for given countries, so that exporting to more countries has a larger stabilizing effect on total external sales than just exporting more products, or that firms spreading their exports over more countries are more productive than those diversifying over products, which would be the case if specific sunk costs incurred when incorporating new destinations are larger than those faced when adding new products.

As expected, size as measured by employment and the current scale of export operations improve the chances of survival. There are several reasons for this to be the case. First, large firms are more likely to operate at a minimum efficient scale and accordingly are a priori in a better position to survive. In addition, if firms learn about their abilities and revise their estimations over time, then firms that grow and become larger are those that have received favorable information and have better expectations about efficiency, and should accordingly face a lower likelihood of exit in the next period than those that do not (see Dunne et al., 1989; Mata et al., 1995)¹⁹. This is specifically true for infant industries in developing countries, i.e., a large post entry size implies that the firm has been able to learn and adapt in such an uncertain environment (see Das and Srinivasan, 1997). Smaller firms, in contrast, employ the less able managers, who are likely to incur in larger mistakes when estimating the true ability level, and would be the first to exit when wages grows and the opportunity cost of being an entrepreneur increases (see Mata and Portugal, 1995). Moreover, large firms may have better access to capital or labor markets, which improves their chances of survival (see Esteve Pérez et al., 2004). Further, large firms might be expected to use more capital intensive methods. As a consequence, their variable costs represent a smaller proportion of their total costs. This makes them less sensitive to price declines (see Mata and Portugal, 1995)²⁰.

In contrast, initial export volumes elevate the risk of exiting. In general, the literature reports that the initial scale of operation is negatively related with this risk (see, e.g., Audretsch, 1991; Audretsch and Mahmood, 1994; and Disney et al., 2003). Small initial size can be the consequence of limits from both the supply and the demand size. Thus, entering at smaller scale can be result of lack of internal finance and/or imperfections in capital markets (see Holtz-Eakin, et al., 1994). Further, entrants that are less optimistic about their unknown cost efficiency may rationally decide limit themselves by starting out small. In proceeding this way, they reduce their sunk commitment, but face higher unit costs. These firms are therefore expected to be less able to stay in the market in the event of reactions by incumbents or market developments leading to unexpected losses, even for short periods (see Mata and Portugal, 1995). On the contrary, large scale entry may reveal greater a priori expectations of positive profits and more periods with bad results are required to overweight these expectations (see Frank, 1988; and Caves, 1998). On the other hand, in an uncertain environment buyers that must make irreversible investments in training suppliers may opt for starting business relationships at a small scale (see Rauch and Watson, 2003). In this case, smaller initial sizes are also associated with higher exit rates and shorter duration.

As can be seen from comparing estimates in Columns (4) and (5) of Table 4, the difference between previous empirical findings and ours can be traced back to the fact that we simultaneously control for current exports. Thus, our results should be interpreted as suggesting that, among firms that, at a certain period, have a given size and have reached a given scale of operation, those that have started out smaller and hence have experienced a higher post-entry growth face a higher probability of remaining active in international markets (see Mata et al., 1995). Alternatively, a large entry size for a given post-entry size can be viewed as

19. This is also consistent with Lucas (1978), who argues that the size distribution of firms is determined by their relative efficiency.

20. Bernard et al. (2006) find that firms are more likely to drop products the smaller is the production of the good by the firm and the shorter is the firm's tenure in producing the good.

signaling a slow growing firm facing negative shocks, which eventually lead to exit. In particular, fluctuations in industry-wide shocks tend to be more common in developing countries such as Peru. In this context, large entry size may become a liability as it may negatively affect flexibility to timely respond to these shocks and thereby firms' survival chances (see Das and Srinivasan, 1997)²¹.

Finally, we find that age has a positive effect on duration, i.e., older firms are more likely to survive. These firms have more precise information on their intrinsic productivity and are therefore less likely to fail, i.e., their future expectations of cost efficiency are less likely to be below that level that would induce exit (see Evans, 1987; Fariñas and Moreno, 2000; and Disney et al., 2003)²². This is the case when firms learn about their efficiency level through production over time as in Jovanovic's (1982) model²³.

We have performed several robustness checks. In Table 5, we control both for macroeconomic conditions including year-fixed effects and for unobserved heterogeneity. Estimates shown there confirm our main findings²⁴. In Table 6, we use alternative export diversification indicators. More concretely, we include the Herfindahl and Gini indexes computed over exports by countries and exports by products as explanatory variables instead of the number of countries and the number of products, respectively. Notice that an increase of these indexes corresponds to a decrease in export diversification along the relevant dimension. Thus, as before, larger diversification (smaller concentration) reduces the probability of exiting export markets and this reduction is larger for firms diversifying on the country-extensive margin. The same holds when we proxy diversification with the number of continents the firms export to and the number of industries (at the 2-digit level) in which they appear as active exporters and a combination of the latter with the number of countries. Summing up, there is strong evidence indicating that our main results are robust across alternative specifications

21. This would be the case if Jovanovic's (1982) model were extended to allow for contemporaneous shocks such as fluctuations in market demand or costs (see Das and Srinivasan, 1997).

22. Stinchcombe (1965) identifies four reasons for new firms to be more likely to fail than older firms, i.e., "liability of newness". First, new firms depend on new roles and tasks that have to be learned at some cost. Second, some roles may need to be invented and this may conflict with constraints on resources. Third, social interactions in new firms may lack the required common normative basis or informal information structure. Finally, stable relationships with clients and providers are not established.

23. Strictly speaking, Jovanovic's (1982) model predicts a negative relationship between age and hazard rates if the required efficiency level below which exit occurs (the failure boundary) does not increase (decrease) rapidly with age (see Dunne et al., 1989; and Disney et al., 2003). Some studies have however found that the probability of exit increases with age, i.e., there might be a "liability of senescence" (see Hannah, 1998). This would be the result of erosion of technology, products, business concepts, and management strategies over time or, in the case of owner-managed firms, problems in finding a successor (see Esteve Pérez et al., 2004).

24. We have also performed these estimations in a discrete time framework. Estimation results, which are similar to those presented here, are available from the authors upon request.

Table 5

Robustness Check I: Macroeconomic Conditions and Unobserved Heterogeneity			
Explanatory Variables	(1)	(2)	(3)
Number of Countries	0.761*** (0.013)	0.759*** (0.014)	0.744*** (0.014)
Number of Countries	0.988*** (0.002)	0.986*** (0.001)	0.985*** (0.001)
Employment	0.899*** (0.006)	0.876*** (0.007)	0.890*** (0.007)
Age 1: 6 to 10 years	1.014 (0.019)	1.238*** (0.025)	1.208*** (0.025)
Age 2: 11 to 20 years	0.919*** (0.023)	0.923*** (0.031)	0.92*** (0.031)
Age 3: More than 20 years	0.933** (0.030)	0.816*** (0.039)	0.864*** (0.040)
Export Initial Value	1.032*** (0.006)	1.072*** (0.008)	1.067*** (0.008)
Export Current Value	0.865*** (0.006)	0.818*** (0.008)	0.817*** (0.008)
Year Fixed Effects	Yes	No	Yes
Frailty	No	Firm	Firm
Test Statistic (Chi-Squared) p-value		49.582**** [0.000]	45.894*** [0.000]

Source: Own elaboration on data provided by PROMPERU and SUNAT.

The table reports Cox Proportional Hazard estimates (hazard ratios). All variables but age are expressed in natural logarithms. Age 0: 1 to 5 years is the omitted category. Robust standard errors clustered on firms are reported below hazard ratios between parentheses. * significant at 10% level; significant at 5% level; *** significant at 1% level.

Table 6

Robustness Check II: Alternative Diversification Measures				
Explanatory Variables	(1)	(2)	(3)	(4)
Herfindahl Countries	5.112*** (0.068)			
Herfindahl Products	1.512*** (0.070)			
Gini Countries		8.810*** (0.133)		
Gini Products		1.871*** (0.051)		
Number of Countries			0.747*** (0.014)	
Number of Sectors			0.953*** (0.004)	0.949*** (0.004)
Number of Continents				0.611*** (0.026)
Employment	0.887*** (0.007)	0.871*** (0.007)	0.885*** (0.007)	0.871*** (0.007)
Age 1: 6 to 10 years	1.210*** (0.025)	1.208*** (0.025)	1.214*** (0.025)	1.218*** (0.025)
Age 2: 11 to 20 years	0.913*** (0.031)	0.907*** (0.031)	0.914*** (0.031)	0.909*** (0.031)
Age 3: More than 20 years	0.856*** (0.040)	0.853*** (0.040)	0.857*** (0.040)	0.862*** (0.040)
Export Initial Value	1.072*** (0.008)	1.070*** (0.008)	1.065*** (0.008)	1.067*** (0.008)
Export Current Value	0.799*** (0.008)	0.794*** (0.008)	0.816*** (0.008)	0.804*** (0.008)
Year Fixed Effects	Yes	Yes	Yes	Yes
Frailty	Firm	Firm	Firm	Firm
Test Statistic (Chi-Squared) p-value	42.231*** [0.000]	41.140*** [0.000]	43.231*** [0.000]	46.127*** [0.000]

Source: Own elaboration on data provided by PROMPERU and SUNAT.

The table reports Cox Proportional Hazard estimates (hazard ratios). All variables, but Herfindahl and Gini Indexes and age, are expressed in natural logarithms. Age 0: 1 to 5 years is the omitted category. Robust standard errors clustered on firms are reported below hazard ratios between parentheses.

* significant at 10% level; ** significant at 5% level; *** significant at 1% level.

5. Concluding Remarks

Survival in export markets is challenging. According to data from Peru, the median duration of a firm export spell is only one year. While extensive research on entry and exit patterns of firms in manufacturing industries within countries is available, little is known about duration of firms' business relationships with foreign partners and its determinants, especially in developing countries. This is rather striking as recent studies have shown that this factor may have important consequences in terms of firms' employment and output and even in terms of countries' overall export performance. This paper has therefore aimed at filling the aforementioned gap in the literature examining export duration using highly disaggregated export firm-level data from Peru over the period 2000-2006 and assessing whether the type of diversification contributes to explain the survival of firms in international markets.

We find that both geographical diversification and product diversification of exports increase the chances of remaining an exporter and, specifically, that exporting to a larger number of countries and, in particular, having a less concentrated distribution of exports across countries decreases the exit risk more than exporting a larger number of products or having a more balanced export bundle in terms of goods. Moreover, older and larger firms in terms of their number of employees as well as firms with larger current exports are more likely to survive in international markets. The opposite is true for exporters that start up large. We believe that our findings provide valuable insights for an effective export promotion policy in developing countries comparables to Peru.

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