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Old Firms and New Products: Does Experience Increase Survival?

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Abstract

We examine the relationship between exporting experience and the duration of firm export product flows. We find that more experienced firms (in years of exporting) show a higher probability of failure associated with the introduction of new products. On the other hand, firms with broader export scope are more likely to have better survival times for newly launched products. Although apparently counter-intuitive, we show that this finding is consistent with models of multi-product firms in which firms begin exporting by launching the products closest to their core competency and gradually expand their range of products by exporting those that are further away from their core, resulting in lower survival probability for later products. Validating this interpretation, we show that the distance of the new products to the core competency of the firm plays an important role in determining the survival of new products.

JEL Classification: F10
Keywords: Duration of Trade, Firm Survival, Export Experience, Multi-product firms

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1 Introduction

Although exporting status at the firm level has been found to be extremely persistent, analysis at the product level, using either country or firm trade flows, has consistently shown evidence of high hazard rates, particularly in the first two years of a trade relationship. This paper aims to reconcile these apparently conflicting findings by exploring the link between the firm's previous export experience and the survival times of new products it introduces to the export market. Although firm experience has frequently been postulated as having a positive effect on firm export activity, this is the first time a direct measure of experience - computed as years of exporting - has been used to address this issue. In contrast to the positive effects of firm size, export scope and diversification on export survival, we find that years of experience as an exporter reduce the survival time of newly launched products.

The study of the duration of trade is an emerging but fast growing sub-field of the trade literature. All papers analyzing this phenomenon point to the fact that the duration of trade is much shorter than predicted by the hysteresis of trade literature (see e.g., Baldwin, 1988; Baldwin and Krugman, 1989; Dixit, 1989). The idea behind the hysteresis hypothesis is that becoming an exporter is costly: firms have to meet market-specific standards and regulations, adapt their packaging, establish distribution channels, accumulate information and so on. In addition, firms face uncertainty about future demand conditions. As a consequence trade relations tend to be stable and unaffected by large shocks.

When looking at the duration of trade at the product or firm level, however, considerable turnover with new suppliers entering and exiting each year has been observed in multiple studies. The seminal papers on this topic by Besedeš and Prusa (2006a, 2006b) found that, regardless of the level of aggregation, more than half of trade spells are just one year long. This analysis at the country-product level was followed by firm-level studies where there is evidence of considerable product churning with varieties regularly introduced and dropped by firms (Iacovone and Javorcik, 2010). In addition, survival times of export relationships are found to be short, regardless of whether these are measured at firm-level (see e.g., Volpe-Martincus and Carballo, 2009), firm-product level (see e.g., Görg, Kneller and Muraközy, 2012) or firm-market level (see e.g., Esteve-Pérez, Pallaro-Lopez and Requena-Silvente, 2013).

One of the main conclusions of the firm as well as country level studies is that surviving the first year is the most difficult and that product and geographic diversification increase export survival (see e.g., Volpe-Martincus and Carballo, 2009). In general the existing literature points to some indicative evidence of a positive relationship between exporting experience and the persistence of firm export status (and firm export growth). However, the measures used to date focus predominately on firm size and scope rather than time spent exporting.[1] This is consistent with the stability of many trade relationships at the country and firm level but still leaves something of a puzzle in terms of the very short durations of individual product flows.

This paper examines the survival of new export product launches at the firm level and shows that how firm experience is measured can result in different effects. We mainly focus

[1] Focusing on market survival rather than new product launches, Aeberhardt et al. (2018) measure experience as the interaction of past export status with firms' total export experience; Araujo et al. (2016) define experience as the number of similar destinations the firm already serves; Albornoz et al. (2016) use export survival time, number of export markets, number of previous incursions and export exposure.

on a direct measure of firm expertise by calculating how long the firm has been an exporter before a new product launch and how this experience over time affects the survival duration of the new products. Given that the initial discovery of market opportunities, competition levels and costs would occur as a firm enters exporting or launches a new product, the time dimension of export experience is likely to be important. Furthermore, export sales growth has been observed to be fastest in the early years after firm export entry, further demonstrating a time element to experience. We also examine how expertise coming from firm size and product diversification affects the new product survival. This paper therefore extends the existing literature by disentangling the effects of time spent accumulating export experience from measures of size and diversification.

The starting hypothesis that more experienced exporters would have longer lived products due to lower search costs is strongly rejected. In fact, more experienced (in years of exporting) firms show higher probabilities of failure associated with their introduction of new products. On the other hand, firms with broader export scope, in terms of the number of products they already export, are more likely to have better survival times for newly launched products.

Although our results initially appear counter-intuitive, they are consistent with the predictions of models such as the Melitz (2003) exporting threshold model and the Eckel and Neary (2010) and Bernard, Redding and Schott (2011) models of multi-product firms. This is because, as more experienced exporters diversify and expand their exports, the newly introduced products are more likely to be smaller and less closely aligned to the firm's core competencies. The survival probabilities of these more marginal products are therefore lower, even when the firm itself is a well-established exporter.

Similarly to Goya and Zahler (2017), we find that measuring the "proximity" or similarity of the new product to the core product of the firm is an important predictor of survival time, a finding that we use to motivate the interpretation of our central finding of the negative effect of experience. We use a detailed measure of similarity across all products constructed by Hidalgo, Klinger, Barabási and Hausmann (2007). Further evidence for our interpretation of the results is given by the finding that the more common measure of experience, product coverage, is non-linear in its effects with the benefits of scope eventually reaching a maximum, after which the distance of new products to the core competency perhaps starts to outweigh the benefits of expertise.

This approach expands on the paper by Görg et al. (2012) who measure the firms expertise as the number of products a firm was exporting before introducing a given product. They use this measure as a test of the theoretical predictions of Bernard et al. (2011) who predict that after trade liberalization multi-product exporters will shift resources towards their core products. Görg et al. (2012) find that the later the firm started to export a product (taken as a proxy for it being further from their core competency), the higher is the hazard of this product being dropped confirming the predictions of Bernard et al. (2011). In addition, Görg et al. (2012) check whether exporting products within the same sector affects export survival and find that previous experience has a strong positive effect on export survival.

Our paper is based on transaction level export data for Irish firms, combining detailed trade records at the firm-product level with firm characteristics from the Census of Industrial Production. The product information is disaggregated to the HS 6-digit level and adjusted to ensure maximum continuity of product definitions over time. Critically for the analysis of survival and experience, the data covers a long time span from 1996 to 2015. This allows us to chose a start date of 2006 from which we examine new product launches and uniquely use

information on the firm history prior to the start of this sample period, circumventing one of the most common problems associated with the censoring of this type of data.

Finally, with a long data series available, we are also able to validate our results further by carrying out a cohort analysis where we evaluate how product survival varies across the firm lifetime. This again allows us to separate the effects coming from time in the export market from changes in other aspects of the firms export performance. The results from this show that, for the same firm, the survival of products launched at the beginning of its export activity is longer than that of products launched later on.

The paper is structured as follows: we begin by describing the main firm data and supporting measures of proximity in Section 2. Section 3 presents the main results on the survival of export products. The alternative estimation strategy based on the analysis of firm cohorts is presented in Section 4. A range of robustness tests are discussed in Section 5 and Section 6 concludes.

2 Data and summary statistics

2.1 Data

Our principal source of information is confidential customs data on Irish firms from the Central Statistics Office (CSO). This covers statistics at the product level on merchandise exports of manufacturing enterprises in Ireland which we match with enterprise accounting variables (collected via the Census of Industrial Production). This linked data set covers the period from 1996 to 2012 on enterprise characteristics and the period from 1996 to 2015 on trade statistics. The availability of data at the enterprise-product level provides a significant degree of additional information on export activity and firm performance which has rarely been available in the past.[2]

We use the data provided by the CSO to calculate the duration of trade as well as firm experience. We define firm experience as the number of years a firm has been an active exporter before launching exports of a particular product. In addition, we use product diversification (measured by the initial number of products exported) as a further expertise measure. Finally, we calculate the initial value of exports by product to account for the fact that more experienced firms face lower uncertainty and therefore tend to have larger values of their initial exports by product. New firms, on the contrary, start by attempting small-scale projects. This has been shown to affect the products chances of survival (see e.g., Rauch and Watson (2003), Besedeš and Prusa (2006b) and Araujo, Mion and Ornelas (2016)).

We define the duration of exports as the number of years a trade relationship has been active. In survival analysis, a terminological distinction is made between a "relationship" and a "spell". Each export relationship may consist of a single spell or of multiple spells. The latter occurs when exports are stopped and restarted later on. This distinction, however, as reported in Besedeš and Prusa (2006b) has only a very small impact on the results of most of the trade survival studies. Therefore, in the core of our analysis we use trade relationships

[2] A detailed description of the patterns of trade - particularly of Irish-owned firms - coming from this data is provided by Lawless, Siedschlag and Studnicka (2017).

(single spells) rather than multiple spells, meaning that we do not take into account breaks in between spells. We will control for multiple spells in our robustness checks.

To calculate the duration of firm-product trade we need to take into account several data issues. First, in common with other European countries, the Irish trade data is collected through two different systems. The Extrastat survey collects extra-European trade and the Intrastat survey gathers data for intra-European trade. The threshold for reporting of exports differs between the two systems, with Intrastat requiring an exporting volume of above €635,000 per annum whereas the Extrastat threshold is considerably lower and collects information on all transactions above €254. To account for this issue, as one of our robustness checks we divide companies into intra and extra-EU exporters. Our results show that this issue does not affect our results.

Second, foreign trade data is recorded at the 8-digit level in the CN classification. Its main inconvenience is that some of the categories change every year reflecting changes in products. Since these changing CN codes might bias our calculations of the length of trade spell, we use concordance tables to transform the classification backwards to a constant CN 1996 terminology. We take a conservative approach to this by limiting the product scope to products existing in 1996. Re-coding CN 8-digit products implies replacing code at time t backwards to $t-1$. That means that re-coding the last year in our sample (2015) requires going back year by year from 2015 to 1996, applying 19 transformations. This procedure creates a problem when trying to replace codes from a shrinking category (i.e., when two or more CN codes at the time $t-1$ were replaced by only one CN code at the time t). In this case we merge them into one of the former codes. In addition, in order to avoid an excessive product entry/exit due to this high level of disaggregation (see e.g., Besedeš and Prusa, 2006a) we aggregate our product level data to HS 6-digit level product categories.[3]

Finally, our last data issue is the fact that we have no information about the trade relationships before 1996 (left-censored observations) and after 2015 (right-censored observations). Survival analysis solves the problem of right-censored observations (see e.g., Hosmer et al., 2011), but not of the left-censored ones. Left-censoring is not an issue in the first part of our analysis (Section 3) as we exclude first ten years of the data in order to calculate firm experience (as explained below). It is however an issue in our alternative firm cohort analysis. To deal with it, we include only firms that starting to export after 1996 from our analysis in Section 4.

2.2 Key variables and summary statistics

The main research question of this paper is the impact of firm experience on trade survival. Therefore, we exclude the first ten years of our data from the calculation of export survival. We do this to generate our experience variable. Hence, we calculate firm experience from 1996 on, and export duration from 2006 on.[4] It means that our maximum firm experience is

[3] In our robustness checks we aggregate our data even further, to SITC 4-digit classification. These results are available on request.

[4] Note that there is no need to control for left-censoring to calculate firm level experience as keeping firms active in 1996 makes our main finding even more robust.

20 years whereas our maximum spell length is ten years.[5]

Since the core of our survival analysis takes into account period 2006-2015, we report the summary statistics for this period (i.e., single spells starting in 2006). Our final data set consists of 9,906 firms: 991 firms on average per year. Each firm exported on average 12 products, and the average value of exports by firm was €860,602 (see Table A.1 and Figure A.1 in the Appendix).

Table 2.2 presents summary statistics for export survival, comparing firm categories based on number of years of exporting, number of products (at the start of a product spell) and broad divisions of initial value.[6] It shows that an average firm-product flow survives 2.06 years. The average duration declines somewhat with years of firm experience and increases (very slightly) with product range. Higher initial values are associated with longer average product duration times. However, contrary to the predictions of Rauch and Watson (2003), the initial value of exports decreases with firm's experience. In general, more experienced firms start new spells with much lower initial value compared to less experienced firms. The ratio of the initial value of exports for the most experienced firms to the value of exports of the least experienced firms is 0.11, and to the second group 0.62 (see Table A.2 in the Appendix for more details).

Table 1: Average and median survival by firm category

Experience group	Average	Median	Number of spells
	Firm categories		
1-5 years	2.57	1	8,894
6-10 years	2.06	1	6,313
>10 years	1.86	1	23,157
1-3 products	1.98	1	2,887
4-12 products	2.06	1	8,950
>12 products	2.07	1	26,527
	Product categories		
< €5,140	1.82	1	24,084
€ 5,140 – € 32,245	2.17	1	8,045
> € 32,245	2.84	2	6,235
All	2.06	1	38,364

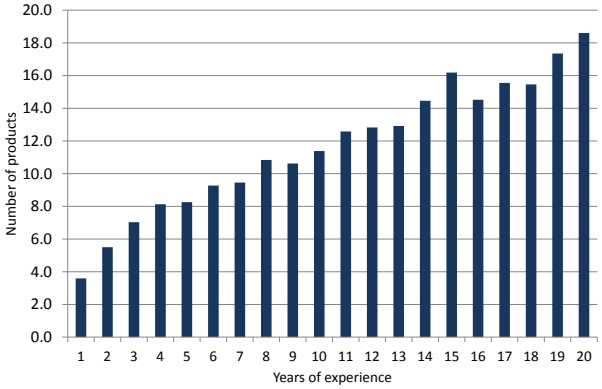
Source: Own calculations based on the CSO data (2017)

Although we find that average duration has opposite relationships with firm experience and scope, there is summary evidence of a link between the number of products exported and years of experience. A firm with one year of experience exports less than four products on average, whereas a firm with 20 years of experience exports 18.6 products on average (see Figure 1). Note however that the number of products does not expand linearly with years of experience - firms with two years experience typically export just over five products, those with five years experience export eight and those with ten years experience export eleven so the pace of additions to the export scope flattens slightly over time.

[5]Note that in Section 4 we calculate trade duration for the period 1997-2015 for firms who have built at least 10 years of experience throughout the sample period.

[6]Each of the measures divides firms into three categories containing around 1/3 of firms.

Figure 1: Average number of products exported by years of experience



Source: Own calculations based on the CSO data (2017)

In addition to the trade data, we use the proximity measure constructed by Hidalgo et al. (2007).[7] It is based on the idea that two products that require similar institutions, capital, infrastructure, technology, etc. are likely to be produced in tandem (similar goods). Dissimilar goods, on the other hand, are less likely to be co-produced.

Formally the proximity ϕ between products i and j is the minimum of pairwise conditional probabilities of a country exporting a good given that it exports another at the SITC 4-digit level.

$$\phi_{i,j} = min\left\{P(RCAx_i \mid (RCAx_j), P(RCAx_j \mid (RCAx_i)\right\} \tag{1}$$

Where RCA is revealed comparative advantage defined as follows

$$RCA_{c,i} = \frac{x(c,i)}{\sum_i x(c,i)} / \frac{\sum_c x(c,i)}{\sum_{c,i} x(c,i)} \tag{2}$$

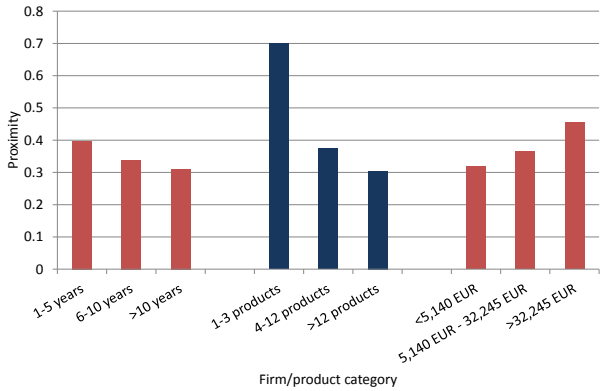
Hidalgo et al. (2007) generate proximity measures between all SITC 4-digit level products using world trade flows. We apply this to captures the proximity of each new product introduced by firm at time t to its core product. We define the firm's core product as being its product with the largest export value at SITC 4-digit level. The proximity measure varies between 0 and 1. In our data, the average proximity is of a new product when it is launched is 0.35 and the median proximity is 0.28.

Figure 2 relates average proximity of a product to a number of firm experience measures based on our descriptive statistics described above: firm export experience, number of products exported, and initial value of exports by product. This figure shows that the average proximity decreases with firm experience, the number of products exported and the number of destination markets and increases with the initial value of exports by product.

To sum up, more experienced and diversified firms move further away from their core products and tend to start smaller with each additional product.

[7]The data is available to download at http://www.chidalgo.com/productspace/data.htm. This indicator uses as its basis the concept of revealed comparative advantage (RCA) developed by Balassa (1965), which measures whether country c exports more of good i as the share of its total exports than the average country.

Figure 2: Average proximity by firm category



Source: Own calculations based on the CSO data (2017)

3 Analysis of export survival

In the first part of this section we use survivor function estimators to examine export product survival and link it to the potential explanatory factors described above. In the second part of the section we use regression analysis to look at the determinants of export survival controlling for a wider range of firm characteristics.

3.1 Evidence on product survival

We start our analysis by computing and plotting export survivor function estimators for a number of categories. Since our export data is recorded in one year time intervals, we estimate the survivor functions using the life table estimator for the period 2006-2015. This method is similar to the Kaplan-Meier (1958) product-limit estimator used for continuous data but adjusts for the fact that exports flows could have ended at any point during the one year interval.

The survivor function $S(t)$ is obtained, at any point of the time t, as the cumulative probability of survival up to this point. Defining N_j as the number of spells at risk at the beginning of interval i_j, d_j as the number of failures; and n_j the adjusted number of spells at risk at the midpoint of the interval.[8] The life table estimator of the survivor function can be defined as

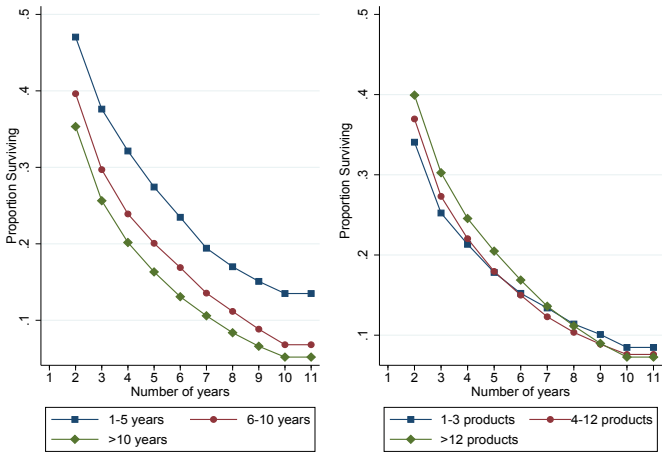
$$\hat{S}(t) = \prod_{i=1}^{j} \frac{n_i - d_i}{n_i} \tag{3}$$

Our first plot (Figure 3) shows the graphical representation of the survivor functions and how they relate to firm experience in terms of years of exporting (left panel) and product scope (right panel). For each measure firms are divided into three groups depending on their

[8] $n_j = N_j - \frac{d_j}{2}$

experience at the beginning of each product spell. Looking at the left figure for years of exporting, we observe that the probability of survival differs reasonably considerably across these three groups.

Figure 3: Survivor function estimators by initial experience group

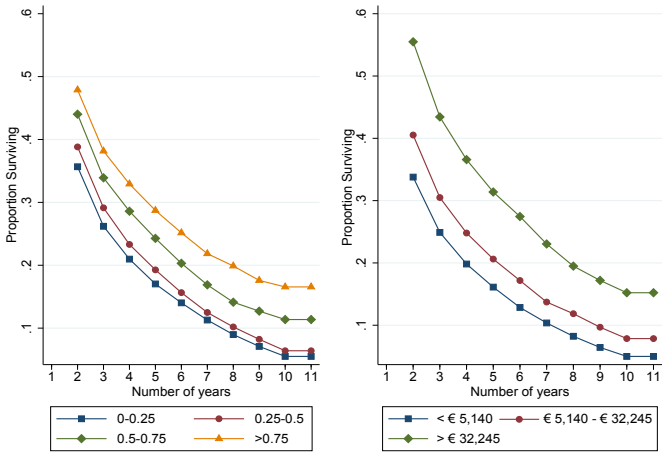


Source: Own calculations based on the CSO data (2017)

Surprisingly, given the expectation from the literature that firms should build export experience over time that would allow them to reduce the costs of launching new products, we find that survival times are higher for the products launched by firms with shorter experience. Only 35% of flows by the most experienced firms survive the first year, whereas among the least experienced ones more than 47% of spells make it to the second year. At the end of the analysis 13% of spells by the least experienced exporters and around 5% of spells by the most experienced ones are still active. In contrast, we see very little difference in the average survival times of products by firms with different initial product coverage.

Two other elements that are expected to have an effect on product survival time are graphed in Figure 4. The left panel shows the survivor function estimators for four categories of products based on their proximity to firm's core product. We divide the proximity measure into four equal groups; recall that this is measured on a scale of 0 to 1, with 1 indicating an identical product and 0 an extremely dissimilar one. The graph of the survivor functions shows that products further away from the core product have a shorter probability of survival. Finally, the right-hand panel shows the differences in survival times by the initial value of the products sales, divided into thirds. In line with our expectations, products with higher first-year export sales are likely to survive longer.

Figure 4: Survivor function estimators by product proximity and initial value



Source: Own calculations based on the CSO data (2017)

3.2 Product survival determinants

To test the factors driving product survival times at the firm level, we use a discrete-time version of the proportional hazard models - the complementary log-log specification (cloglog). This empirical approach has been shown by Hess and Persson (2012) to be the most appropriate methodology for estimating export survival.

We estimate the following model:

$$cloglog[h(j,X)] = \beta' X + \gamma_j \tag{4}$$

where h is the hazard rate, X is a vector of time-varying covariates and γ_j is a set of spell length dummies (to capture the duration dependence). The dependent variable is a dummy equal to one for an ending spell. We treat spells as continuous and ignore breaks between them.[9]

Our explanatory variables include the following firm characteristics: size (measured by employment), productivity (measured by total sales per worker), firm export experience, initial number of products exported by firm, initial value of exports and proximity to the core product. In addition, we include year and HS 2-digit controls and cluster the standard errors by firm.[10]

Table 2 presents our baseline results. We report the exponentiated coefficients, representing the hazard ratio, that is, how the hazard changes if the explanatory variable increases with one unit. Hence, if a coefficient is greater than one, the hazard of dropping a product is increasing and correspondingly the lower is the survival. Conversely a coefficient below one indicates a longer survival time.

[9] We control for multiple spells in our robustness checks.

[10] We estimate a simple form of a complementary log-log model which does not allow us to control for firm heterogeneity. Our results, however, hold for specifications using a random-effects version of the model.

In the first specification (column 1) we control for firm characteristics only (productivity and employment) before beginning to explore the effects of different types of experience and expertise. We then gradually add our main variables of interest (columns 2-6). Our results show that the relationship between the basic firm characteristics and survival times of individual products is not particularly strong. Employment is significant in most of the specifications and the coefficients suggest that products exported by larger firms are more likely to be dropped. Although this is somewhat unexpected, it can be rationalised as being due to larger firms having greater capacity to launch experimental products even if these are at higher risk of failure. Productivity is significant in the first three specifications and has the expected sign with more productive firms having longer surviving products. Once other measures of experience and product coverage are included, however, the significance of the productivity measure drops.

Moving to our main variables of interest we see that the number of products already being exported by the firm at the time that it launches a new product has a consistently positive effect on the duration of the new product. This confirms the findings by Volpe-Martincus and Carballo (2009) who find that diversification reduces the risk of exiting international markets. Likewise, in line with Besedeš and Prusa (2006b) and Besedeš (2008), we find that higher initial export values are associated with longer survival times.

However, when we add our measure of firm experience coming from the number of years the firm was an active exporter from column 4, we find that this has a negative impact on product survival. This is surprising given that experience is generally assumed to have positive effects on the firm's ability to assess market opportunities and to face lower costs of launching an export product. This is the interpretation that would be given to the positive effect of product scope.

A factor that has the potential to reconcile these apparently conflicting results is the level of similarity between the new product and those already exported by the firm. The positive effect of experience and scope would be expected to be more likely to apply to new products if these are similar to the ones already being exported. Adding the measure of proximity between the new product and the core product shows that greater proximity has a clear positive impact on product survival, confirming the findings of Goya and Zehler (2017).

Our results suggest that experienced firms launch products that are further away from their core competency and therefore have a lower probability of survival. This interpretation of the results is in line with theoretical prediction of Bernard et al. (2011) who show that, after trade liberalization, multi-product exporters are more likely to drop products from their export mix which are further away from their product-level expertise.

The final specification reinforces this interpretation as we find that allowing for a non-linear effect of product scope shows significant effects on the squared and cubed terms. The positive effect of exporting many products therefore reduces at a certain point, consistent with our interpretation that the more products a firm exports, the more likely a new product is to be more marginal relative to the core competency of the firm with the corresponding increased risk of product failure.

Table 2: Baseline results

	(1)	(2)	(3)	(4)	(5)	(6)
Employment	0.996	1.021***	1.034***	1.025*	1.023*	1.025*
	(0.004)	(0.005)	(0.005)	(0.014)	(0.013)	(0.013)
Productivity	0.970***	0.974***	0.979***	1.014	1.011	1.010
	(0.006)	(0.006)	(0.006)	(0.015)	(0.015)	(0.015)
Initial no of products		0.943***	0.908***	0.850***	0.831***	0.673***
		(0.006)	(0.006)	(0.017)	(0.017)	(0.060)
Initial exports by product			0.920***	0.922***	0.927***	0.927***
			(0.002)	(0.003)	(0.003)	(0.003)
Initial experience				1.241***	1.226***	1.222***
				(0.028)	(0.028)	(0.029)
Proximity					0.845***	0.843***
					(0.011)	(0.011)
Initial no of products squared						1.102**
						(0.049)
Initial no of products cubed						0.988**
						(0.006)
Observations	60,259	60,259	60,259	60,259	60,259	60,259
No. of spells	38,346	38,346	38,346	38,346	38,346	38,346
Year FE	YES	YES	YES	YES	YES	YES
HS2 FE	YES	YES	YES	YES	YES	YES
Log likelihood	-37629	-37921	-37045	-36251	-36072	-36059

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows exponentiated coefficients. Dependent variable is a dummy equal to one when a spell ends. All variables are in logs.

4 Alternative view: firm cohort analysis

In this section we look at the impact of experience on export survival from a firm cohort perspective. To do this we focus solely on firms about which we know that they have built at least 10 years of experience during the analysed period and look at the survival probability of the products they launch during the period 1997-2015 (we exclude 1996 as well as firms with 20 years of experience (and starting in 1996) to control for left censoring). This allows us to evaluate the impact of export experience on export survival while firms were building it up.

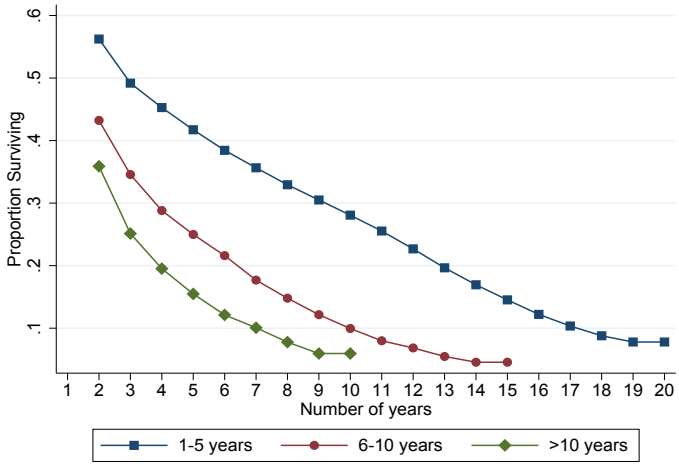
We start by looking at average and median survival for the experience group categories. Here we are looking at the firms in the early (1-5 years), middle (6-10 years) and later (over 10) years of their export career so, unlike in the previous section, we can follow the same firms and look at how the survival time of their products evolved. Table 3 confirms our findings from Section 3. The products launched early in the firm's export life are longer lasting than those launched once the firm has been exporting for a number of years. The variation in average spell length by product scope is limited but the pattern of higher initial values being associated with longer spells is also found when we use this alternative set of the data.

Table 3: Average and median survival, cohort analysis

Experience group	Average	Median	Number of spells
	Firm categories		
1-5 years	5.55	2	6,451
6-10 years	2.94	1	5,675
> 10 years	1.67	1	6,601
1-3 products	3.54	1	1,623
4-12 products	3.93	1	4,781
>12 products	3.16	1	12,323
	Product categories		
< € 5,140	2.76	1	10,854
€ 5,140 – € 32,24	3.46	1	4,260
> € 32,245	5.22	3	3,613
All	3.39	1	18,727

Source: Own calculations based on the CSO data (2017)

Figure 5: Survivor function estimators by cohort



Source: Own calculations based on the CSO data (2017)

We then plot the survivor functions estimators by cohort (Figure 5). Our results confirm our findings from Section 3, export survival of products launched at the beginning of firm's export activity is longer than export survival of products launched later on. Almost 60% of products launched within the first five years survive the first year whereas only 38% of products launched after 10 years of activity survive the first year.

To examine how survival changes for products of the same firms, we estimate two probit models in which we evaluate the probability of surviving the first year and the probability of surviving beyond two years as well as a complementary log-log model for this specific cohort of firms. We show the results of our analysis in Table 4. More precisely, column 1 displays the results of the probit regression where the dependent variable equals one for a spell ending after one year. Column 2 displays results for spells ending after two years. Column 3 displays results from the complementary log-log model. The dependent variable is a dummy equal one when a spell ends. The sample contains all product spells for firms that started to export

between 1997 and 2004 and built up at least 10 years of experience.

Our results confirm the findings from the previous section. Spells starting at the beginning of export experience survive longer than spells staring later on. In addition, exporting more products has a positive impact on export survival but this effect is non-linear. Proximity to the core product has again a positive impact on export survival.

Table 4: Firm cohort analysis

	(1) One year	(2) Two years	(3) Cloglog
Employment	-0.004	-0.011*	1.019
	(0.004)	(0.007)	(0.025)
Productivity	0.008*	0.008	1.043**
	(0.004)	(0.007)	(0.019)
Initial number of products	-0.178***	-0.225***	0.567***
	(0.030)	(0.054)	(0.082)
Initial exports by product	-0.021***	-0.024***	0.909***
	(0.001)	(0.002)	(0.005)
Initial experience	0.274***	0.375***	1.930***
	(0.006)	(0.009)	(0.066)
Proximity	-0.042***	-0.058***	0.812***
	(0.004)	(0.005)	(0.016)
Initial no of products squared	0.052***	0.059**	1.186**
	(0.015)	(0.029)	(0.090)
Initial no of products cubed	-0.006***	-0.006	0.981*
	(0.002)	(0.004)	(0.011)
Observations	68,563	68,547	42,380
No. of spells	17,529	17,517	18,727
Year FE	YES	YES	YES
HS2 FE	YES	YES	YES
Spell length dummies			YES
log likelihood	-28925	-31307	-23612

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Dependent variables are dummies equal to one: column 1: spell ending after one year; column 2: spell ending after two years; column 3: dummy equal to one when a spell ends. All variables are in logs. Columns 1 and 2 show marginal effects. Column 3 shows exponentiated coefficients.

5 Robustness checks

In this section we present several robustness checks to examine if the effects identified previously hold for different sub-sets of the data and if they are affected by our measurement of the spell length.

In Table 5, we first look at a breakdown of the data by firm nationality of ownership, with column 1 containing the results for Irish firms and column 2 the results for non-Irish firms. This division is motivated by the structure of the Irish exporting sector, which is characterized by a large number of foreign-owned exporters. As our construction of the measure of experience for multinationals only applies to the length of time they have been exporting from

their Irish base, it may be understated relative to the firm's overall international experience. However, this issue does not appear to impact the main pattern of our results, with the two columns showing that the hazard of a product being dropped increases with firm experience for both types of firms. The main difference in the results by firm ownership is that the initial number of products is insignificant for non-Irish firms. It is not entirely clear why this might be the case, although one potential explanation is that decisions on new product production are being taken at a headquarter level rather than by firm's Irish base.

Specifications 3 and 4 divide firms into intra-EU (column 3) and extra-EU (column 4) exporters to account for the difference in reporting thresholds for both kinds of exports. The broad pattern of results remains robust although experience has a larger coefficient for firms exporting to the EU. The main difference of note between these specifications is that the initial number of products has the opposite sign for intra-EU exporters, switching to reducing the duration of export spells if the firm exports many products. Although this is consistent with our finding that years of experience may result in newly launched products being more marginal to the firm and therefore at greater risk of exit, it is not clear why this effect would apply to product scope only for intra-EU exports and may be related in part to the difference in data collection thresholds.

Specifications 5-8 use multiple spells rather than single spells. Column 5 uses all spells including when there are breaks and column 6 further adds a dummy for when the same product returns. In addition, specifications 7 and 8 control for the fact that some breaks between spells can be mis-measured (for example driven by the fact that firm may have fallen under the threshold of reporting).[11] Thus, in order to examine truly multiple spells we take into account only spells with a break of at least 2 years (column 7) and at least 3 years (column 8). The results across all specifications are extremely similar, indicating that the definition of the spell length is not a driving factor behind our results.

Proximity and initial export sales have almost identical effects in all specifications.

[11] See e.g., Besedeš and Prusa 2006b for more details.

Table 5: Robustness checks

	(1) (Irish)	(2) (non-Irish)	(3) (intra-EU)	(4) (extra-EU)	(5) (Multi. spell)	(6) (Multi. spell)	(7) (Multi. spell)	(8) (Multi. spell)
Employment	1.017	1.007	1.021	1.063***	1.035***	1.036***	1.042***	1.042***
	(0.018)	(0.021)	(0.016)	(0.020)	(0.011)	(0.011)	(0.011)	(0.011)
Productivity	0.993	1.007	1.020	1.006	0.999	1.002	1.003	1.003
	(0.022)	(0.019)	(0.018)	(0.024)	(0.011)	(0.012)	(0.012)	(0.011)
Initial number of products	0.595***	1.108	1.453*	0.609***	0.694***	0.760***	0.759***	0.761***
	(0.056)	(0.309)	(0.307)	(0.069)	(0.024)	(0.028)	(0.030)	(0.037)
Initial exports by product	0.912***	0.939***	0.927***	0.943***	0.917***	0.918***	0.916***	0.915***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Initial experience	1.148***	1.319***	1.275***	1.097***	1.180***	1.191***	1.175***	1.168***
	(0.024)	(0.059)	(0.035)	(0.033)	(0.021)	(0.022)	(0.018)	(0.018)
Proximity	0.835***	0.864***	0.828***	0.873***	0.869***	0.873***	0.885***	0.884***
	(0.014)	(0.016)	(0.013)	(0.018)	(0.010)	(0.010)	(0.011)	(0.011)
Initial no of products squared	1.181***	0.946	0.861*	1.141*	1.102***	1.065***	1.064***	1.064**
	(0.064)	(0.104)	(0.076)	(0.078)	(0.021)	(0.023)	(0.022)	(0.026)
Initial no of products cubed	0.977***	1.002	1.013	0.985	0.988***	0.991**	0.991***	0.991**
	(0.009)	(0.013)	(0.011)	(0.011)	(0.003)	(0.003)	(0.003)	(0.004)
Returning spell dummy						0.731***	0.691***	0.770***
						(0.019)	(0.019)	(0.030)
Observations	29,037	31,198	47,006	13,240	60,259	60,259	39,921	37,520
No. of spells	18,721	19,463	29,053	9,309	44,008	44,008	33,057	31,220
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
HS2 FE	YES	YES	YES	YES	YES	YES	YES	YES
log likelihood	-17134	-18727	-27880	-7932	-33764	-33633	-21729	-20116

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The table shows exponentiated coefficients. Dependent variable is a dummy equal to one when a spell ends. Column 1: Irish firms; column 2: non-Irish firms; column 3: exporters to the EU, column 4: exporters outside the EU; column 5-6: multiple spells; columns 7-8: multiple spells (break-adjusted). All variables are in logs.

6 Conclusions

In this paper we present new empirical evidence on the relationship between exporting experience and the duration of export relationships at the firm-product level. More precisely, we distinguish between the effect of firm expertise coming from product coverage and the effects coming from the length of time a firm has been engaged in exports.

Our starting hypothesis that more experienced exporters (in years of exporting) would have longer lived products due to lower search costs is strongly rejected. On the contrary, more experienced firms show higher probabilities of failure associated with launching new products. On the other hand, firms with broader export scope are more likely to have better survival times for their new products. The effects of this measure are, however, non-linear. This suggests that the benefits of scope reach a maximum at some point after which the distance of the new products to the core competency begins to outweigh the benefits of the expertise.

Our results are consistent with the predictions of models in which more experienced exporters diversify and expand their export portfolios. Their additional products are, however, more likely to be smaller, less closely aligned to the firm's core competencies with lower survival rates. This adds a new dimension to our picture of how multi-product firms export and suggests that there is much more to be understood about the linkages between product entry, survival and costs of exporting.

A Appendix

Table A.1: Summary statistics 1996-2005

	Mean	Standard dev.	Min	Max	Total
Number of firms	990.6	63.9	891.0	1,115	
Number of products exported	12.3	17.4	1.0	196.3	
Number of destinations	11.3	15.3	1.0	128.9	
Productivity	360	938	6	15,510	
Employment	123	357	1	7,543	120,789
Exports	860,602	4,946,057	1	105,348,997	864,808,812

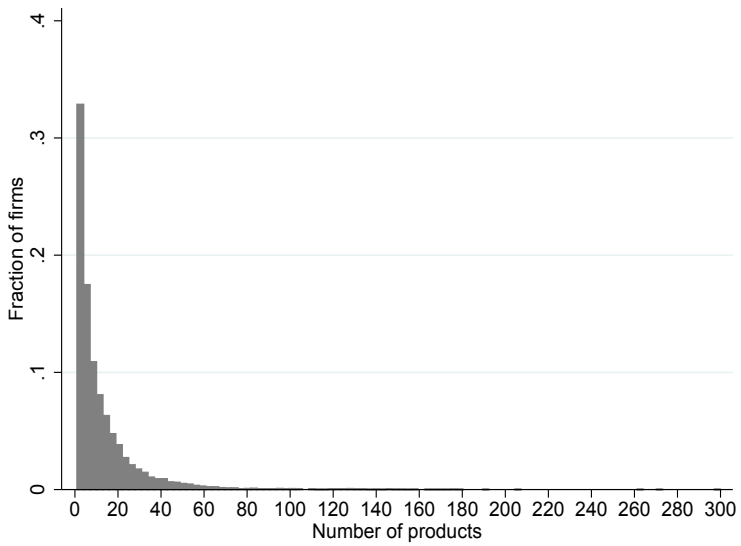
Source: Own calculations based on the CSO data (2017)

Table A.2: Initial export value by firm experience

	Average	Min	Max	Ratio >10 years to:	Ratio 6-10 years to:
1-5 years	1,128,813	1	2,010,098,176	0.11	0.18
6-10 years	201,510	1	647,962,688	0.62	1
>10 years	124,756	1	804,774,848	1	1.62

Source: Own calculations based on the CSO data (2017)

Figure A.1: Distribution of products per firm



Source: Own calculations based on the CSO data (2017)

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