Sequentially Exporting Products across Countries*

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Abstract

Exploiting disaggregated data on French exporters, we show that firms expand their product scope and geographical presence sequentially. This process of internationalization is uneven over time, exhibiting more volatility early than later in the life cycle of exporters. Specifically, young exporters are particularly likely to exit, and if they keep exporting, to expand at the intensive and sub-extensive margins, doing so by widening product scope within a destination before entering new destinations. We also find that firms' core products are particularly resilient despite being used to "test the waters" when entering additional countries. Existing models of firm export dynamics are not designed to explain these empirical regularities. We argue that they can be rationalized by a mechanism where new exporters are uncertain about the profitability of their products in different markets, but learn from their initial export experiences and then adjust their sales, number of products and destination countries accordingly.

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1 Introduction

How do firms enter and expand within and across foreign markets? In an insightful recent survey of the literature on firm dynamics, Alessandria et al. (2021, p. 35) conclude that "despite the careful modeling of entry costs, the literature has largely avoided the treatment of a firm's dynamic decisions across multiple destinations. [...] Answers to key questions [...], such as the effects of bilateral trade wars, may be critically affected by the exact nature of trade costs across destinations and the opportunities for market switching." In this paper, we uncover novel facts about how firms export multiple products across different foreign markets. We show that firm export dynamics involves expansion, as well as contraction, at different (sub-)extensive margins. Over time, some firms reach new destinations and add products to current and new destinations. Meanwhile, others discontinue products, abandon countries, and sometimes quit exporting altogether. Interestingly, this process is much more pronounced for young exporters.

Exploiting data on all French exporters between 1993 and 2006, we start by documenting that, in line with previous research, exporters exhibit significant entry and exit in foreign markets as well as churning of products sold abroad, and that new exporters typically start small in volume, reaching a single market with a single product. Many quickly give up exporting. Conversely, the majority of those that keep serving foreign markets swiftly expand along all these dimensions: total volume, number of products sold abroad, and number of countries served. Moreover, branching out through new products and new countries often follows a sequential pattern, in which most of the expansion that happens early in a firm's export tenure is by adding products instead of countries.

These findings suggest a specific pattern of age dependence whereby there is more volatility in exporters' early years than later. There could be many reasons behind this pattern. We therefore carry out a detailed empirical analysis to scrutinize and refine it. Our methodology extends the approach of Albornoz et al. (2012) to the product dimension, where we compare the dynamics after a firm's first-ever export spell and after subsequent spells with old and new products in old and new destinations. To do so, we define categorical variables for the first year of a spell, the first product sold and the first country served by each firm. Using these variables, as well as double and triple interaction terms, we tease out age dependence in exporters' growth, exit, and entry behavior.

The results broadly confirm the stylized facts mentioned above. Growth in the second year of

the first-ever spell is between 11 and 25 percentage points higher than growth after the second year of other spells with either the same product or country. Young exporters are also substantially more likely to expand scope in their first destination, and to take their first product to other destinations, than experienced exporters, although this last difference is smaller than the previous one. Furthermore, immediate exit is 15 percentage points more likely after an exporter's first-ever export spell than after a later spell with a different product in a different country, and the triple-interaction coefficient shows differential exit in firms' first market and first product of about 6 percentage points.

We show that these novel empirical findings are not driven by firm size or by changes in firms' productivity. They apply both to firms that start exporting very small (the large majority) and to firms that start exporting multiple products to multiple countries, or that are part of a multinational company. They remain valid when we allow for learning from export "pioneers" and when we control for firms' financial constraints. They are also robust to partial-year effect corrections, to different definitions of experienced exporters, and to controlling for a wide set of fixed effects.

This uneven "internationalization path" is difficult to reconcile with standard models of firm export dynamics. In particular, they are inconsistent with the "canonical model of export dynamics," as defined by Alessandria et al. (2021), where firms enter foreign markets in response to productivity shocks, after incurring sunk entry costs. Other mechanisms developed in recent papers could help to explain some of our empirical results, but as we discuss in section 4.2.3, they were not designed to accommodate the dynamics of multi-product firms in multiple destinations.

We discuss one such mechanism in Section 4.2.4, which we develop in detail in the theoretical Online Appendix B (all online appendices are available at shorturl.at/npLY3). It extends the model developed by Albornoz et al. (2012) to incorporate the product dimension. The key assumption is that, upon entry, firms operating a flexible manufacturing technology infer information about their ability to successfully export their core and non-core products in their first foreign destination as well as in other potential destinations. Firms incur fixed costs both to start selling to new countries and to expand/adapt their product scope within destinations. When export profitability is persistent over time and correlated across countries and products, uncertainty and fixed costs create destination and product scope option values for forward-looking firms, which then optimally engage in sequential product-and-destination exporting. Since uncertainty is highest for new exporters,

first-ever export spells are characterized by high initial failure rates. Yet as firms learn their export profitability, if they decide to keep exporting, they tend to expand along all margins, increasing sales of their initial products in their initial destinations, adding products in their initial destinations, and entering new destinations with new and old products. The precise path dependence depends on the relative fixed costs of adding products vs. adding destinations.

After reviewing the literature in the next subsection, the rest of the paper is organized as follows. In Section 2, we document new facts about age-dependence in exporter dynamics at the extensive and sub-extensive margins. In Section 3, we carry out a similar exercise at the intensive margin. In Section 4, we report a series of robustness checks and discuss the interpretation of our results in light of the literature. Section 5 concludes.

1.1 Literature

Our paper connects the literature on firm export dynamics with that on multi-product firms in international markets. The two topics are often studied independently. For example, Alessandria et al. (2021) review the literature on firm export dynamics without explicit reference to multi-product firms. In turn, the literature on multi-product exporters concentrates on cross-sectional facts and steady-state analyses. Our focus on export dynamics of multi-product exporters intersects both lines of research with specific contributions to each of them.

Within the export dynamics literature, one stream emphasizes how geographic interdependence affects firm decisions to export to new countries. For example, Morales et al. (2019)'s "extended gravity" forces imply that entry in a destination facilitates entry in other related destinations according to contiguity, geographical or cultural distances. Defever et al. (2015), Albornoz et al. (2016) and Alfaro Ureña et al. (2021) follow related approaches. While those papers allow for interdependence across destinations, a key distinguishing feature of this paper is that we detect interdependence at the product and destination levels and show that both dimensions are key to understanding firms' export paths.

Another line of research investigates the role of experience and market interdependence under uncertainty. Inspired by pioneering work by Evenett and Venables (2002) and Eaton et al. (2008), Albornoz et al. (2012) develop and test the notion of export experience and profit correlation across destinations as a way to learn profitability in multiple destinations. This mechanism has

been adapted and extended both to explain export dynamic patterns in specific contexts and to explain the process of firm internationalization more generally.[1] While this body of work shows evidence consistent with firms learning their own profitability abroad as they engage in exporting, it does not examine jointly the product and destination dimensions, as we do here.[2]

The literature on multi-product firms in international markets typically focuses on cross-sectional regularities in terms of export product scope, firm productivity, product quality, or the effect of trade liberalization via changes in the product mix.[3] The importance of understanding multi-product exporting is obvious: as Bernard et al. (2018) show, multi-product, multi-country firms account for most of a country's aggregate exports at any point in time. Our paper sheds light on the process through which multi-product firms expand their sales within and across countries. Another contribution is to establish new facts about "core" products in firm export dynamics.[4]

Very few papers within the multi-product firm literature study product-level export dynamics. Notable exceptions are Timoshenko (2015b) and Sheveleva and Krishna (2017).[5] The former finds that the variation in export scope declines with exporters' age in a new destination. This process of new exporters adding and dropping products in foreign countries is rationalized as learning about the "product appeal" of their products, in a context where marginal costs rise with firms' product scopes. Instead, Sheveleva and Krishna (2017) rationalize the same finding assuming that firms know the product appeal but not the value of the "brand" to foreign customers, which can only be unveiled by actual sales. We expand on this research by showing how the decision about adding products interacts with the decision about entry in new countries, creating a process whereby firms expand (and contract) through a broader set of sub-extensive margins.

[1] See, for example, Egger et al. (2014), Conconi et al. (2016), Holloway (2017), Chen et al. (2020), Chen et al. (2022), and Berlingieri et al. (2021).

[2] Several other papers on export dynamics allow for learning, but without interdependence across products or countries. For example, Berman et al. (2019) develop a Bayesian model of learning about product demand and find compelling evidence that French firms adjust volumes in line with that mechanism, especially early in their export-destination spells. Fitzgerald et al. (2019) find that the declining hazard rate over time and the observed quantity and price dynamics in Irish exports are explained by a process of gradual learning about demand, together with investment in marketing and advertising. Other contributions in this line of research include Freund and Pierola (2010), Nguyen (2012), Cadot et al. (2013), Aeberhardt et al. (2014), Timoshenko (2015a), Araujo et al. (2016), Cebreros (2016), Carrère and Strauss-Kahn (2017), Ruhl and Willis (2017), Arkolakis et al. (2018), Li (2018), Lawless and Studnicka (2019), and Esteve-Pérez (2021).

[3] See, for example, Eckel and Neary (2010); Bernard et al. (2011); Dhingra (2013); Qiu and Zhou (2013); Nocke and Yeaple (2014); Mayer et al. (2014, 2021); Eckel et al. (2016); and Arkolakis et al. (2021).

[4] These findings complement the pioneering work of Iacovone and Javorcik (2010), who establish that new exporters usually enter foreign countries with a product already sold domestically.

[5] Outside the trade literature, see Argente et al. (2022) for an insightful analysis of product-level dynamics for multi-product firms.

In Section 4, after presenting our empirical findings in detail, we provide a more targeted discussion of the literature in light of our findings.

2 Export Experience and Extensive Margin Dynamics

Firm export dynamics change substantially as firms acquire experience in foreign markets. We use data on French exports at the firm-product-country-year level between 1994 and 2006[6] to document these changes. In this section, we consider entry and exit patterns at the product-country level.

2.1 Entry

Firms expand their sales abroad largely by branching out products and destinations.[7] In a given destination, firms grow by introducing new products. For a given product, firms expand by reaching new destinations.[8] We document these patterns below.

2.1.1 Firm Expansion at the Product-Destination Sub-extensive Margins

Table 1 reports descriptive statistics about the number of products and countries firms export to, split by exporting age. The upper panel reports statistics on all active new exporters (a firm is excluded from the calculations once it exits). Among the 324,004 age-1 firms, the median number of products, countries and product-country pairs are all 1. Among the 64,543 exporters that are still active 4 years later ('age 5'), the median numbers of products and countries are both 2, while the median number of product-country pairs is 3. The average number in each of those dimensions increases monotonically with export age.

Of course, that increase may capture selective exit of the least profitable firms, which have fewer product-country pairs, rather than a true gradual expansion at the firm level. To see the dynamics net of that selection effect, in the lower panel of Table 1 we report the same statistics for the 40,078 firms that export in the five *consecutive* years (or more) after entry. The median and average numbers of products and countries rise gradually in that sub-population, too.

[6] Online Appendix A provides details on the construction of the dataset and descriptives on aggregate exports.

[7] We use the terms "market," "country" and "destination" interchangeably to denote a customs territory to which firms can export their products.

[8] See Section A.1.4 of the Online Appendix for a decomposition of the long difference in aggregate French exports across different margins.

Importantly, in both panels the jump from age 1 to age 2 is, by far, the largest, whereas after age 3 the expansion is less stark. Taken together, these facts suggest that successful new exporters tend to add countries and products gradually, but do so more actively early on in their life-cycle.

Table 1: Number of products and countries by exporting age among all new active exporters (upper panel) and among new exporters exporting for five consecutive years (lower panel)

All new exporters

	Number of products		*Number of countries*		*Number of product-country pairs*		
age	mean	median	mean	median	mean	median	number of firms
1	1.908	1	1.518	1	2.722	1	324,004
2	3.857	2	2.796	1	7.167	2	115,820
3	4.325	2	3.168	1	8.472	2	91,595
4	4.650	2	3.452	1	9.465	2	76,099
5	4.915	2	3.641	2	10.305	3	64,543

All new exporters with 5 years of consecutive exports

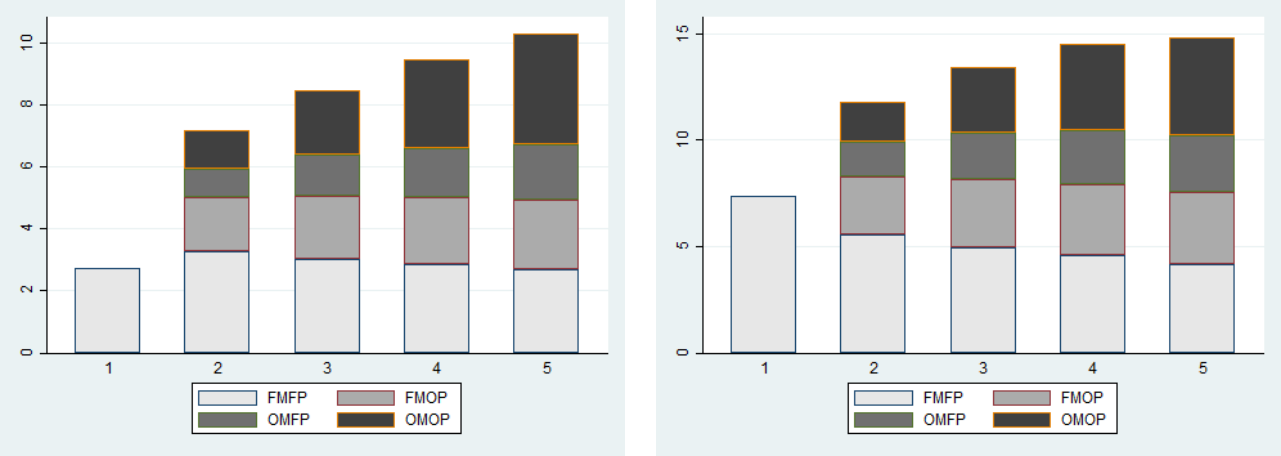
	Number of products		*Number of countries*		*Number of product-country pairs*		
age	mean	median	mean	median	mean	median	number of firms
1	3.869	2	2.916	1	7.358	2	40,078
2	5.697	2	4.105	2	11.759	4	40,078
3	6.311	3	4.530	2	13.435	4	40,078
4	6.582	3	4.819	2	14.468	4	40,078
5	6.543	3	4.860	2	14.809	4	40,078

Notes: The table reports the mean and median number of products, countries and product-country pairs by exporting age, for all new active exporters (upper panel) and for new exporters exporting 5 consecutive years (lower panel).

To help discern patterns in new exporting firms' gradual expansion, Figure 1 describes the number of product-country pairs by exporting age in further detail. We break down product-country pairs in four categories: pairs involving initial products *and* initial countries (FMFP)[9]; pairs involving products other than the firm's first in the firm's first export countries (FMOP); pairs involving initial products in countries other than the firm's first (OMFP); and pairs involving other products in other countries (OMOP). The left panel considers the whole sample of entrants; the right panel considers only firms exporting for five consecutive years after entry. Clearly, the latter enter with more products and into more markets than the former.

[9]The number of FMFP pairs may increase with age. This can happen when a firm starts exporting more than one product and serving more than one destination. Thus, multiple products will have the status of "FP" and multiple markets will have the status of "FM." Then, if the firm subsequently sells one of its FPs in a different FM than where it was first sold, we have an increase in the number of FMFP pairs for that firm. In practice, such cases are rare.

Figure 1: Number of product-countries by exporting age: all firms (left); firms exporting for five consecutive years (right)



Notes: The figures show the average number of product-destinations added by firms' exporting age, for all new exporters (left panel) and for those continuously exporting during the first five years (right panel). Product-destinations are grouped in four categories: pairs involving initial products and initial countries (FMFP); pairs involving products other than the firm's first in the firm's first export countries (FMOP); pairs involving initial products in countries other than the firm's first (OMFP); and pairs involving other products in other countries (OMOP).

Figure 1 confirms that firms' sub-extensive expansion happens primarily between years 1 and 2 of their presence abroad. It also reveals that the product-destination margin with the highest growth rate between a firm's first and second years as exporter involves adding products in the initial destination(s). These regularities hold both when we consider all new exporting firms (left-hand-side panel) and when we consider only those that continuously export in the first five years since entry (right-hand-side panel). Subsequently, entry in new markets with either old or new products becomes the most common expansion strategy. These patterns suggest that firms branch out their exports sequentially, first expanding product scopes in their initial destinations, and then gradually expanding geographically into new destinations.

2.1.2 Entry Analysis

Naturally, selection, heterogeneity and other factors play a role in the facts described above. We now provide a more systematic analysis of how exporters expand across the various sub-extensive margins along their export tenure path.

To do this, we construct a sample that is appropriate for the analysis of firm expansion at the

sub-extensive margins after the firm starts exporting. The sample excludes old exporters and firms with a single observation to focus on successful new exporters (i.e., those that export for more than one year). For each of these firms and their products, we square our dataset to consider all possible countries and years, including those without recorded exports. Specifically, if in year t a firm-product pair ip is observed in the original sample for the first time, we define an entry dummy for every country j in the sample where ip was *not* observed in t. We fill in observations in every year following t, until firm i actually enters j with product p (or until 2006, if it does not). Once/if the entry is recorded, that ijp triplet is dropped from the sample for the subsequent years.[10]

Using that sample, we create a full set of interactions between three indicator variables: whether the firm began exporting in the previous year; whether the product was exported in the firm's first spell; and whether the country was served in the firm's first spell.[11] We then estimate the following linear probability model:

$$\begin{aligned} Entry_{ijpt} = \gamma_0 + \gamma_Y FY_{i,t-1} + \gamma_{YM}\left(FY_{i,t-1} \times FM_{ij}\right) + \gamma_M FM_{ij} + \gamma_{YP}\left(FY_{i,t-1} \times FP_{ip}\right) + \gamma_P FP_{ip} \\ + \gamma_{MP}\left(FM_{ij} \times FP_{ip}\right) + \gamma_{YMP}\left(FY_{i,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + v_{ijpt}, \end{aligned} \tag{1}$$

where $Entry_{ijpt}$ is a binary variable that takes value one if firm i enters destination j with product p in year t, and zero otherwise. $FY_{i,t-1}$ equals one if firm i is in the second (consecutive) year of its export history; FM_{ij} equals one if country j is the first-ever country served by firm i; FP_{ip} equals one if product p is the first-ever product exported by firm i; otherwise, they are zero. Standard errors are clustered at the firm level.[12]

Naturally, many factors affect firms' entry decisions. To account for those factors, we add standard gravity equation covariates (G_{jt}) and a large set of fixed effects ($\{FE\}$) that include firm, year, destination, and product fixed effects.[13] or all systematic differences across firms that do not

[10]The construction of the sample is explained in detail in Section A.1 of the Online Appendix. We note that squaring the sample for all potential countries and years dramatically increases its size. For computational reasons, we then take a random draw of 30% of the initial sample; this still leaves us with roughly 250 million observations.

[11]This approach, based on indicators variables for "first" activities, builds on the empirical strategy of Albornoz et al. (2012) by introducing the product dimension, as well as all the corresponding interactions. We follow a similar approach in the analyses of sections 2.2.2 and 3.2.

[12]Notice that the coefficient on the triple interaction, γ_{YMP}, can be estimated because, in a few cases, a firm starts exporting to multiple countries or products and explores other combinations of the same countries and products in its second year as exporter.

[13]For computational reasons, we cannot use higher-dimensional fixed effects, such as country-year and product-year fixed effects, for this specification. We further discuss this point in the robustness section 4.1.

change over time and affect export entry. Year fixed effects control for global, as well as France-specific contractions and expansions. Destination fixed effects and gravity variables subsume export market characteristics. Product fixed effects capture the general appeal of specific products.

Finally, we also include controls for firm size. Starting with the seminal work of Evans (1987), several researchers have found an inverse relationship between growth rates and both size and age at the firm level. To make sure we are not capturing size dependence, we add firm-specific TFP growth controls for the subset of firms for which balance sheet data is available.[14] As a robustness check, we also explicitly condition on total sales (domestic plus foreign) to control for firm size.[15]

It should be noted that our strategy for dealing with omitted variables cannot formally rule out the possibility of unobserved temporary firm shocks correlated across time, destinations and products driving the observed patterns. Thus, we cannot claim causal identification of age effects.

Table 2 shows the results from estimating equation (1).[16] Column 1 reports the results from a simple OLS estimate, while column 2 adds gravity controls and year and destination fixed effects. Columns 3 and 4 further include product and firm fixed effects, respectively.[17] Columns 5 and 6 examine the robustness of the results reported under columns 3 and 4 to firm-specific unobserved sources of TFP growth (in the sample of firms for which balance sheet data is available).

The main coefficients of interest are those that reflect entry activity right after firms' first year as exporters: γ_Y, γ_{YM} and γ_{YP}. Coefficient γ_Y captures whether new exporters are more likely than more experienced exporters to introduce a new product in a new destination. Coefficient γ_{YM} captures the additional probability that a young exporter adds a new product to its first market, relative to an old exporter, whereas γ_{YP} captures the additional probability that a young exporter enters a new country to sell its first product, relative to an old exporter.

The estimates of γ_Y are statistically significant but tiny, indicating that entries corresponding to both a new product and a new destination are nearly as common for young and old exporters. The coefficients γ_{YM} and γ_{YP} are always positive and statistically significant. The estimated magnitude of γ_{YM}—between 2.1 and 3.5 percentage points—is rather large. The estimated magnitude of γ_{YP}

[14] TFP is estimated at the firm level and follows Levinsohn and Petrin (2003). Online Appendix A provides further detail.

[15] See Table A.7 in the Online Appendix.

[16] For brevity, in the main tables we only report the estimates of the main coefficients of interest and of relevant sums of coefficients (at the bottom of the tables). Tables with the full results are in Online Appendix A.2.10.

[17] The results are similar when we include destination-year and product-year fixed effects, here and in the regressions on exit and intensive margin growth (sections 2.2.2 and 3.2, respectively). See Online Appendix A.2.8.

is smaller, but is not small relative to the unconditional probability of entry of 0.33%.

Table 2: Entry regressions (30% sample)

	(1) Entry	(2) Entry	(3) Entry	(4) Entry	(5) Entry	(6) Entry
γ_Y	0.0003***	0.001***	0.001***	-0.0005***	0.001***	-0.0003***
	(0.00004)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
γ_{YM}	0.036***	0.035***	0.035***	0.035***	0.021***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
γ_{YP}	0.002***	0.002***	0.002***	0.002***	0.003***	0.002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.009	0.013	0.013	0.016	0.010	0.013
Number of Observations	2.5e+08	2.4e+08	2.4e+08	2.4e+08	6.2e+07	6.2e+07
Coefficient Tests						
$\gamma_Y + \gamma_{YM}$	0.036***	0.036***	0.036***	0.035***	0.022***	0.021***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$\gamma_Y + \gamma_{YP}$	0.002***	0.003***	0.003***	0.002***	0.003***	0.002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\gamma_{YM} - \gamma_{YP}$	0.034***	0.033***	0.033***	0.033***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Notes: The table reports the results of regressions of firm entry conditional on surviving on our indicators for first year of an export spell (FY_{ijpt-1}), first exported product (FP_{ip}) and first export destination (FM_{ij}), separately and for three double and one triple interaction(s), together with controls for gravity variables (see Table 4 notes for the full list), firm TFP growth and different sets of fixed effects as in specification (1). We only report estimates for the FY_{ijpt-1}, $FY_{ijpt-1} \times FP_{ip}$ and $FY_{ijpt-1} \times FM_{ij}$ coefficients. The full set of estimates is reported in Table A.25 in the Online Appendix A.2. Columns 1-4 report results for the full sample of firms, while Columns 5-6 report results for the restricted sample of firms for which balance-sheet data is available (FICUS). The last three rows report estimates and standard errors of sums of linear combinations of coefficients in the column's corresponding econometric specifications. Standard errors clustered at the firm level are reported in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively. Source: merged CEPII Gravity-French tax authority (FICUS)-French Customs data, 1993-2006.

To shed light on the prevalent patterns of entry, we contrast early vs. later entry and distinguish between the type of entry (i.e., with new products or in new destinations). First, we test whether an exporter is more likely to expand its product scope in its first market right after a successful first-ever spell ($\gamma_Y + \gamma_M + \gamma_{YM}$) than an old exporter ($\gamma_M$). That difference is given by $\gamma_Y + \gamma_{YM}$. As displayed at the bottom of Table 2, this sum is significant and positive in all specifications, including those with firm fixed effects, when we compare the behavior of the same firm early and

later in its export tenure. This shows that firms are more prone to introduce new products in their first markets right after an initial successful experience there than later.

Similarly, we test whether a young successful exporter is also more likely to take its first product to another market ($\gamma_Y + \gamma_P + \gamma_{YP}$) than an old exporter ($\gamma_P$). That difference, given by $\gamma_Y + \gamma_{YP}$, is again positive and significant in all specifications. Note, however, that the magnitude of this difference is considerably smaller than the previous one, suggesting that adding new products to the first destination is more likely for a young exporter (relative to an old one) than taking the first product to a new country. To check that possibility formally, we compute the second difference, $\gamma_{YM} - \gamma_{YP}$.[18] This difference explicitly compares expansion for young versus old exporters in products relative to markets. Since the sum is positive and significant, it confirms that firm early (relative to later) expansion abroad is more prevalent in products than in destinations.

Main findings on entry. The regression results confirm and make more precise the stylized facts discussed in section 2.1.1. We find that expansion at a sub-extensive margin is more likely right after a firm starts to export than later in the firm's exporting life cycle. The expansion takes several forms, but adding new products in the first destination and entering new export markets with the first product are considerably more likely than creating entirely new country-product pairs.[19]

2.2 Exit

The decision of firms to stop exporting and to drop products and countries contributes substantially to aggregate export dynamics (Table A.4, Online Appendix A.1.4). We now investigate in more detail the patterns of firm exit at the extensive and sub-extensive margins.

2.2.1 Firm Exit at the Extensive and Product-Destination Sub-extensive Margins

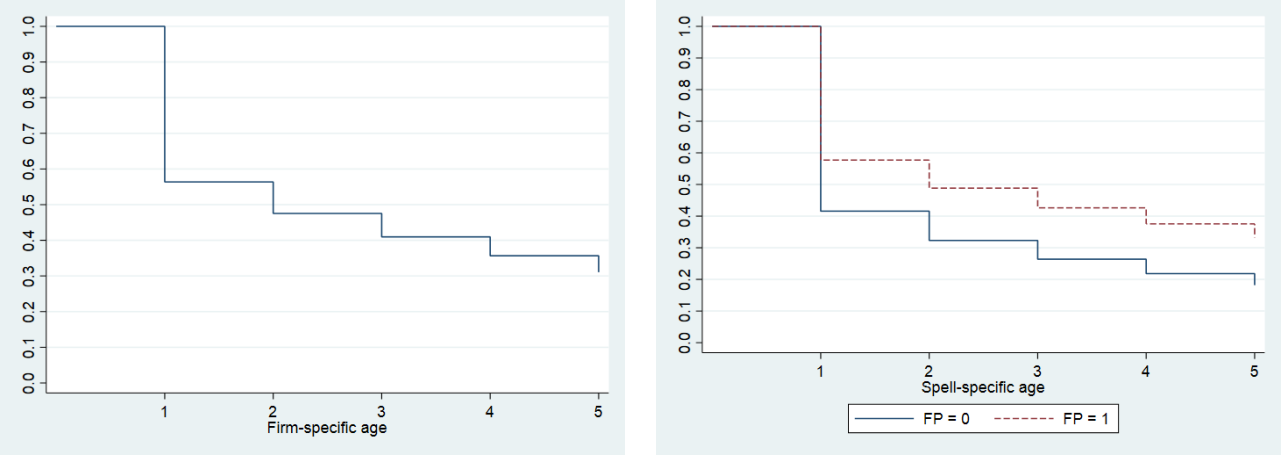
Figure 2 displays the complement to the conditional exit probabilities up to age $t = 5$, or Kaplan-Meier survival probability estimates. In the left panel, we define age and exit at the *firm* level. In the right panel, we consider instead *firm-product-country* spell age and exit. We plot two curves

[18] Notice that the first difference is given by $\gamma_{YM} + \gamma_M - \gamma_{YP} - \gamma_P$, whereas the second difference is given by $\gamma_M - \gamma_P$. We obtain the difference-in-difference term $\gamma_{YM} - \gamma_{YP}$ by subtracting the latter from the former.

[19] In columns (5) and (6) of the Online Appendix Table A.7, we replicate columns (4) and (6) of Table 4 with total (domestic plus foreign) sales as an additional control. The estimates of the relevant coefficients remain very similar.

representing survival rates by age for spells involving a firm's first product ($FP = 1$) and subsequent products ($FP = 0$). In both cases, age refers to the number of years after a first recorded export, under the assumption that firms classified as new exporters did not sell abroad before 1994.[20]

Figure 2: Survival functions by firm exporting age (left panel) and by firm-product-country spell age (right panel)



Notes: The figures show Kaplan-Meier survival probabilities up to age $t = 5$, defined as the product of the complement of observed exit frequencies at ages lower or equal to t. The left-hand side panel reports survival probabilities by new exporters' age. The right-hand side panel reports them by firm-product-country spell age, both for the first product of the firm ($FP = 1$) and for other products ($FP = 0$).

The figure's left panel shows high initial firm exit rates: 44% of firms abandon foreign markets after exporting for a single year. That figure falls sharply with firm age, to 16% after 5 years. Figure 2's right panel shows that export spells are also short-lived. However, spells involving firms' first exported product have substantially lower exit rates. This difference is greater at the beginning of spells (42% vs. 58%), but remains present thereafter. This suggests that firms begin exporting products with either higher expected profits or with lower risk than the products introduced later.

These facts reveal that many firms exit foreign markets soon after they start exporting, but if they survive initially, the odds of exiting drop markedly. Still, those that keep exporting often discontinue new product-destinations combinations soon after introducing them, although less so if they include the firm's first-ever exported product.

[20]See Online Appendices A.1.2 and A.2.7 for details and robustness checks on that assumption, respectively.

2.2.2 Exit Analysis

Because selection and heterogeneity may play an important role in the facts discussed above, we now examine more systematically the decision of firms to exit foreign markets and to discontinue product-country pairs. To do this, we estimate the following linear probability model:

$$Exit_{ijpt} = \beta_0 + \beta_Y FY_{ijp,t-1} + \beta_{YM}\left(FY_{ijp,t-1} \times FM_{ij}\right) + \beta_M FM_{ij} + \beta_{YP}\left(FY_{ijp,t-1} \times FP_{ip}\right) + \beta_P FP_{ip} + \beta_{MP}\left(FM_{ij} \times FP_{ip}\right) + \beta_{YMP}\left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + w_{ijpt}, \quad (2)$$

where $Exit_{ijpt}$ is a binary variable that takes value one if firm i stops exporting product p in market j in year t after doing so in year $t-1$, and zero otherwise. $FY_{ijp,t-1}$ is a binary variable that takes value one if firm i is in the second year of its jp spell. FM_{ij} and FP_{ip} are defined as in section 2.1.2. Just as we did there, we control here for possible confounders, including gravity covariates, different sets of country, product and year fixed effects, as well as changes in firm productivity for the subset of firms for which balance sheet data is available.

Table 3 reports the results. The six columns are organized exactly as in Table 2. In all but the firm fixed-effects specification without controlling for TFP growth (column 4), we find a positive and highly significant coefficient for the triple-difference coefficient. This result shows that there is a differentially higher first-year-first-market-first-product exit rate of about 6 percentage points (in the specifications with product fixed effects).[21] This can be compared with a 32.9% average exit probability for an ijp triplet across the whole sample.

Note that β_{YMP} is partly identified off between-firm comparisons involving single-year exporters, namely firms that export for just one year. The exception are the specifications with firm fixed effects, which do not identify the effects on exit from single-year firms. However, single-year firms are key for the analysis of exit among young exporters, as 44% of exporting firms are single-year (Figure 2). This leaves important information out of the analysis. Accordingly, we treat the coefficients in columns (3) and (5), which contain product fixed effects but not firm fixed effects,

[21] More precisely, the interpretation of the triple-coefficient coefficient is as follows. The first difference—early exit from the first market with the first product relative to late exit from the first market with the first product—is given by $(\beta_Y + \beta_{YM} + \beta_{YP} + \beta_{YMP})$. The second difference subtracts from this term the difference between early exit from a subsequent market with the first product relative to late exit from a subsequent market with the first product $(\beta_Y + \beta_{YP})$, yielding $(\beta_{YM} + \beta_{YMP})$. Finally, the third difference subtracts from this term the analogous double difference for subsequent products (β_{YM}), yielding the triple-difference coefficient, β_{YMP}.

Table 3: Exit regressions

	(1) Exit	(2) Exit	(3) Exit	(4) Exit	(5) Exit	(6) Exit
β_{YMP}	0.036***	0.068***	0.062***	-0.024***	0.064***	0.017***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.003)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.122	0.192	0.202	0.299	0.244	0.305
Number of Observations	2.1e+07	2.1e+07	2.1e+07	2.1e+07	9.0e+06	9.0e+06
Coefficient Tests						
$\beta_Y + \beta_{YM} + \beta_M + \beta_{YP} + \beta_P + \beta_{MP} + \beta_{YMP}$	0.166***	0.150***	0.147***	0.021***	0.156***	0.066***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.009)	(0.002)
$\beta_{YM} + \beta_M + \beta_{YP} + \beta_P + \beta_{MP} + \beta_{YMP}$	-0.157***	-0.131***	-0.124***	-0.194***	-0.143***	-0.188***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)
$\beta_{YP} + \beta_P + \beta_{MP} + \beta_{YMP}$	-0.163***	-0.130***	-0.120***	-0.202***	-0.136***	-0.180***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
$\beta_{YM} + \beta_M + \beta_{MP} + \beta_{YMP}$	0.005**	0.044***	0.034***	-0.023***	0.031***	0.008***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)

Notes: The table reports the results of regressions of firm exit on our indicators for first year of an export spell (FY_{ijpt-1}), first exported product (FP_{ip}) and first export destination (FM_{ij}), separately and for three double and one triple interaction(s), together with controls for gravity variables (see Table 4 notes for the full list), firm TFP growth and different sets of fixed effects as in specification (2). We only report estimates for the triple interaction ($FY_{ijpt-1} \times FM_{ij} \times FP_{ip}$) coefficient. The full set of estimates is reported in Table A.26 in Online Appendix A.2. Columns 1-4 report results for the full sample of firms, while Columns 5-6 report results for the restricted sample of firms for which balance-sheet data is available (FICUS). The last four rows report estimates and standard errors of sums of linear combinations of coefficients in the column's corresponding econometric specifications. Standard errors clustered at the firm level are reported in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively. Source: merged CEPII Gravity-French tax authority (FICUS)-French Customs data, 1993-2006.

as the most relevant estimates for the analysis of exit.[22]

To further establish how exit patterns vary in early stages of export experience, relative to later in firms' export tenure, we check whether exit rates are indeed higher at the beginning of the first-ever spell than in mature spells that include a subsequent product and a subsequent destination. This difference is captured by the sum of all seven coefficients: $\beta_Y + \beta_{YM} + \beta_M + \beta_{YP} + \beta_P + \beta_{MP} + \beta_{YMP}$. We confirm that it is positive in all specifications. In those with product fixed effects, the difference is almost 16 percentage points.

Now, that comparison is probably too extreme, since we know from Figure 2 that exit out of an export spell is markedly higher between the first and the second years than later. To better understand differences between early exit at the firm level versus early exit at the spell level (in which case the firm may remain exporting other product-destination combinations), we focus on

[22]In columns (3) and (4) of the Online Appendix Table A.7, we replicate columns (3) and (5) of Table 3 with total (domestic plus foreign) sales as an additional control. The estimates of the relevant coefficients remain very similar.

comparisons between the exit behavior of firms right after they start a new spell. Specifically, we contrast exit at the beginning of the first-ever spell (which is similar to firm-level exit, with probability given by the sum of all seven coefficients) with exit at the beginning of a subsequent spell (i) with an additional product and an additional destination (β_Y); (ii) with an additional product in the firm's initial destination ($\beta_Y+\beta_{YM}+\beta_M$); (iii) in an additional destination with the firm's initial product ($\beta_Y+\beta_{YP}+\beta_P$). Both the first difference, given by $\beta_{YM}+\beta_M+\beta_{YP}+\beta_P+\beta_{MP}+\beta_{YMP}$, and the second difference, given by $\beta_{YP}+\beta_P+\beta_{MP}+\beta_{YMP}$, are estimated to be negative and statistically significant. This shows that exit right after a firm starts to export is *less* likely than exit from a new spell when the firm is introducing a different product (be that in the first market or not), confirming that spells containing firms' first-ever exported products are particularly resilient.

On the other hand, the third difference, given by $\beta_{YM}+\beta_M+\beta_{MP}+\beta_{YMP}$, is estimated to be positive and significant. This shows that exit right after the first-ever spell is more likely than exit right after starting a subsequent spell with the first product but in an additional market, confirming that dynamics early and later in a firm's export tenure are very different.

Main findings on exit. The results show that exit rates are particularly high after firms' first export spell. This confirms that export dynamics depends on a *firm*'s exporting age and not just its experience in a given spell. However, there is also heterogeneity in the sense that exit from spells involving the first product is systematically less likely.

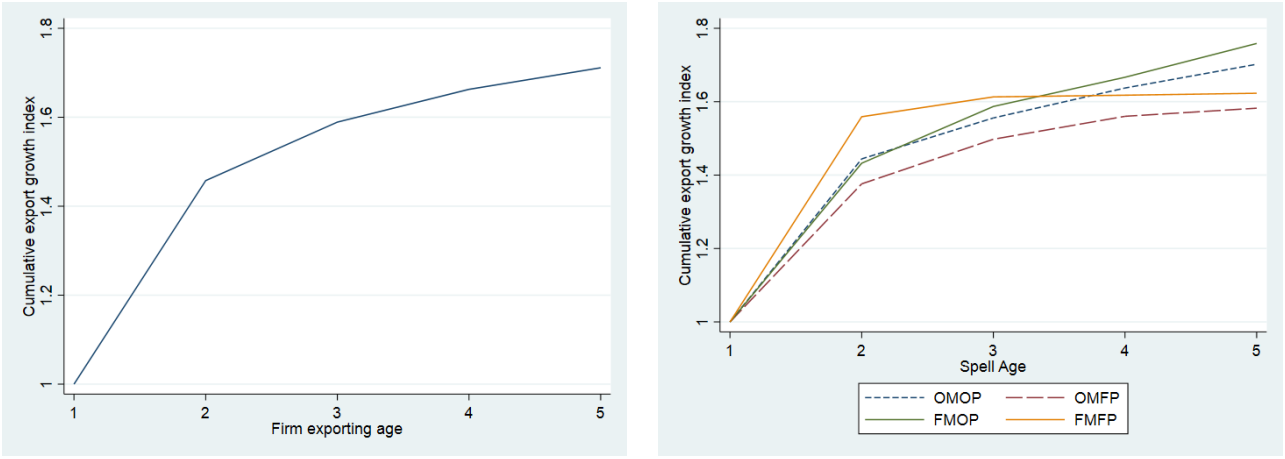
3 Export Experience and Intensive Margin Growth

Finally, we study now how firm export experience drives intensive margin growth.

3.1 Firm Expansion at the Intensive Margin

Figure 3 shows an index of cumulative export growth by exporting firm age (left panel) and spell age (right panel) for firms that export for five or more years. The index is set to one at age 1. It is then defined recursively at each age, by multiplying its value at the preceding age by the mean export growth rate at the current age. Both growth and age are defined at the firm level (left panel) or at the spell level (right panel). We distinguish spells depending on whether they include the firm's first product(s) and first market(s).

Figure 3: Index of cumulative mean export growth rates, by firm exporting age (left panel) and by firm-product-country export spell age (right panel)



Notes: The figures display an index of cumulative mean export growth by exporting firm age (left panel) and spell age (right panel), for firms that export for five or more years. In the right panel, we define products and markets as follows. FM corresponds to the first foreign market to which a firm exports. FP corresponds to the first product a firm exports. OM corresponds to markets other than a firm's first market. OP corresponds to products other than the firm's first product. We combine each product and each market definition to obtain the four categories in the figure.

The left panel of Figure 3 shows that firms that keep exporting tend to increase foreign sales over time. However, this growth is uneven: exporters undergo the highest growth rates at the beginning of their export tenure, with a marked slowdown afterwards. Now, this exceptional growth right after firms start to export is affected by the fact that export entry happens throughout the year. If foreign sales take place periodically over a calendar year, total sales in the first year will appear artificially low—and first-to-second year growth artificially high. The left panel of the figure should be interpreted with that caveat in mind.

The right panel of the figure examines instead cumulative export growth according to *spell* age, distinguishing between those that include or not the firm's first product and first market, analogously to Figure 1. Under the assumption that the calendar partial-year effect described above is on average similar for every type of spell, it permits a comparison across spell types free of that statistical effect. The figure shows that, after the second year, growth slows down for each type of spell. However, spells in the exporter's first market and with its first product (i.e., those directly linked to the firm's initial experience as an exporter) display substantially higher initial growth before converging to cumulative growth similar to other types of spells. In contrast, the

spells with lowest initial growth involve subsequent products and subsequent markets.

These facts indicate that intensive margin export dynamics is also markedly affected by the extent of firms' experience abroad. On average, sales in product-destination spells that are not discontinued increase over time, especially right after they are introduced, but that initial growth is particularly high in firms' initial spells, i.e. right after they start exporting.

3.2 Intensive Margin Analysis

To verify whether those early growth patterns are robust to controlling for confounding factors and selection, we now investigate formally how foreign sales of successful exporters evolve.

We proceed analogously to our analysis of exit in section 2.2.2. Specifically, we estimate the following equation:

$$\begin{aligned}\Delta \log X_{ijpt} = \alpha_0 + \alpha_Y FY_{ijp,t-1} + \alpha_{YM}\left(FY_{ijp,t-1} \times FM_{ij}\right) + \alpha_M FM_{ij} + \alpha_{YP}\left(FY_{ijp,t-1} \times FP_{ip}\right) + \alpha_P FP_{ip} \\ + \alpha_{MP}\left(FM_{ij} \times FP_{ip}\right) + \alpha_{YMP}\left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + u_{ijpt}, \quad (3)\end{aligned}$$

where $\Delta \log X_{ijpt}$ is the growth rate of the value of exports between t and $t-1$ by firm i of product p and market j. Observe that $\Delta \log X_{ijpt}$ is only defined for consecutive observations X_{ijpt} and X_{ijpt-1}. The other variables are defined exactly as in the exit regression (2). To focus on new exporters, we exclude all firms exporting in 1993.[23]

Table 4 reports the results. We find a consistently positive and significant coefficient for the triple-difference term, α_{YMP}. It shows that the additional first-year intensive margin growth in the first market is between 11 and 25 percent higher for the firm's first product than for subsequent products.[24] That is, there is differential growth early in the firm's first market for its first product, when the firm starts to export. Since we control for firm TFP growth and size, we find age dependence in export growth independent of firm size.[25]

[23] Results remain qualitatively unchanged if we include firms exporting in 1993 or if we treat firms exporting in 1994 and 1995 as old exporters (see Online Appendix A.2.7).

[24] More precisely, the first difference—early growth in the first market with the first product relative to late growth in the first market with the first product—is given by $(\alpha_Y + \alpha_{YM} + \alpha_{YP} + \alpha_{YMP})$. The second difference subtracts from this term the difference between early growth in a subsequent market with the first product relative to late growth in a subsequent market with the first product $(\alpha_Y + \alpha_{YP})$, yielding $(\alpha_{YM} + \alpha_{YMP})$. Finally, the third difference subtracts from this term the analogous double-difference for subsequent products (α_{YM}), yielding the triple-difference coefficient, α_{YMP}.

[25] Growth regressions with size controls are reported in columns (1) and (2) of Table A.7 in the Online Appendix.

Table 4: Export growth rate regressions

	(1) Growth	(2) Growth	(3) Growth	(4) Growth	(5) Growth	(6) Growth
α_{YMP}	0.183***	0.182***	0.182***	0.246***	0.110***	0.136***
	(0.020)	(0.021)	(0.021)	(0.022)	(0.028)	(0.030)
Gravity controls	no	yes	yes	yes	yes	yes
Year FE	no	yes	yes	yes	yes	yes
Country FE	no	yes	yes	yes	yes	yes
Product FE	no	no	yes	no	yes	no
Firm FE	no	no	no	yes	no	yes
TFP Growth Control	no	no	no	no	yes	yes
R-squared	0.015	0.015	0.019	0.065	0.019	0.057
Number of Observations	2.5e+06	2.4e+06	2.4e+06	2.4e+06	8.9e+05	8.9e+05
Coefficient Tests						
$\alpha_Y + \alpha_{YM} + \alpha_M + \alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$	0.443***	0.446***	0.446***	0.566***	0.388***	0.462***
	(0.011)	(0.012)	(0.012)	(0.014)	(0.017)	(0.021)
$\alpha_{YM} + \alpha_M + \alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$	0.125***	0.124***	0.120***	0.217***	0.074***	0.124***
	(0.018)	(0.018)	(0.018)	(0.016)	(0.018)	(0.021)
$\alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$	0.129***	0.130***	0.122***	0.223***	0.068***	0.126***
	(0.014)	(0.014)	(0.014)	(0.016)	(0.022)	(0.026)
$\alpha_{YM} + \alpha_M + \alpha_{MP} + \alpha_{YMP}$	0.126***	0.123***	0.126***	0.213***	0.058***	0.102***
	(0.011)	(0.012)	(0.012)	(0.013)	(0.017)	(0.020)

Notes: The table reports the results of regressions of firm sales growth rates on our indicators for first year of an export spell (FY_{ijpt-1}), first exported product (FP_{ip}) and first export destination (FM_{ij}), separately and for three double and one triple interaction(s), together with controls for gravity variables (population weighted distance to France, population, GDP, GDP per capita, contiguity with France, common official language, past colonial ties, GATT/WTO membership, Regional Trade Agreements with the EU, common legal origin, common currency and participation in cooperation agreements between the EU and African, Caribbean and Pacific countries), firm TFP growth and different sets of fixed effects as in specification (3). We only report estimates for the triple interaction ($FY_{ijpt-1} \times FP_{ip} \times FM_{ij}$) coefficient. The full set of estimates is reported in Table A.27 in Online Appendix A.2. Columns 1-4 report results for the full sample of firms, while Columns 5-6 report results for the restricted sample of firms for which balance-sheet data is available (FICUS). The last four rows report estimates and standard errors of sums of linear combinations of coefficients in the column's corresponding econometric specifications. Standard errors clustered at the firm level are reported in parentheses. ***, ** and * denote significance at 1%, 5% and 10%, respectively. Source: merged CEPII Gravity-French tax authority (FICUS)-French Customs data, 1993-2006.

To understand more broadly how intensive margin growth varies with firm export experience, we make additional comparisons. First, we contrast growth at the beginning of the first-ever spell with growth at a later stage in subsequent products and markets. The difference is given by the sum of all seven coefficients: $\alpha_Y + \alpha_{YM} + \alpha_M + \alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$. As shown at the bottom of Table 4, this sum is positive and significant. Estimates of the difference range from 44 to 57 percentage points in the specifications with firm fixed effects.[26]

That comparison is, however, inflated by the partial-year effect discussed above, which is reflected in the coefficient of $FY_{ijp,t-1}$, α_Y.[27] We avoid that problem by contrasting first-year growth

[26] As with exit, identification in firm fixed estimation excludes firms with singletons. Those are firms with only two consecutive export spells. However, as Table 4 shows, results of growth regressions with and without firm fixed effects are qualitatively similar. This may be because firms with just one growth observation are not qualitatively different, or simply because they amount to only 26% of all firms in our growth sample (26628 out of 100352).

[27] Bernard et al. (2017) show that correcting for the overestimation of first-year sales growth rates amongst surviving

of the first-ever spell with first-year growth of spells that have either subsequent products or subsequent destinations—or both. Starting with the last case (first-year growth in spells containing neither the first product nor the first market), the difference is given by $\alpha_{YM} + \alpha_M + \alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$. It is smaller, but remains large, between 12 and 22 percentage points.

Next, the difference between growth at the beginning of the first-ever spell and growth at the beginning of a subsequent spell in the first market, but with an additional product, is given by $\alpha_{YP} + \alpha_P + \alpha_{MP} + \alpha_{YMP}$. In turn, the difference between growth at the beginning of the first-ever spell and growth at the beginning of a subsequent spell with the first product, but in an additional destination, is given by $\alpha_{YM} + \alpha_M + \alpha_{MP} + \alpha_{YMP}$. Both sums are positive, statistically significant, and their magnitudes are sizeable, ranging between 10 and 22 percentage points depending on the specification. In each of these comparisons, the largest estimate is in specification (4), which includes firm fixed effects, where we compare the behavior of the same firm as it starts to export and as it introduces a new product-destination combination.

Main findings on the intensive margin. These results show that, for firms that keep exporting after their initial attempt, the earliest export experience is rather special. Specifically, the intensive margin growth after the first-ever experience abroad of a firm is systematically higher than its growth in all other combinations of years and product-destination spells.

4 Robustness and Discussion

We now describe a series of robustness checks and discuss the interpretation of the results.

4.1 Robustness Checks

The novel facts presented in sections 2-3 are robust to the inclusion of a variety of possible confounding factors and omitted variables, to heterogeneous effects, and to alternative definitions. The results from the robustness analysis are presented in different sections of the empirical Online Appendix A.2. We summarize them below.

firms doubles the contribution of exporters' extensive (entry and exit) margins to total export growth. Nevertheless, we stress that our interest here is *not* in the coefficient on $FY_{ijp,t-1}$. Hence, this is not a central concern for our analysis. Still, as a robustness check, in Online Appendix A.2 we apply their correction explicitly. We show that while the coefficient on $FY_{ijp,t-1}$ is indeed affected, the results that matter for our analysis are essentially unchanged by the partial-year-effect correction.

First, Section A.2.1 reports results of growth regressions with a partial-year effect correction, as in Bernard et al. (2017). Estimates of the key parameters are slightly higher than without the correction, and display similar patterns across specifications. We also show that our results on entry are similar when we restrict our sample to entrants starting in the first half of the calendar year only. Second, we check that our results on age-dependent dynamics are not driven by firm size (Section A.2.2). To do so, we re-run all regressions with total firm sales as an additional control. Estimates are very similar to our baseline in the restricted sample (where we estimate firm TFP), validating our choice to capture size effects with TFP growth controls.

Third, we re-run all three types of regressions on subsamples of multinational firms[28] (Section A.2.3) and of firms that sell multiple products to multiple countries from the start of their foreign experience (Section A.2.4). Coefficient estimates are usually smaller, but remain statistically significant and follow similar patterns. A fourth robustness check concerns potential spillovers from nearby firms. Section A.2.5 shows lower, but comparable coefficients of interest when controlling for the number of exporting peers in the region and for the intensity of their export growth. Fifth, age dependence may capture financial constraints that are binding in the early stages of export tenure. Section A.2.6 shows that the results are robust to controlling for industry-specific financial frictions, using a measure of asset tangibility proposed by Manova (2013).

Sixth, in Section A.2.7 we show that the results remain similar in a shorter panel with a more stringent definition of new exporters. Seventh, Section A.2.8 presents results of growth and exit regressions with country-year and product-year fixed effects to control for possible omitted supply and demand shocks.[29] Estimates of the main parameters are slightly lower in the growth regressions, but similar in exit regressions, and overall broadly consistent with our baseline findings. Finally, in Section A.2.9 we show the results from a sector-by-sector analysis.

4.2 Discussion

After summarizing our findings, we point out how they differ from the predictions of the canonical model of export dynamics. We then discuss the results in light of other frameworks in the literature.

[28] To identify French multinationals and foreign-owned French firms, we rely on the French statistical office (INSEE)'s LIFI survey of ownership links between corporations.

[29] Due to the sheer size of the entry dataset, computational constraints prevent us from estimating a similarly augmented model of entry.

Finally, we interpret the results based on an extended version of the model in Albornoz et al. (2012).

4.2.1 Summary of Findings

Hence, we find robust empirical evidence that exporting firms display (1) high initial failure rates, rapid (2) sub-extensive (product-destination) and (3) intensive margin expansions conditional on surviving. Although such features are present for all types of new product-country export spells, a key distinguishing aspect is that each of them is particularly strong right after firms' first export spell. In addition, we find that (4) spells with exporters' first products are more resilient and, (5) after an initial success, new exporters are more likely to expand by introducing new products in their first export market than by entering new markets with their first product. Importantly, given existing evidence of size dependent dynamics, all of our results are robust to controlling for firm size and firm productivity growth.

4.2.2 Inconsistencies with the Canonical Model

Confronting this set of facts to existing theories of firm export dynamics and of multi-product exporters reveals, first, that our findings are at odds with what Alessandria et al. (2021) call the "canonical model of export dynamics," built upon Das et al. (2007). In that model, new exporters enter in response to positive productivity shocks and face sunk entry costs. Thus, controlling for productivity growth, young exporters should not be more likely to exit. If anything, sunk entry costs create an option value to remain an exporter, rendering new exporters less likely to exit right after entry (Albornoz et al., 2016). This prediction is even more likely to hold with persistent productivity shocks.[30] Similarly, controlling for size, young exporters would not be more likely to expand at either their extensive or intensive margins than old exporters, since in that family of models firms of the same size are expected to grow at a similar pace. Furthermore, a key aspect behind our findings (1)-(3) is that they are more prominent right after firms' first export experience than after they enter a new destination or introduce a new product abroad. To explain this form of age dependence going beyond size dependence, we must turn to other mechanisms.

[30] On the basis of a model with sunk entry costs and persistent productivity shocks, Gumpert et al. (2020) partly match the (spell) age profile of exit rates out of exporting. However, they still underpredict first-year exit rates despite targeting them explicitly. While their general results provide support for size-dependence in export dynamics, the very low implied estimates of sunk entry costs (below .1% of annual sales) illustrate the difficulty in reconciling sunk cost models with early exit.

The canonical model of export dynamics abstracts from products to focus on firms. But the literature on multi-product exporters has achieved considerable sophistication in explaining cross-sectional facts on multi-product exporters' size, product range and geographical scope.[31] Several of those models assume (and verify empirically) that firms have a "core" product, associated to lower marginal cost or higher demand. However, since most of the existing models are based on static theories, they are not designed to explain differential age dependence at the product margin, as our finding (4) requires. The few exceptions that are dynamic (e.g., Timoshenko, 2015b) restrict the analysis to a single destination, and therefore do not address the pattern of product-destination expansion, as our finding (5) describes.

4.2.3 Other Potential Mechanisms

Research on firm export dynamics has advanced a number of alternative mechanisms to explain age dependence that go beyond the canonical model. For some of them—learning from others, financial constraints—we show in the Online Appendix that our empirical findings remain valid when controlling for such factors. Here we consider other models that yield age dependence.

An important mechanism relates to customer-base accumulation with market penetration costs. Broadly speaking, this includes trade models where increasing market share or participation in new markets requires convex adjustment costs (Argente et al., 2021; Arkolakis, 2010, 2016; Fitzgerald et al., 2019; Piveteau, 2021). That class of models rationalizes why young exporters start small and face high exit rates, and why survivors grow faster in early years. But as Arkolakis (2016) makes clear, age dependence is typically linked to size dependence. Instead, as discussed above, our empirical findings are present with and without controls for firm size. Furthermore, theories based on such a mechanism typically model marketing costs as spell-specific. Thus, a firm would face similar expected dynamics in each market it operates (where "market" can be defined by destination, by product, or by destination-product pairs). Accordingly, these models are not designed to explain why firms grow faster at the intensive margin and by adding products and destinations at the beginning of their exporting life cycle, relative to when they start new spells later in their export tenure. One potentially interesting line of future research could extend the customer-base

[31] See, among others, Eckel and Neary (2010); Bernard et al. (2011); Dhingra (2013); Qiu and Zhou (2013); Nocke and Yeaple (2014); Mayer et al. (2014, 2021); Eckel et al. (2016); Arkolakis et al. (2021).

accumulation logic to a model where firms are active in multiple markets and sell multiple products, and where the expansion of a firm's customer base due to marketing expenditures in a market would spill over other markets, creating interdependences at the firm level. Viewed from the lens of that hypothetical model, our results imply that "global firm appeal" (on top of product-specific appeal) generally rises faster right after the first export spell, for the firms that keep exporting.

Another potential mechanism relates to search and matching frictions. Frictions to establish buyer/seller relationships may cause age dependence if, for instance, asymmetric information allows for the development of reputations (Aeberhardt et al., 2014; Araujo et al., 2016). Because of opportunistic behavior, there would be high early exit rates. In turn, in surviving relationships trust-building dynamics causes rapid expansion. Another important example is when search and matching frictions combine with uncertainty about demand. In such a setup, Eaton et al. (2021) explain why some buyer-supplier relationships end early, while others expand thanks to an upward revision of beliefs and an endogenous increase in search effort. As with customer base accumulation, however, explaining our findings would require the dynamics of buyer-seller relationships in different products and destinations to vary systematically along the firm exporting life cycle.

Models that explicitly take into account dynamic complementarities in export dynamics across different markets are, naturally, well suited to rationalize market interdependencies at the firm level. This includes, in particular, models with "extended gravity" forces. For instance, Alfaro Ureña et al. (2021) introduce sunk per-country entry costs that decrease with the number of destinations in an otherwise canonical model of export dynamics. These models are designed to explain the geographical expansion of successful new exporters. On the other hand, they have nothing to say about the sequential pattern of product scope expansion within markets. Analogously, Timoshenko (2015b) considers a model of multi-product firms that learn about demand in a single export destination, which explains early churning of products within destinations. On the other hand, by design that approach has nothing to say about firm expansion across countries. Instead, to rationalize our empirical findings one would need a dynamic framework with market interdependencies that allows firms to expand both in the product and the country dimensions. Moreover, it would need to generate different dynamics for firms' first spells as exporters, relative to their subsequent spells.

Finally, while adaptations are possible, these families of models do not explain the observed resilience of new exporters' first products. The same point applies to firms' decisions to prioritize

expansion of product scope over entering new destinations early in their export tenure.

4.2.4 A Mechanism Based on Learning across Products and Countries

In Albornoz et al. (2012), we develop a learning model, where firms are forward-looking but uncertain about their profitability abroad, to rationalize related facts at the firm level across destinations, but without considering the product dimension. In Section B.1 of the Online Appendix, we present and discuss an extension of that model that incorporates product-specific uncertainty. We then formally derive from it all of our empirical findings. The main workings of the model are as follows.

Firms operate a "core-competency" flexible manufacturing technology (Eckel and Neary, 2010) and incur entry costs to export new products or serve new countries. Firm export profitability is ex ante uncertain, but is revealed to the firm once it starts to export. Furthermore, it is persistent over time and correlated across products and countries. Thus, if a firm finds out that it is highly profitable selling a given product in a given destination, it knows that it will also be profitable exporting other products to the first but also to other foreign destinations.

A consequence of this model is that, unless firms are very confident ex ante about their ability to profitably sell abroad, they will limit entry to a small number of product-country pairs, typically selling low volumes of their most profitable product in a single foreign market. This is why, for firms that keep exporting, first products display more resilience irrespective of firm size. Based on their performance in that first spell, exporters revise their initial beliefs, and that first revision will be sharper than subsequent belief updates in future spells. This implies higher failure rates, but also higher growth and entry rates upon surviving that first spell. Due to the correlation across countries and markets, this also explains the differential growth, entry and exit rates after the first spell relative to early years of later spells.[32] Finally, if adding a product entails a lower cost than entering a new destination, or if profitability is more correlated across products than across countries,[33] then new exporters will expand their product scopes before expanding geographically. Thus, this model suggests that the knowledge firms acquire as they start to export helps to explain

[32]This last feature distinguishes our model from models with market-specific learning, which explain within-spell dynamics but not why they are more pronounced in the first spell, e.g., Freund and Pierola (2010); Nguyen (2012); Cadot et al. (2013); Timoshenko (2015a); Cebreros (2016); Carrère and Strauss-Kahn (2017); Arkolakis et al. (2018); Li (2018); Berman et al. (2019); Steinberg (2021).

[33]We thank an anonymous referee for pointing this out.

how they expand their product scope and geographical presence.[34]

5 Conclusion

We uncover robust empirical evidence of age dependence in export dynamics. Exporting firms display high initial failure rates, but survivors expand rapidly along the intensive and sub-extensive product and country margins. These changes are significantly more prominent right after a firm's first export spell than later in the firm's export tenure. In addition, spells with first products are more resilient, and successful new exporters tend to expand their product scopes in their first destination before expanding geographically with their first products. Because these findings are robust to firm size and productivity growth controls, they do not sit well with the "canonical model of export dynamics." But they are consistent with a model of learning where export profitability is uncertain, persistent in time, and correlated across products and markets.

While previous work has focused on the study of export dynamics in either the country or the product dimension, our simple empirical strategy allows the analysis of both at the same time. However, it has important limitations. For example, it does not reveal or test for specific learning mechanisms, or allows us to explore counterfactuals. Extending the analysis to address the interdependence in firms' choices of what, when and where to export in a structural model would be desirable, but may require solving a potentially very hard optimization problem, as Alfaro Ureña et al. (2021) make clear. We look forward to further advances in this direction.

This matters beyond enhancing our knowledge of firm export dynamics. In particular, the interdependence in firms' export decisions has implications for understanding the consequences of trade policy and quantifying its effects. In our learning interpretation, entry in the first product-market reveals information about the value of future entry. This creates trade policy spillovers across products and destinations. Future work allowing for these spillovers in the evaluation of trade policies would be welcome.

[34]This partially addresses Alessandria et al. (2021, p.19)'s remark that "understanding how [...] firm-level organizational capital can be used across products and destinations is an unsettled issue."

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