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Abstract

Using firm-level export data from six African (Burkina Faso and Senegal) and Latin American (Guatemala, Mexico, Peru, and Uruguay) countries, we examine factors that determine the survival of export flows. We explore the effects on export survival of changes in the number of home-country exporters serving the same destination, firm-level export diversification, and country-level factors. Unlike previous studies, we find that export survival rates decrease with the number of co-exporters selling the same product to the same country. We also find that the relationship between firm-level product diversification and export flow survival is hump-shaped: firms that do not diversify or are highly diversified have lower survival of product-destination flows. Our findings are robust to various alternative specifications. The main findings hold across both regions and all countries. However, the number of co-exporters negatively affects survival in Africa more than in Latin America.

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1 INTRODUCTION

Growth in aggregate exports is anemic in many developing economies because export flows have low survival rates. Firms incur the expense of finding buyers overseas, but the exporting relationships often end within the first year. For example, in the 2000s, 16% of Chinese and 30% of Chilean exporters fail to maintain export flows from 1 year to the next (Blum et al., 2013; Olabisi, 2015). The impact of these failing export flows is significant. Das et al. (2007) estimate that the average firm invests half a million dollars to establish an exporting foothold in a foreign market—resources that may have been employed more profitably elsewhere in the economy.

When firms in the same product markets learn from each other's experience in producing and exporting to a particular destination, these networks of similar firms may enjoy positive external economies—synergies—leading to higher export survival. Some previous work studying the determinants of export survival, such as Cadot et al. (2013) (who examine four African economies), argue that synergies explain why the survival odds of new export flows are positively correlated with the number of exporters serving the same product-destination combination. Other research examining firm-level data from Laos (Stirbat et al., 2015) and Chile (Alvarez, 2007) documents similar positive associations between survival and cohort size. These researchers also invoke positive spillovers as the explanation.

In our article, we re-examine whether larger exporting clusters indeed create synergies or instead result from unobserved conducive factors that cause there to be more entry, higher survival, and positive correlation between the two. We also examine how the survival of export flows responds to the firm's choice of product specialization or diversification. Our empirics rely on a unique firm-level data set of exports collected by the World Bank as part of its Export Dynamics Database initiative (Cebeci et al., 2012; Fernandes et al., 2016).

We contribute to the literature in the following three ways. Our article extends the work of Cadot et al. (2013) examining the impact of cohort size on export survival, by controlling for unobserved factors specific to the detailed market level of the origin-product-destination combination. Second, we estimate a nonlinear relationship between export survival with firm-level product diversification. Finally, we conduct our analysis using data from six African and Latin American countries. Previous work focused on different regions: Western Europe (Nitsch, 2009; Brenton et al., 2010), Africa alone (Cadot et al., 2013), South Asia (Stirbat et al., 2015), and Eastern Europe (Görg et al., 2012). We examine these two regions together for several reasons. Trade policy, which differs in important ways between Africa and Latin America, can influence export success. Furthermore, Latin America is in a unique position regarding international trade, given its proximity to the U.S., historical dependence on commodity exports, and attempts at industrial policy. African economies, on the other hand, are farther from world markets, are marked by strong ties to European markets, have low levels of intra-regional trade, and depend heavily on commodities. Examining both African and Latin American countries allows us to analyze whether the determinants of export survival differ by region. Following Besedes and Blyde (2010), we also evaluate how country-level factors influence export survival and whether these influences differ by region.

There are three main findings in our article. First, after controlling for unobserved confounding factors in the origin-product-destination markets, export survival rates decrease with the number of co-exporters serving the same product-country combination. Other studies find that this relationship is positive and interpret the result as evidence of synergies (positive external economies; see, for example, Cadot et al. (2013)). While we replicate the findings of Cadot et al. (2013), once we control for unobserved confounding factors related to the profitability of the specific markets, the reported synergies not only disappear but the relationship between cohort size and survival is shown to be negative. We find this key result in the full data set, in each of the two regions separately, and in each of the six countries separately. The negative effect of cohort size on first-year survival is also found when country-level variables are included, when aggregated data from a larger set of countries is explored, and when second-year survival is examined.

This first finding implies that the positive relationship observed in some previous studies between export survival and the number of firms in the same export market may be capturing the presence of unobserved factors that affect the profitability of the market. That is, unobserved cost, productivity, or demand factors that make a market more profitable than other observably similar markets may cause the market to have more exporters and also higher survival rates of export flows. Including fixed effects to account for such factors raises the evidentiary bar in the search for synergies, by requiring their estimation to come only from variation over time and firms within an origin-product-destination market and removing the possibility of bias from time-invariant, market-specific confounders. Given that Melitz-type trade models, standard models in industrial organization, our own theoretical model presented in an appendix,[1] and basic microeconomic theory all predict that competition from more firms in a market should lead to lower profits and hence a lower survival rate of novel export flows, we believe that a high bar for a contrary finding is appropriate. Although we find no evidence of synergies, we do not contend that they do not exist. Rather, we argue that in our data when the cohort size increases, the negative effect of increased competition on survival dominates any synergies. Thus, holding unobserved

[1] A model in the appendix provides one example among many models which show that, everything else equal, an extra competitor leads to a decrease in survival rates.

profitability factors constant, having more competitors selling goods in the same product-destination space results in lower survival of export flows.

The second main finding is that product diversification appears to affect survival rates of export flows in a nonmonotonic fashion. We measure diversification with a firm-level Herfindahl-Hirschmann Index (HHI) calculated from the firm's export value shares by product for the year. Export flow survival in the first year exhibits a hump-shaped relationship with product diversification.[2] The survival rates of export flows increase as firms begin to diversify their product mix (i.e., as HHI begins to move below 1, its maximum possible value representing the point of no diversification at all). However, below a threshold HHI near 0.7, further diversification reduces the survival chances of the product-destination flows.

Third, when we investigate the impact of cohort size on export flow survival of firms in African and Latin American countries separately, we find differences in the magnitude of the effect. In particular, the marginal effect of competition from more firms seems to affect the export survival of African firms more than Latin American firms.

The rest of the article is organized as follows: Section 2 discusses briefly some of the factors influencing export survival, Section 3 introduces the data and methodology, Section 4 goes over the results and provides some robustness checks, and Section 5 concludes.

2 FACTORS INFLUENCING EXPORT SURVIVAL AMONG FIRMS

The literature looking at factors influencing export survival has emphasized the role of export clusters, export diversification, and the characteristics of origin and destination countries.[3] Tovar and Martínez (2011) use firm-level data from Colombia to show that larger export clusters within the same product-destination category (which the authors call networks) are associated with improved odds of survival of exporters in the cohort. Cadot et al. (2013) find a similar result with a different set of countries. The presence of other firms from the same country that offer the same product in a specific destination can lead to synergies that increase the probability of survival. Cadot et al. (2013) argue that synergy results from the sharing of information, with new entrants learning from incumbents about the profitability of the product, consumer preferences and reliability of buyers. If this information deriving from the experience of co-exporters is also shared among financial institutions, firms might gain easier access to credit and higher survival Cadot et al. (2013). In these causal explanations of the positive association between the cohort size and export survival, an increase in the number of firms would lead to better chances of survival due to the sharing of information, even holding constant the underlying profitability of the market.

[2] Replacing this measure of product diversification with a similar HHI constructed from export value shares across product-destination combinations yields similar qualitative results.

[3] Export survival of a firm is also related to the role that firms play along the global production chain. There seem to be higher survival rates for firms that produce intermediate goods compared to final goods (Obashi, 2010; Córcoles et al., 2015). Given the focus of the present work, this aspect is not investigated here.

On the other hand, an increase in the number of exporters serving the same product-destination market can lead to more intense competition that can negatively affect export survival. Hausmann and Rodrik (2003) provide a theoretical model and some informal evidence that if a firm discovers a profitable export market, other firms will imitate because the barriers to enter the market are low. Such imitation and follow-on entry can make the export market unprofitable for some of the firms in the long run. Their model implies that on the way to a free-entry equilibrium, the rents of the early incumbents or later entrants can disappear, leading to exit as more firms (perhaps with lower costs) join the same market. Using data from Mexico under NAFTA, Iacovone and Javorcik (2010) provide evidence that firms discovering export opportunities are rapidly imitated by other firms. Their data show that whereas incumbents in their fifth year account for close to 20% of total sales, first-year exporters provide competition, having a 12% share of sales. They conclude that "a vast percentage of export varieties do not survive for more than a year in the market" (p. 483). Their analysis shows evidence of widespread competition among incumbents and entrants increases in the same market, which is likely to affect negatively survival rates.

Firm-level export diversification has also been associated with export survival rates in the literature. Tovar and Martínez (2011) show that month-to-month survival rates are higher for firms that diversify exports across multiple countries, and even more so for firms diversifying exports across product categories. Similarly, several other studies find that survival or other measures of export success improve with diversification across both geography and products (Carballo and Volpe Martincus, 2008; Volpe Martincus and Carballo, 2009; Cadot et al., 2013; Stirbat et al., 2015). These studies typically look only for monotonic effects of diversification on survival; in contrast we provide evidence that there is an optimal amount of product diversification for export survival.

Characteristics of origin and destination countries also matter for firm-level export survival (Besedeš, 2013; Behrens et al., 2013; Cadot et al., 2013; Iacovone et al., 2013). The policy environment in the origin country is likely to affect trade costs and the ability to export. For example, institutional factors such as the rule of law, private property rights, and the political environment will determine the business environment and will facilitate or hinder the conduct of business domestically and internationally. The country's level of financial development can also affect the success of firms in the international market. Access to private credit is likely to reduce production costs and facilitate trade (Beck, 2002; Manova, 2012; Jaud et al., 2015) as well as result in lower expected costs associated with export failure (Mora, 2019). Export survival may also respond directly to demand shocks in destination countries. These demand shocks are influenced by the economic and policy environment in destination countries (Foster et al., 2008). Trade agreements play a key role in facilitating trade relationships between countries.

Besedeš (2013) shows that NAFTA increased the hazard rate of export failure for trade between the United States and Mexico, that is, lower export survival, with smaller exporters accounting for most of the exits. For Mexico, competition from Chinese exports means that smaller plants and marginal products are more likely to exit, while larger plants and core products are likely to survive (Iacovone et al., 2013). In the context of Sub-Saharan countries, trade agreements have a positive effect on the extensive margin of trade (Nicita and Rollo, 2015). Cultural characteristics at the country level such as sharing common language between countries could also facilitate trade relationships. Furthermore, Fugazza and Molina (2009) show that the duration of trade relationships increases with the region's level of development. Geographic characteristics are closely related to trade costs and thus matter for export survival. The probability of a previously unsupplied overseas market receiving goods from an exporter in the future depends on the proximity of the former from markets that the exporter currently supplies (Evenett and Venables, 2002).

We account for how country-specific factors affect export survival in four ways, by: (a) including origin–destination fixed effects to account for confounding factors specific to the bilateral trade relationship; (b) including fixed effects to absorb time-varying factors common to all exporters either exporting from (origin-year) or exporting to (destination year) a given country;

(c) estimating the empirical model separately by region and country, to determine whether the relationships between the explanatory factors of interest and export survival are moderated by unobserved differences among the countries; and (d) including national-level variables such as the product of the GDPs of the two countries, the level of financial development and rule of law, exchange rates, and the presence of trade treaties.

3 DATA AND METHODOLOGY

We use a novel collection of firm-level data covering export transactions. The unit of observation in the data is an export flow, showing values and quantities exported by a unique firm-product-destination combination in a given year t. HS six-digit product categories define the product variable p; where necessary we also refer to HS two-digit categories as product groups (indexed by g).[4] The destination country d for each export flow is also identified. Firms are identified with anonymous codes that are unique to each origin country and stored in variable f; exporters cannot be linked across countries if they operate in more than one. The Trade and Integration Unit of the World Bank Research Department compiled the data from the raw transactions recorded by customs authorities into the Exporter Dynamics Database (Fernandes et al., 2016).[5]

Our analysis covers the following six African and Latin American countries and periods: Burkina Faso (2005–2010, 6 years), Senegal (2000–2010, 11 years), Guatemala, (2003–2010, 8 years), Mexico (2000–2009, 10 years), Peru (1993–2009, 17 years), and Uruguay (2001–2012, 12 years). Among the African

[4] The Harmonized System (HS) is a six-digit code system for classifying internationally traded goods. A description of the HS and the twoand six-digit product categories can be accessed at https://unstats.un.org/unsd/tradekb/Knowledgebase/50018/Harmonized-Commodity-Description-and-Coding-Systems-HS.

[5] The firm-level export data are available only for a limited number of countries, and we used all data available from African and Latin American countries with one exception. Data for Malawi are also available; we excluded this country because the years of coverage have a large discontinuity.

and Latin American countries included in the EDD, external researchers have access only to the countries we include in our analysis.[6]

We compare our firm-level data with the corresponding aggregate export flows in the UN COMTRADE database to assess its quality. Total export values at the country-product level are highly correlated, even if they do not match exactly. The correlation coefficients between total export values for the two export data sources at the product-origin–destination level are 0.98 for Senegal and 0.96 for Burkina Faso, 0.99 for Mexico and 0.999 for Peru.[7]

We also extend our investigation in Section 4.2 to include the Exporter Dynamics Database (EDD), a data set lacking firm-level exports but with a greater geographic scope of 68 countries. While the EDD does not allow investigation of firm-specific factors, it allows us to compare our findings for market-level variables with those from areas outside the developing economies of Africa and Latin America. The unit of observation in the EDD file we use is a product group-origin–destination country combination. Variables in the EDD include the number of exporters, average exporter size, and total exports. The EDD also describes export diversification, in terms of the share of top exporters, as well as the number of products and destinations per exporter. Cebeci et al. (2012) outline how the EDD was sourced, cleaned, and compiled.

Table 1 describes the most pertinent elements of the firm-level data by country. We focus on the roughly 2.4 million firm-product-destination-year observations that represent export flows in their first year, out of the 4.3 million observations in the full data set. We follow others in the literature (Besedeš and Prusa, 2011; Cadot et al., 2013; Fernandes et al., 2016) and use only first-year flows because the hazard rate of export failure decreases dramatically with duration; surviving the first year in a new market is the greatest challenge for exporters. In addition to the concern about growth, the effect of extra competition from larger cohort sizes on survival should be stronger for first-year flows, since none of the potential advantages of experience and incumbency are available yet. The final sample of nearly 2.4 million observations comprises exports from over 185,000 unique firms, in more than 5,700 product categories, to nearly 240 destination countries between 1993 and 2011. From Table 1, we observe that the countries also differ greatly in terms of size—the number of exporters—as well as the products and destinations linked to those exporters.

The survival rates of firm-product-destination export flows vary notably by product, firm, and country. We define first-year export flow survival rates formally as the fraction of export flows observed in year t that are also present in year t + 1. This variable ranges from a mean value of 0.14 for Burkina Faso to 0.28 for Uruguay, the highest value in this sample, with Mexico a close second at 0.27 (as shown in Table 1). These differences illustrate the initial observation in this article that aggregate export growth in

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[6] But see footnote 5. Detailed description of the data and data collection process for each country are at microdata. worldbank.org/index.php/catalog/2545/study-description.

[7] Cebeci et al. (2012), who examine the quality of the data in the EDD, explain that some of the difference may be due to how exchange rates are measured. They also reports on data quality for other countries in the EDD database.

countries like Burkina Faso would be notably higher if survival after the first year were not so low; in this case, half the value for Uruguay. Our focus on survival rates in the first-year only follows Cadot et al. (2013) and Fernandes et al. (2016), among others. This approach avoids confounding the advantages of export incumbency with the other predictors of the survival of an export flow.

Our key variable is cohort size, n^{c}_{pdt} , the number of firms from a country selling the same product to the same destination in a given year. There are notable differences in cohort size among the countries of export origin in our sample. As expected, countries with more exporters have larger product-destination cohorts. For example, the average first-year export flow from Senegal is part of a cohort of size 2.4, compared with a cohort of nearly 130 for Mexico. This measure of cohort size plays the leading role in our estimations when we re-examine the evidence regarding positive external economies among exporting firms.[8]

Firm-level product diversification also varies broadly from country to country. Such diversification (or, more properly speaking, product concentration) is measured with the Herfindahl-Hirschmann Index (HHI; taking values on the unit interval) based on shares of export value by product. Lower values of HHI correspond to greater diversification. The variable HHI^{HS6}_{ft} measures the firm's (lack of) diversification across products with no regard for the destination country:

$$HHI_{ft}^{HS6} = \sum_{p}\left[V_{fpt} / \left(\sum_{p} V_{fpt}\right)\right]^2$$

where product share V_{fpt} is the sum of export flow values over all destinations served by the exporter in the year (and, as always, the firm index pertains to exports from a single country). HHI so measured is 0.54 for Uruguay, near 0.46 for Mexico and Burkina Faso, but is much lower (less than 0.4) for Peru, Guatemala and Senegal. The pattern suggests that exporting in more than one HS6 product category is more common for firms in the latter three countries. Exporters of only one product in a particular year, for example, made up 47% of the firm-years associated with Mexico, compared with 42% for Senegal.

The number of firm-product combinations from origin country c in destination d, n^{c}_{dt}, may reflect in part the strength and scope of existing trade relationships between two countries that firms can leverage to sustain exports (Cadot et al., 2013). The number of firm-product combinations in a bilateral trade relationship varies in rough proportion with the number of firms in the origin country, as expected. The product count n_{fpt} and destination count n_{fdt} (the number of destinations to which firm f exports product p and the number of products that firm f exports to destination d) reflect differences in the pattern of firm-level diversification for the countries.

Two other control variables are included in the regressions but are left out of Table 1 to save space. Specific-market initial export value, V_{fpdt} (a standard control variable in this literature, and one we

[8] While Table 1 shows summary statistics for the levels of the cohort size variable, in the estimations the regressor is in log form. The same applies to the variables for destination count, product count, and product-destination count.

include to match the work of Cadot et al. (2013)), shows considerable variation among countries. For example, average export flow values are $49,000 for Senegal and $197,000 for Mexico. The final regressor appearing in the estimations is the product's sales share of all the firm's exports, a measure of how "core" the product is among the firm's exports:

$$Z_{fpt} = V_{fpt} / \left(\sum_{p} V_{fpt} \right)$$

Previous literature finds that survival of core products is higher (Cadot et al., 2013; Iacovone et al., 2013; Eckel et al., 2015). Z_{fpt} ranges from an average of 0.3 in Uruguay to 0.12 in Guatemala. The systematic differences among countries in all the firm-specific variables motivate the country fixed effects in the regressions using aggregate data that appear later in this article.

We observe that export survival rates are lower on average for the African countries in Table 1. This prompts questions about how regional differences in the size of the national economies may drive the results, since the African countries in our sample have smaller GDPs and fewer firms per country than the Latin American countries. It also raises questions about the how the differing products exported by each country and their trade partners affect the results. These questions are answered in Section 4.3. The role of geography may also be glimpsed in the differences between the average product counts of African and Latin American economies in our data (with the exception of Uruguay). These differences may be due to differing shares of crude commodities and manufactures in the countries' and regions' exports, since there are many more product varieties among manufactured goods than among crude commodities.

To explore the determinants of export survival, we use a linear probability model, with variables defined to emulate the main empirical model in Cadot et al. (2013). Our first goal is to show that our baseline findings are similar even though our data sets differ. After establishing the baseline, we then show that the findings change as we introduce additional fixed effects not considered before by Cadot et al. (2013) or other authors.

We use the linear probability model (LPM) for the mean survival rate for several reasons. The LPM is immune to the incidental parameter problem when including large numbers of fixed effects and it is a highly defensible model for conditional expectation even when nonlinear models may seem apt (Angrist, 2001). Furthermore, the marginal effects from probit regressions rarely differ substantially from OLS regression coefficients.[9] We therefore investigate this relationship in the following way:

$$I_{fpdt} = \alpha + \beta_1 n_{pdt}^c + \beta_2 n_{fpt} + \beta_3 n_{fdt} + \beta_4 n_{dt}^c + \beta_5 V_{fpdt} + \beta_6 Z_{fpt} + HHI_{ft}^{HS6} + \varepsilon_{fpdt} \quad (1)$$

The dependent variable I_{fpdt}, which is observed only for observations with export value $V_{fpdt} > 0$, indicates whether an export flow of a product p from a firm f in country c to destination d survives from

[9] See Sueyoshi (1995) for discussion of the implications of using the probit model to model discrete survival data.

period t to t + 1. That is, I_{fpdt} =1 if V_{fpdt} +1 > 0 and I_{fpdt} =0 if V_{fpdt} +1 = 0. The term α in Equation (1) represents various sets of fixed effects for country, product, firm and other combinations as described later in this section. The number of co-exporters in the same product to the same destination (n^c_{pdt}), export cohort (n^c_{dp}), and other variables in the equation follow the definitions and explanations provided above. Apart from HHI^{HS6}_{ft}, all regressors enter the specification in log form. ε_{fpdt} is an error term.

In the absence of appropriate sets of fixed effects, various unobserved factors may lead to omitted variables bias. The natural concern is that the number of firms in a product-destination cohort is endogenous, being jointly determined along with the survival rates of export flows by the primitives of producer costs (or productivity) and market demand that affect the profitability of the market and shape competition among firms.

4 EMPIRICAL RESULTS

We present next our empirical results on firm-level diversification and the survival of yearly export flows using the Exporter Dynamic Database at the firm-product-destination transaction level and at the aggregate product group-origin–destination level. We also estimate our model for African and Latin American countries separately by region and nation to confirm that the findings from the main analysis are not driven by any one region or country. Furthermore, we conduct two other robustness checks. In the first, we take an alternative approach to estimation by controlling for country-level characteristics. In the other, we consider export survival past the second year instead if the first year.

4.1 Results at the firm level

Column (1) of Table 2 shows the baseline specification, which is same as one of the basic specifications in Cadot et al. (2013). The estimations shown in Columns (2) and (3) of Table 2 add linear and quadratic specifications for HHI. In these first three estimations we include fixed effects for only the HS2 product group, origin–destination, origin-year and destination-year, to match Cadot et al. (2013). The standard errors in all estimations account for multi-way clustering on product-destination and firm. The discussion of the firm-level results is organized around our main research questions: the impact of cohort size and the nonlinear effect of product diversification.

4.1.1 The effect of cohort size on export survival

The coefficient for the cohort size, n^c_{pdt} , is positive and statistically significant in all three estimations. The results thus replicate the positive association found in previous literature between export survival rates and the number of firms serving the same product-destination combination in the same year. The following example illustrates the magnitude of the coefficient. Consider the market for exporting ballpoint pens from Mexico to the United States in 2010. Column (1) suggests, if the results were taken to be causal, that the probability of a first-time export of ballpoint pens surviving past the first year would increase by roughly 3.4 percentage points if the cohort of Mexican firms exporting ballpoint pens to the US were to double in number.

As discussed above, these results could follow from synergy among firms exporting in the same market. However, a natural expectation is that larger cohorts would result in lower individual firm survival, after holding other things equal. A positive impact of cohort size contradicts Melitz-type trade models, as in the model presented in Appendix B.1, as well as standard models of industrial organization: other things equal, when more firms compete in a market each firm's profit is lower, and therefore so is each firm's chance of survival. Another competitor entering a product-destination market typically steals at least some market share from existing firms and pushes prices down as well.[10] Lower profitability implies a lower buffer for adverse cost, productivity or demand shocks, and hence lower export survival. When confronted with an unexpected sign of an estimated coefficient, before looking to a theoretical explanation Occam's razor suggests exploring whether the counter-intuitive result might instead stem from unobserved confounding factors—in this case, factors that attract firms to markets with better prospects for profit and survival.

We control for such potential confounding factors with fixed effects at a detailed level of the market: the origin-product-destination combination. These fixed effects control for cost or demand shocks affecting the exporting country, the country purchasing the goods, the product, and every specific combination of these. Once we include origin-product-destination fixed effects (Columns (4)–(6) of Table 2), we obtain a markedly different result than before: where there are more firms exporting within a cohort, the export flow survival rate falls.[11] (We are also left with slightly fewer usable observations for the regression, as some origin-product-destination combinations only occur once in the data). This result obtains in each of the three estimations, and the negative coefficient on cohort size is highly statistically significant. Thus, the apparent synergies or positive externalities from cohort size disappear completely. This finding suggests that the observed pattern of apparent synergies may in fact be driven by unobserved profitability factors in the destination markets for a specific product that lead to increases in both the number of exporting firms and the survival of first-time exporters in that specific market.

It is unsurprising that unobserved heterogeneity in the profitability of markets may have caused the apparent synergy, because there is a great deal of heterogeneity across origin-product-destination markets left after controlling for all the variables and fixed effects in estimation 3 in Table 2. The overall standard deviation of the residuals from that estimation is 0.39, while the “between” standard deviation of the average residuals in a market across origin-product-destination markets is 0.27. This heterogeneity is one reason why average export survival rates in our data vary widely across markets. Survival varies from nearly zero for products like frogs' legs (HS 020820), to higher than 0.7 for products like zinc plates (HS 790500).

[10] Most standard models of competition (e.g., Cournot competition, Bertrand competition with differentiated products, monopolistic competition models with a fixed number of firms, etc.) share this result. To mention just one specific result, consider Cowling and Waterson (1976) for Cournot competition with constant marginal costs and demand from consumers who spend a fixed amount of their income on the (homogeneous) good. Under these conditions, the HHI is exactly proportional to industry profitability.

[11] The additional estimations discussed in Section 4.3 show that this fundamental result is not driven by one region and also holds individually for each country.

4.1.2 The effect of product diversification

The estimations in Columns (2) and (5) of Table 2 yield a positive association between our measure of firm-level diversification, HHI, and the probability of survival, suggesting that diversification lowers the chances for survival. However, when HHI enters the regression as a quadratic (Columns (3) and (6) of Table 2), the relationship is shown to be hump-shaped. Survival rates increase as a firm diversifies, but only to a certain point (HHIs of 0.72 and 0.75, respectively). Beyond those thresholds, further diversification lowers the chance that the firm's product-destination flow survives beyond the first year. Thus, it appears possible that some firms overly diversify, at least from the standpoint of survival.[12] This notion is in accord with literature suggesting that core export products for a firm have greater chances of survival; a highly diversified firm has no core products (at least as proxied by market share).

Previous work shows that survival rates are higher for firms that diversify exports (Tovar and Martínez, 2011; Cadot et al., 2013). Our analysis expands that literature by showing evidence that the relationship between survival rates and export diversification at the firm-level is positive in the important region where a firm first begins to diversify (which includes over half of firms)[13] but not monotonic. At some point, a firm can apparently spread its export portfolio too thin and increase the hazard of losing its existing export flows.

We also estimate specifications that include diversification across product-destination combinations, and these do not change the explained variation or the coefficients for diversification across products. We do not report these regressions, but the results suggest that most of the effect of firm-level diversification on export survival is driven by how firms specialize or diversify their product portfolio alone, rather than their destination-specific portfolios.

Most of the coefficients for the other variables included in our baseline model match the expectations set in previous work: export survival rates are positively associated with the destination (n_{fpt}) and product (n_{fdt}) counts and export value (V_{fpdt})[14] (see Table 2). Cadot et al. (2013) ascribe the positive association of survival with the destination count, as a proxy for geographic diversification, to the presence of unobserved confounders such as more robust production lines, better information about

[12] Note, however, that diversification beyond the point of maximum survival may nevertheless be part of a rational search strategy that firms undertake to explore the profitability of new markets. Maximum survival need not correspond to maximum long-term profitability. Furthermore, ex post evidence of failure does not imply ex ante irrational behavior even if the goal of the firm is to maximize survival, given the informational constraints facing small exporters. For discussion of SMEs' limited information regarding export markets, see Julien and Ramangalahy (2003).

[13] Based on estimation 6 from Table 2, the marginal effect of the HHI for product diversification on export survival is zero at 0.750; the largest value of HHI for which the marginal effect is significantly positive (at the 5% level) is 0.701. About 56.7% of firm-years in the sample have HHIs in the region where the hypothesis that the marginal effect is negative cannot be rejected (note that a negative marginal effect of HHI corresponds to a positive effect of diversification).

[14] The estimated coefficient for export value need not be interpreted as a causal effect; this variable is included only as a control and to match the previous literature. If this regressor is omitted from estimation 4 in Table 2, the coefficient of interest for cohort size changes little (−0.0397, SE = 0.004).

the cross-country drivers of a product's demand, or higher product quality. Results from a set of estimations including firm fixed effects (not reported here) confirm that the positive coefficients on the destination counts are likely due to such confounders instead of causal impacts of geographic diversification per se.[15] Similarly, inclusion of firm-destination fixed effects reveals no evidence that the positive association between the product count and survival is causal.[16]

The number of firm-product pairs exporting to the destination country (n^c_{dt}) is negatively associated with survival in the first three estimations, but this apparent negative effect disappears once we add the origin-product-destination fixed effects. The coefficients on the product's share of the firm's exports are negative, in contrast to the expectation that core products will have higher survival (Iacovone et al., 2013). However, the coefficients are very small and are insignificant once the quadratic in HHI is added to the specifications.

4.2 Results at the aggregate level

We next examine whether our main findings hold for data that span more countries, but with a less-detailed definition of export flows. In Table 3, we broadly follow the specifications in Table 2 to see whether our main findings also apply to all 68 countries in the Exporter Dynamics Database (EDD). Since these data are reported as product group-origin–destination aggregates (as described in Section 3), we cannot construct exact counterparts to the variables in Table 2 for this exercise. In the EDD, the product group is available only to the HS two-digit level.[17] For example, one observation in the data represents exports from Senegal to Germany in the meats, fish and seafood food preparations group (HS 16). The dependent variable in these regressions is the survival rate of first-year export flows in a product group-origin–destination market.

[15] When we add firm-product fixed effects to estimations 1 to 3 of Table 2 (results not reported), the signs of the coefficients on the destination count are reversed from positive to statistically significantly negative. Once the factors mentioned by Cadot et al. (2013) (private information about demand, product quality, etc.) are absorbed into firmproduct fixed effects, the remaining variation over time of the destination count—which should be sufficient to reveal any positive impact solely from geographic diversification itself—yields a negative coefficient on n_{fpt}. The same result obtains in each case when the model is estimated separately for each country. Thus, there appears to be no evidence for a causal positive effect of geographical diversification in its own right on export survival. In contrast, the results suggest the opposite, perhaps because firms try to leverage cost, quality, or marketing advantages into increasingly weaker markets.
[16] When we add firm-destination fixed effects to estimations 1 to 3 of Table 2 (results not reported), the signs of the coefficients on the product count are reversed from positive to statistically significantly negative. The same result obtains in each case when the model is estimated separately for each country. Cadot et al. (2013) describe the product count as a proxy for product scope. Selling more products, however, is endogenously determined by the firm's costs, economies of scope, joint marketing efforts in the destination country, reputation, and other factors. After controlling for such unobserved factors with firm-destination fixed effects, it appears that exporting more products to the same destination decreases the likelihood that any one export flow survives past the first year. As with the results discussed in footnote 15, this may be because firms try to leverage cost, quality, or marketing advantages into selling increasingly less profitable products.
[17] See footnote 4.

The key regressor, cohort size, is the number of firms exporting in each origin-group-destination set (denoted n^c_{gdt}, where g stands for the HS2 product group). Apart from the switch from product to product group, n^c_{gdt} is the direct analog to n^c_{pdt} in the previous regressions. Instead of the firm's initial export value, in these regressions we include two measures of export size: the average export value per new exporter within the product group-origin–destination cell, and the same measure computed for all exporters. In the firm-level estimations, the initial export value could have been from a continuing firm (since the first-year flows in that sample could have been from a firm previously exporting other products or to other destinations) or an entrant. Thus, we include these two new regressors to cover both cases. The latter reflects the activity of established exporting firms, while the former may capture effects of firms entering new markets at scale (similar to the coefficient on the firm's initial export value from before) or the effects of a surge of new competition.

The number of exporters from the origin country serving the destination country is like the firm-product count n^c_{pdt} from before, except that each firm is counted only once.[18] The count of the unique destinations for each country's product group is the measure most comparable to n_{fpt} from before. We also include the average product count (i.e., the number of HS6 products per exporter) in place of n_{fdt}. Our other control variable is the product group's share of exports from the origin country to the destination in the year (a replacement for the "core product" proxy Z_{fpt} from the firm-level regressions).[19] No measure of firm-level product diversification comparable to HHI^{HS6} is available. All regressors enter the regression in log form.

Apart from the variable of primary interest, n^c_{dt} , the definitions of the control variables are different enough from the previous regressions that direct comparison of results is not possible. Therefore, we focus mainly on the main coefficient, for cohort size. Table 3 shows that our main finding is broadly applicable to the larger set of countries in the EDD—a greater number of co-exporters in the market leads to lower survival rates for export flows. In particular, we observe the same reversal of the sign for the coefficient that measures the effect of cohort size as in Table 2. Without the controls for unobserved product group-origin–destination confounding profitability factors (Columns (1) and (2) in Table 3), there is apparent synergy, while adding the additional fixed effects yields instead the expected negative coefficient on cohort size.

4.3 Results from regional analyses

To investigate how our findings may differ by region, we estimate the same models shown in Columns (1) and (6) of Table 2 using data from firms in African and Latin American countries separately. The results are shown in Table 4. The baseline estimations, which do not include the origin-product-destination fixed effects, are shown in Column (1) of Table 4 for African firms and Column (3) for Latin American firms. In these estimations the coefficients on the cohort size variable are positive, similar to

[18] The number of exporters from the origin country serving the destination country is from a version of the EDD with no breakdown by product group.

[19] This variable is calculated as the product of the average exports per exporter and the number of exporters in the product group-origin-destination market for the year, divided by total exports between the origin and destination countries across all product groups in the year.

the baseline specification for the entire sample (Column (1) of Table 2). Interestingly, the magnitude of the coefficient for the cohort size variable is much larger for the African sample than for the Latin American sample (0.052 vs. 0.034). Once we include the origin-product-destination fixed effects, the cohort size coefficient becomes negative and statistically significant (Columns (2) and (4) of Table 4). Again, we observe that the magnitude of the coefficient of our variable of interest is much larger for the African sample than the Latin American sample (−0.091 vs. −0.033). Thus, competition from additional firms seems to affect export survival more in Africa than in Latin America.

We also further break down the results by country. Table A1 shows the estimates by country for the regression specification equivalent to Column (3) of Table 2; in all cases, the cohort size coefficient is positive. The country-by-country results with the origin-product-destination fixed effects included are in Table A2 (equivalent to Column (6) of Table 2). As before, the cohort size coefficient in each regression turns negative once the potential endogeneity of the regressor is accounted for with the fixed effects, and each is statistically significant. Thus, the findings regarding synergy versus competition in the effects of cohort size on survival do not depend on any one country's part of the entire sample. In all these estimations, the quadratic terms for product diversification are significant and have the same signs as in the main estimation. However, the effect of product diversification is hump-shaped only for Mexico, Senegal, and Peru; for the other countries the marginal effect of HHI is positive everywhere.[20]

Table 5 shows the results when we estimate the model for African and Latin American countries separately using the aggregate level data. We observe that the coefficient for the cohort size is positive and statistically significant for both regions when the product group-origin–destination fixed effects are left out. When we add those fixed effects, the coefficient of the cohort size is negative and statistically significant for both samples, in accord with all previous results in this regard. The magnitude of the coefficient on cohort size is larger for the Latin American sample, the opposite of the results with the regional firm-level data. We expect the results obtained when using firm-level data to be more reliable to assess the impact of cohort size in the different regions since aggregate data could mask the dynamics that firms face in the international market. To investigate how our findings may differ by region, we estimate the same models shown in Columns (1) and (6) of Table 2 using data from firms in African and Latin American countries separately. The results are shown in Table 4. The baseline estimations, which do not include the origin-product-destination fixed effects, are shown in Column (1) of Table 4 for African firms and Column (3) for Latin American firms. In these estimations the coefficients on the cohort size variable are positive, similar to the baseline specification for the entire sample (Column (1) of Table 2). Interestingly, the magnitude of the coefficient for the cohort size variable is much larger for the African sample than for the Latin American sample (0.052 vs. 0.034). Once we include the origin-product-destination fixed effects, the cohort size coefficient becomes negative and statistically significant (Columns (2) and (4) of Table 4). Again, we observe that the magnitude of the coefficient of our variable of interest is much larger for the African sample than the Latin American

[20] That is, the peak of the hump implied by the coefficients is slightly above 1.0 for Burkina Faso, Guatemala, and Uruguay.

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4.4 Further robustness checks

We conduct two final robustness checks: controlling for country-level characteristics and modeling export survival past the second year.

4.4.1 Country-level factors and survival

Partly as a robustness check and partly because of the importance found for export survival of country and bilateral characteristics (as discussed in the literature review), we also estimate the same models specified in Columns (1) and (6) of Table 2 including certain country-level variables. These are: the product of GDP in the origin and destination country, measures of financial development and the law and order in the origin country, the exchange rate, and an indicator for a trade agreement covering the two countries (data sources and details are described in Section 2.2). We include country-level variables similar to some of the ones included in Besedes and Blyde (2010). Estimates including country-level variables are shown in Table 6. Table 6 shows the estimates for the full sample in Columns (1) and (2), for the African sample in Columns (3) and (4), and for the Latin American sample in Columns (5) and (6).

In relation to the cohort size variable, we observe that size, sign, and significance of the coefficients in Table 6 are very similar to those obtained in the main specifications (the estimates in Tables 2 and 4). As in those estimations, the coefficient of the cohort size switches from positive and statistically significant to negative and statistically significant for all samples. We observe that the magnitude of the coefficient of the cohort size is greater for the African sample, as it was in the regional estimations in Table 4. Thus cohort size seems to, as found above, have a greater negative effect on the survival of export flows from Africa than from Latin America. As we found before, the relationship between survival rates and export diversification at the firm-level is nonmonotonic (in particular, hump-shaped) for both regions. Thus these estimations show that our main conclusions are robust to using some of the country- and country-pair level, time-varying variables employed in previous studies instead of the origin-year and destination year fixed effects.

While included mainly for the sake of the robustness check, the new regressors also display some significant associations with export survival. The interaction term between GDP in the origin and destination country has a positive coefficient, which is the typical result in the literature. We follow Besedes and Blyde (2010) by measuring financial development with the ratio of private credit to GDP. While the natural expectation is that higher levels of financial development in an origin country would lead to higher levels of export survival, as found in Besedes and Blyde (2010), the results show the opposite. The coefficients for the financial development variable are negative and statistically significant when we estimate the model for the full and Latin American samples. These results may suggest that firm-, product- and country-level attributes that predict export survival override the effects of private credit, or that access to private credit is correlated with more risk-taking in exports, after we control for the other regressors and unobserved factors specific to the origin–destination pair.[21]

We find that export survival rates increase with the degree of law and order in the full and Latin American samples, consistent with previous published work (Besedes and Blyde, 2010). There is no variation in the law and order index for the African countries during the years of our sample, and so its coefficient cannot be estimated for the African subsample.[22] The exchange rate has a negative and statistically significant effect in most estimations, which is also expected since currency appreciation is reflected in lower export demand in the destination country. Surprisingly, trade treaties show a statistically significant negative effect in the full and Latin American estimations. It is unknown whether this result stems from disadvantageous treaty terms in Latin America, the quality of the treaty data,[23] or other reasons. Not finding a positive association between trade treaties and survival for firms in the African countries is interesting, given the finding of Nicita and Rollo (2015) regarding treaties and the extensive margin of trade. It may be that trade treaties in Africa encourage new firms to begin exporting, without improving the survival odds of individual export flows.

[2121] In particular, inclusion of all the fixed effects in the first column of Table 6 (for example) means that the impact of financial development on survival is identified in these estimations from variation within a single HS2 product group traded between the origin–destination pair, net of time trends commonly affecting the whole sample. If the origin– destination fixed effects are omitted from the estimation, the financial development variable has the expected positive association with export survival.

[22] This also explains, of course, why the law and order coefficients are identical in the Latin American and full samples.

[23] See footnote 28.

4.4.2 Second-year survival

Furthermore, our main findings are largely robust to using other subsets of the larger data set. Specifically, Table 7 repeats the regression exercises in Table 2 for export flows in their second consecutive year. The dependent variable is an indicator for whether the second year flow, conditional on having survived its first year, also survives to its third year. Given the findings in Besedes and Blyde (2010) and Besedeš and Prusa (2011) that export flow survival rates increase with age, second year flows are not directly comparable to first-year flows. In the 4.3 million data observations available for all countries and years in the EDD, about 600,000 are for flows in their second year.

In Columns (4)–(6) of Table 7, the coefficient on the number of co-exporters changes from positive to negative once we introduce origin-product-destination fixed effects, just as in Table 2.[24] The evidence is thus in line with our main findings. Even for export flows in their second consecutive year, for which firms may have established advantages of incumbency and reputation, we do not find evidence of synergies once we control for confounding factors specific to the product market in the bilateral trade relationship. Rather, it appears to support the idea that larger cohort sizes lead to increased competition and lower survival rates, as predicted by the model in Appendix B.1.

5 CONCLUSION

Aggregate export growth is linked to the export survival margin, not just the intensive margin (average export value per exporting firm) and the extensive margin (the number of exporters). The findings of a growing literature show that with higher export survival rates, export growth in developing economies would increase. Some recent research suggests the interesting notion that higher survival rates may be due to synergies, that is, positive external economies that increase export flow survival rates as the number of home-country exporters increase (Tovar and Martínez, 2011; Cadot et al., 2013).

Our work revisits this literature by focusing on the survival of export flows from six African and Latin American countries. While there are apparent synergies when the model is estimated without the full set of fixed effects, we find the opposite after controlling for unobserved profitability factors that may attract more firms and increase survival in a market. The evidence indicates that facing more co-exporting competitors in foreign market for a product decreases the survival of a first-year export flow. This pattern of sign reversal on the cohort variable holds in the full firm-level data set, in both regions separately, in each country individually, and with aggregate data for a broader set of exporting countries. We also find that the cohort size seems to affect negatively the export flow survival of African firms to a greater degree than in Latin America.

Additionally, we find that a firm's export diversification of products influences export flow survival. Survival rates in the first year exhibits a hump-shaped relationship with diversification, so that export flow survival is lower not only for single-product exporting firms but also for highly-diversified firms. The

[24] As stated above, the difference in the number of observations is expected since some firms export only a single product to a destination.

highest levels of export flow survival correspond to firms with product diversification HHIs near 0.72–0.75.

These finding have important policy implications. Policies that seek to increase export sales by targeting specific products or industries may be partially self-defeating if gains from the intensive and extensive margins are counterbalanced by higher export flow failure from increased competition. If so, then such policies would result in a smaller than expected increase in export sales in that industry. Country-level characteristics such as good institutions have a larger impact on export success, as shown in the present results and elsewhere in the literature, and improvements at this level would benefit firms in all industries and are likely to have a larger impact in terms of export growth at the country level. These findings suggest further research into policy-relevant questions on the drivers of exports and export growth in developing economies.

For future research, it will be important to test whether the results found in our empirical analysis hold when we account for changes in the size of the firm and its experience in the global market (see Berthou and Vicard (2015) using French data). Export survival of a firm is also related to the role that it plays along the global production chain. It has been found that the survival rate for firms that produce intermediate goods is higher than those that produce final goods (Córcoles et al., 2015). Thus, accounting for the role of the firm in the global production chain is also warranted. We are unable to control for these factors given the nature of our data set.

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TABLES

TABLE 1 Descriptive statistics: Firm-product-destination data

Variables	**Mean**	***SD***	**min**	**max**
Mexico—131,809 firms, 1,541,752 observations (2000–2009)				
Export survival (first year) (I_{fpdt})	0.27	0.44	0	1
Cohort size: Product destination (n^c_{pdt})	129.68	309.78	1	2,343
Firm HHI: Product (HHI^{HS6}_{ft})	0.46	0.31	0.01	1
Destination count (n_{fpt})	3.47	7.04	1	117
Product count(n_{fdt})	81.81	321.44	1	4,146
Firm-product count (n^c_{dt})	68,829	72,436	1	174,478
Peru—30,302 firms, 45,433 observations (1993–2009)				
Export survival (first year) (I_{fpdt})	0.22	0.41	0	1
Cohort size: Product destination (n^c_{pdt})	16.32	33.06	1	415
Firm HHI: Product (HHI^{HS6}_{ft})	0.38	0.29	0.01	1
Destination count (n_{fpt})	2.38	3.42	1	55
Product count (n_{fdt})	20.98	35.61	1	354
Firm-product count (n^c_{dt})	3,684.8	4,089.5	1	13,952
Guatemala—12,463 firms, 259,622 observations (2003–2010)				
Export survival (first year) (I_{fpdt})	0.22	0.41	0	1
Cohort size: Product destination (n^c_{pdt})	10.87	19.13	1	252
Firm HHI: Product (HHI^{HS6}_{ft})	0.34	0.30	0.02	1
Destination count (n_{fpt})	2.14	2.63	1	45
Product count(n_{fdt})	41.27	66.79	1	484
Firm-product count (n^c)	5,655.6	4,402.4	1	13,620
Uruguay—6907 firms, 61,888 observations (2001–2012)				
Export survival (first year) (I_{fpdt})	0.28	0.45	0	1
Cohort size: Product destination (n^c_{pdt})	3.40	5.39	1	74
Firm HHI: Product (HHI^{HS6}_{ft})	0.54	0.29	0.04	1
Destination count (n_{fpt})	3.68	5.11	1	44
Product count(n_{fdt})	8.37	15.14	1	155
Firm-product count (n^c)	639.22	571.49	1	1,803
Senegal—2,508 firms, 47,202 observations (2000–2010)				
Export survival (first year) (I_{fpdt})	0.19	0.39	0	1
Cohort size: Product destination (n^c_{pdt})	2.41	3.20	1	35
Firm HHI: Product (HHI^{HS6}_{ft})	0.38	0.27	0.03	1
Destination count (n_{fpt})	2.55	3.82	1	53
Product count(n_{fdt})	12.09	19.36	1	163
Firm-product count (n^c_{pft})	410.99	312.94	1	1,126

Burkina Faso—1,247 firms, 10,419 observations (2005–2010)				
Export survival (first year) (I_{fpdt})	0.14	0.35	0	1
Cohort size: Product destination (n^c_{pdt})	2.68	3.98	1	31
Firm HHI: Product (HHI^{HS6}_{ft})	0.47	0.31	0.07	1
Destination count (n_{fpt})	2.05	2.71	1	25
Product count (n_{fdt})	8.60	19.69	1	165
Firm-product count (n^c_{pft})	169	125.57	1	401

Note: Variables n^c_{pdt}, n_{fpt}, n_{fdt}, and n^c_{dt} enter the regressions in log form but are in levels here.

TABLE 2 Determinants of survival past first year: Firm-level

Variables	(1) Baseline	(2) + HHI	(3) + HHI^2	(4) (1) + FE	(5) (2) + FE	(6) (3) + FE
Cohort size (n^c_{pdt})	0.034***	0.034***	0.034***	−0.034***	−0.034***	−0.034***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
Destination count (n_{fpt})	0.114***	0.114***	0.115***	0.117***	0.117***	0.118***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Product count (n_{fdt})	0.034***	0.040***	0.045***	0.037***	0.043***	0.047***
	(0.003)	(0.003)	(0.002)	(0.001)	(0.002)	(0.001)
Log(value)	0.038***	0.037***	0.036***	0.039***	0.039***	0.038***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)
Firm-product count (n^c_{dt})	−0.021***	−0.022***	−0.021***	−0.004	−0.005	−0.004
	(0.008)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)
Share of firm exports (Z_{fpt})	−0.002***	−0.001***	−0.000	−0.002***	−0.001**	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HHI^{HS6}_{ft}		0.048***	0.217***		0.047***	0.184***
		(0.004)	(0.041)		(0.004)	(0.021)
HHI^{HS6}_{ft} squared			−0.151***			−0.123***
			(0.036)			(0.018)
Observations	2,365,886	2,365,886	2,365,886	2,215,549	2,215,549	2,215,549
R-squared	0.192	0.193	0.193	0.274	0.275	0.275
Origin–destination FE	Y	Y	Y	–	–	–
Product group (HS2) FE	Y	Y	Y	–	–	–
Origin-product-destination FE	N	N	N	Y	Y	Y
Origin-year FE	Y	Y	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y	Y	Y

Note: Standard errors robust to multi-way clustering on product-destination and firm are in parentheses. The dependent variable is a dummy variable for a new export flow surviving to its second year. The unit of observation in the regressions is a firm-product-destination-year combination, limited to export flows in their first year. The main variables, as described in the text, are the number of exporting firms in the same cohort selling to the same product-destination combination (n^c_{pdt}) and the diversification index of the firm's product export (HHI^{HS6}_{ft}). All independent variables except HHI are in logs. An entry of "–" in the table of fixed effects indicates that those fixed effects are subsumed into other included fixed effects.

*p < .1. **p < .05. ***p < .01.

TABLE 3 Determinants of survival past first year: Aggregate data

Variables	**(1) Baseline**	**(2) Full**	**(3) (1) + POD FE**	**(4) (2) + POD FE**
Cohort size (n^c_{gdt})	0.021***	0.016***	−0.076***	−0.075***
	(0.001)	(0.001)	(0.001)	(0.002)
Average exporter size	0.001***	−0.002*	−0.011***	−0.012***
	(0.000)	(0.001)	(0.000)	(0.001)
Average new exporter size	0.029***	0.029***	0.038***	0.038***
	(0.000)	(0.000)	(0.000)	(0.000)
Firm count (n^c_{dt})	−0.072***	−0.070***	−0.005*	−0.007**
	(0.003)	(0.003)	(0.003)	(0.003)
Destination count		0.008***		0.037***
		(0.001)		(0.004)
Average product count		0.017***		0.025***
		(0.001)		(0.001)
Share of exports		0.002**		−0.001
		(0.001)		(0.001)
Observations	636,641	622,343	595,620	582,763
R-squared	0.172	0.175	0.372	0.373
Product group (HS2) FE	Y	Y	–	–
Origin–destination FE	Y	Y	–	–
Product group-origin–destination FE	N	N	Y	Y
Origin-year FE	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to clustering on product group-origin–destination are in parentheses. POD FE in the column headings refers to product Group-Origin–Destination fixed effects, where the product group is an HS2 category. The dependent variable is the proportion of new export flows surviving to their second year. The unit of observation in the regressions is a unique country origin–destination-HS2 combination. The main explanatory variable is the number of exporting firms selling products in the same HS two-digit product group to the same destination in the same year (n^c_{gdt}). All independent variables are in logs. An entry of "–" in the table of fixed effects indicates that those fixed effects are subsumed into other included fixed effects.

TABLE 4 Determinants of survival past first year by region: Firm-level data

Variables	(1) AFRICA Baseline	(2) AFRICA HHI^2	(3) LATAM Baseline	(4) LATAM HHI^2
Cohort size (n^c_{pdt})	0.052***	−0.091***	0.034***	−0.033***
	(0.004)	(0.007)	(0.001)	(0.004)
Destination count (n_{fpt})	0.130***	0.139***	0.114***	0.118***
	(0.005)	(0.006)	(0.002)	(0.002)
Product count (n_{fdt})	0.036***	0.053***	0.034***	0.047***
	(0.003)	(0.004)	(0.003)	(0.001)
Firm-product count (n^c_{dt})	−0.032**	−0.014	−0.029***	−0.009
	(0.016)	(0.031)	(0.008)	(0.009)
Log(value)	0.027***	0.033***	0.038***	0.038***
	(0.002)	(0.002)	(0.001)	(0.000)
Share of firm exports (Z_{fpt})	0.000	0.002	−0.002***	−0.000
	(0.002)	(0.002)	(0.000)	(0.000)
HHI^{HS6}_{ft}		0.311***		0.181***
		(0.049)		(0.022)
HHI^{HS6}_{ft} squared		−0.189***		−0.121***
		(0.042)		(0.018)
Observations	57,357	40,520	2,308,295	2,174,715
R-squared	0.227	0.421	0.191	0.273
Origin–destination FE	Y	–	Y	–
Product group (HS2) FE	Y	–	Y	–
Origin-product-destination FE	N	Y	N	Y
Origin-year FE	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to multi-way clustering on product-destination and firm are in parentheses. The dependent variable is a dummy variable for a new export flow surviving to its second year. The unit of observation in the regressions is a firm-product-destination-year combination, limited to export flows in their first year. All independent variables except HHI are in logs. An entry of "–" in the table of fixed effects indicates that those fixed effects are subsumed into other included fixed effects.

TABLE 5 Survival past first year by region: Aggregate data

Variables	**(1) AFRICA No POD FE**	**(2) LATAM No POD FE**	**(3) AFRICA (1) + POD FE**	**(4) LATAM + (2) + POD FE**
Cohort size (n^c_{gdt})	0.025***	0.015***	−0.065***	−0.089***
	(0.002)	(0.003)	(0.003)	(0.004)
Average exporter size	−0.001	−0.005**	−0.012***	−0.016***
	(0.002)	(0.002)	(0.002)	(0.003)
Average new exporter size	0.026***	0.031***	0.034***	0.039***
	(0.001)	(0.001)	(0.001)	(0.001)
Firm count (n^c_{dt})	−0.068***	−0.071***	−0.007	−0.002
	(0.006)	(0.007)	(0.007)	(0.008)
Destination count	0.007***	0.009***	0.027***	0.043***
	(0.003)	(0.003)	(0.007)	(0.007)
Average product count	0.017***	0.014***	0.024***	0.019***
	(0.001)	(0.001)	(0.002)	(0.002)
Share of exports	−0.000	0.005**	−0.001	0.004
	(0.002)	(0.002)	(0.002)	(0.003)
Observations	152,821	166,666	143,504	158,594
R-squared	0.162	0.172	0.353	0.365
Product group (HS2) FE	Y	Y	–	–
Origin–destination FE	Y	Y	–	–
Product group-origin–destination FE	N	N	Y	Y
Origin-year FE	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to clustering on product group-origin–destination are in parentheses. POD FE in the column headings refers to product Group-Origin–Destination fixed effects, where P represents product group is an HS2 category. The unit of observation in the regressions is a unique country product group-origin–destination combination. The main explanatory variable is the number of exporting firms selling products in the same HS two-digit product group to the same destination in the same year (n^c_{gdt}). All independent variables are in logs. All independent variables are in logs. An entry of "–" in the table of fixed effects indicates that those fixed effects are subsumed into other included fixed effects.

TABLE 6 Survival past first year: Firm-level data controlling for country characteristics

Variables	**(1) ALL Baseline**	**(2) ALL OPD FE**	**(3) AFRICA Baseline**	**(4) AFRICA OPD FE**	**(5) LATAM Baseline**	**(6) LATAM OPD FE**
Cohort size (n^c_{pdt})	0.034***	−0.032***	0.048***	−0.094***	0.034***	−0.031***
	(0.001)	(0.004)	(0.005)	(0.008)	(0.001)	(0.004)
Dest count (n_{fpt})	0.116***	0.120***	0.134***	0.144***	0.115***	0.119***
	(0.004)	(0.003)	(0.006)	(0.001)	(0.004)	(0.003)
Product count (n_{fdt})	0.034***	0.047***	0.036***	0.051***	0.034***	0.047***
	(0.003)	(0.002)	(0.004)	(0.005)	(0.003)	(0.002)
Firm-product count (n^c_{dt})	−0.011**	0.016**	−0.007	0.013	−0.009	0.018***
	(0.006)	(0.006)	(0.011)	(0.014)	(0.006)	(0.006)
Log(value)	0.039***	0.039***	0.027***	0.033***	0.039***	0.039***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Share of exports (Z_{fpt})	−0.002***	−0.000	0.000	0.002	−0.002***	−0.000
	(0.000)	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)
HHI^{HS6}_{ft}		0.187***		0.309***		0.184***
		(0.026)		(0.053)		(0.026)
HHI^{HS6}_{ft} squared		−0.125***		−0.193***		−0.124***
		(0.022)		(0.047)		(0.023)
Log($GDP_c \times GDP_d$)	0.002***	0.001**	0.003***	0.002*	0.002**	0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Financial development	−0.211***	−0.237***	−0.290	−0.082	−0.219***	−0.242***
	(0.015)	(0.013)	(0.185)	(0.170)	(0.016)	(0.014)
Law and order	0.073***	0.072***			0.073***	0.072***
	(0.007)	(0.005)			(0.008)	(0.006)
Exchange rate	−0.013**	−0.017***	−0.020	−0.042***	−0.017***	−0.020***
	(0.006)	(0.005)	(0.016)	(0.016)	(0.006)	(0.005)
Treaty	−0.008**	−0.011***	0.137***	0.049	−0.009**	−0.011***
	(0.004)	(0.004)	(0.035)	(0.042)	(0.004)	(0.004)
Observations	1,997,130	1,882,945	43,267	30,111	1,953,863	1,852,834
R-squared	0.263	0.219	0.418	0.185	0.261	
Origin–destination FE	Y	–	Y	–	Y	–
Product group (HS2) FE	Y	–	Y	–	Y	–
Origin-product-destination (OPD) FE	N	Y	N	Y	N	Y
Year FE	Y	Y	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to multi-way clustering on product-destination and firm are in parentheses. See notes to Table 2. These estimations include year fixed effects. However, they do not include origin-year or destination-year fixed effects; the origin-related fixed effects would preclude estimating coefficients for the financial development and law and order regressors. The coefficient on the law and order regressor is not identified in estimations 3 and 4 because the variable has no variation in the African sample.

TABLE 7 Determinants of survival past second year: Firm-level data

Variables	(1) Baseline	(2) + HHI	(3) + HHI^2	(4) (1) with OPD FE	(5) (2) with OPD FE	(6) (3) with OPD FE
Cohort size (n^c_{pdt})	0.025***	0.024***	0.024***	−0.035***	−0.035***	−0.035***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Destination count (n_{fpt})	0.089***	0.088***	0.089***	0.091***	0.090***	0.091***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Product count (n_{fdt})	0.040***	0.049***	0.055***	0.041***	0.049***	0.053***
	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)
Log(value)	0.043***	0.042***	0.041***	0.047***	0.046***	0.045***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm-product count (n^c_{dt})	−0.009	−0.010	−0.009	0.058***	0.056***	0.058***
	(0.015)	(0.015)	(0.015)	(0.018)	(0.018)	(0.018)
Share of firm exports (Z_{fpt})	0.001	0.002***	0.004***	−0.001	0.001	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HHI^{HS6}_{ft}		0.068***	0.265***		0.060***	0.199***
		(0.008)	(0.056)		(0.007)	(0.032)
HHI^{HS6}_{ft} squared			−0.175***			−0.123***
			(0.048)			(0.026)
Observations	593,146	593,146	593,146	527,558	527,558	527,558
R-squared	0.232	0.233	0.234	0.344	0.344	0.344
Origin–destination FE	Y	Y	Y	–	–	–
Product group (HS2) FE	Y	Y	Y	–	–	–
Origin-product-destination FE	N	N	N	Y	Y	Y
Origin-year FE	Y	Y	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to multi-way clustering on product-destination and firm are in parentheses. The dependent variable is a dummy variable for a second-year export flow surviving to its third year. The unit of observation in the regressions is a firm-product-destination-year combination, limited to export flows in their second year. The main variables, as described in the text, are the number of exporting firms in the same cohort selling to the same product-destination combination (nc) and the diversification index of the firm's product export ($HHI^{HS6}{}_{ft}$). All independent variables except HHI are in logs. An entry of "–" in the table of fixed effects indicates that those fixed effects are subsumed into other included fixed effects.

APPENDIX A

The following tables repeat the estimations from Columns (3) and (6) of Table 2 country by country. Note that the firm-product count regressor (n^c_{dt}) is missing because it is subsumed into the destination-year fixed effects in these single-country regressions. Table A1 does not include the origin-product-destination fixed effects to control for market-specific profitability factors, whereas Table A2 does. As in all the other estimations in the main text, the results for cohort size show apparent "synergy" in Table A1 but the expected negative effects of competition in Table A2.

TABLE A1 Determinants of survival past first year by country: Firm-level data without OPD fixed effects

Variables	(1) BFA	(2) SEN	(3) URY	(4) GTM	(5) MEX	(6) PER
Cohort size (n^c_{pdt})	0.063***	0.049***	0.040***	0.024***	0.033***	0.042***
	(0.008)	(0.004)	(0.005)	(0.002)	(0.001)	(0.001)
Destination count (n_{fpt})	0.098***	0.137***	0.113***	0.134***	0.121***	0.087***
	(0.012)	(0.006)	(0.005)	(0.007)	(0.002)	(0.003)
Product count (n_{fdt})	0.041***	0.050***	0.058***	0.039***	0.043***	0.051***
	(0.007)	(0.004)	(0.005)	(0.005)	(0.002)	(0.002)
Log(value)	0.029***	0.027***	0.045***	0.038***	0.037***	0.034***
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Share of firm exports	0.000	−0.001	−0.001	0.001	−0.000	−0.000
	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
HHI_{ft}^{HS6}	0.244***	0.268***	0.165***	0.125***	0.232***	0.182***
	(0.089)	(0.052)	(0.063)	(0.045)	(0.059)	(0.025)
HHI_{ft}^{HS6} squared	−0.132*	−0.159***	−0.076	−0.061	−0.170***	−0.100***
	(0.072)	(0.047)	(0.050)	(0.038)	(0.050)	(0.021)
Observations	10,274	46,974	61,624	259,473	1,541,590	445,037
R-squared	0.209	0.240	0.219	0.266	0.196	0.151
Origin–destination FE	Y	Y	Y	Y	Y	Y
Product group (HS2) FE	Y	Y	Y	Y	Y	Y
Origin-product-destination FE	N	N	N	N	N	N
Origin-year (i.e., year) FE	Y	Y	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Standard errors robust to multi-way clustering on product-destination and firm are in parentheses. OPD fixed effects are those for the Origin-Product-Destination combination. The dependent variable is a dummy variable for a new export flow surviving to its second year. The unit of observation in the regressions is a firm-product-destination-year combination, limited to export flows in their first year. The main variables, as described in the text, are the number of exporting firms in the same cohort selling to the same product-destination combination (n^c_{pdt}) and the diversification index of the firm's product export (HHI^{HS6}_{ft}). All independent variables except HHI are in logs.

TABLE A2 Survival past first year by country: Firm-level data with OPD fixed effects

Variables	(1) BFA	(2) SEN	(3) URY	(4) GTM	(5) MEX	(6) PER
Cohort size (n^c_{pdt})	−0.121***	−0.087***	−0.106***	−0.058***	−0.031***	−0.019***
	(0.014)	(0.008)	(0.008)	(0.004)	(0.007)	(0.002)
Destination count (n_{fpt})	0.103***	0.145***	0.124***	0.139***	0.123***	0.088***
	(0.015)	(0.006)	(0.006)	(0.007)	(0.002)	(0.003)
Product count (n_{fdt})	0.053***	0.053***	0.053***	0.042***	0.044***	0.059***
	(0.008)	(0.004)	(0.006)	(0.005)	(0.001)	(0.002)
Log(value)	0.040***	0.031***	0.054***	0.038***	0.038***	0.036***
	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Share of firm exports (Z_{fpt})	0.000	0.002	−0.003*	0.003***	−0.001	−0.000
	(0.003)	(0.002)	(0.002)	(0.001)	(0.000)	(0.001)
HHI^{HS6}_{ft}	0.340***	0.321***	0.135*	0.131***	0.180***	0.191***
	(0.114)	(0.055)	(0.069)	(0.045)	(0.029)	(0.026)
HHI^{HS6}_{ft} squared	−0.166*	−0.206***	−0.065	−0.065*	−0.127***	−0.106***
	(0.094)	(0.048)	(0.054)	(0.037)	(0.024)	(0.021)
Observations	6742	33,705	45,832	237,850	1,481,188	409,283
R-squared	0.436	0.422	0.438	0.373	0.264	0.236
Origin–destination FE	–	–	–	–	–	–
Product group (HS2) FE FE	–	–	–	–	–	–
Origin-product-destination FE	Y	Y	Y	Y	Y	Y
Origin-year (i.e., year) FE	Y	Y	Y	Y	Y	Y
Destination-year FE	Y	Y	Y	Y	Y	Y

*p < .1. **p < .05. ***p < .01.

Note: Robust standard errors in parentheses. OPD fixed effects are those for the Origin-Product-Destination combination. The dependent variable is a dummy variable for a new export flow surviving to its second year. See also notes to the previous table.

APPENDIX B

Model: Survival rates and competition

Many international trade models with monopolistic competition show that, all else equal, an increase in competition (an increase in the number of firms exporting or in the number of varieties exported) results in a decrease in average demand for each existing exporter and would likely lead to a decrease in the value exported and even a decrease in the survival rate for exporters.[25] As an example demonstrating that more competition leads to more exit of firms, we present the following Melitz-type trade model (based on Spearot (2013)).

Consumers maximize utility

In Spearot (2013), preferences are quasilinear and exhibit love of variety. Preferences of the representative consumer for differentiated varieties chosen from set Ω have the following form:

$$U^l = x_0^l + \theta \int_{i\in\Omega} q_i^l di - \frac{\eta}{2}\left(\int_{i\in\Omega} q_i^l di\right)^2 + \frac{\gamma}{2}\int_{i\in\Omega} (q_i^l)^2 di \qquad \text{(B1)}$$

where q_i^l is the quantity consumed of variety i by individual l; x_0^l is the numeraire good; $\theta, \eta > 0$ determine the pattern of substitution between varieties; and $\gamma > 0$ shows the value of variety.

The representative consumer maximizes utility subject to a budget constraint; the budget is written as $x_0^l + \int_{i\in\Omega} p_i^c q_i^l di \leq I$, where I is the income of the representative consumer and p_i^c is the price paid by the consumer for a unit of q_i^l. Solving the consumer's problem gives us the following inverse demand for individual l: $p_i^c = A - \gamma q_i^l$, where $A = \theta - \eta \int_{i\in\Omega} q_i^l$. As we show below, A is a demand parameter, and all else equal a more competitive market (more q_i varieties available) leads to a decrease in A and, thus, a decrease in demand for all varieties. Within A, $\int_{i\in\Omega} q_i^l$ is total production in this market. Thus, we can also think of A as including GDP at the export destination as well as preferences, aggregate price level, etc.

For a country with L consumers, demand for variety i is $q_i = Lq_i^l = \frac{L}{\gamma}(A - p_i^c)$ and the inverse demand function is $p_i^c = A - \frac{\gamma}{L} q_i$.

Firms maximize profits

Firms pay an ad-valorem tariff (τ) per unit exported and $p^c = (1+\tau)p_i^s = tp_i^s$, where $t = (1+\tau)$ and p_i^s is the price received by the firms exporting variety i. We assume that each firm produces only one variety and that the variety is produced at a constant, but firm-specific, marginal cost (c_i); thus, i denotes both the firm and the product variety. Firms face the following inverse demand function: $p_i^s = \frac{1}{t}\left(A - \frac{\gamma}{L} q_i\right)$, where firms take A as given. Firms maximize profits by choosing the quantity produced of variety i; the maximization problem can be written as follows:

[25] For a summary of recent literature, both theoretical and empirical, of firms in trade see Díez et al. (2018).

$$\pi(c_i) = \max_{q_i} \frac{1}{t}\left(A - \frac{\gamma}{L}q_i\right)q_i - c_i q_i \tag{B2}$$

Solving the firm's problem gives us the optimal production for the firm producing variety i; the solution to the firm problem is $q(c_i) = \frac{L}{2\gamma}(A - c_i t)$. Firms export as long as $A > c_i t$; that is, firms with low enough marginal costs export and the others only supply their home market.

Model implications

The export value, not including tariff revenue, for this firm is $V(c_i) = \frac{L}{4\gamma t}\left(A^2 - (c_i t)^2\right)$. Export value is increasing with the number of consumers abroad (L) and with the demand parameter (A); export value is decreasing with marginal costs (c_i) and tariff costs (t). Note, however, that lower trade costs affect export revenue through two channels. The first is positive and direct by increasing $V(c_i)$, and the second is negative and indirect by increasing competition (lower A); for a more thorough examination of when the first outweighs the second, and vice versa, see Spearot (2013). Here we focus on the demand parameter A. By substituting optimal production $\left(q_i^l = \frac{q(c_i)}{L} = \frac{1}{2\gamma}(A - c_i t)\right)$ into $A = \theta - \eta \int_{i \in \Omega} q_i^l$, we can express A as follows:

$$A = \left(\frac{2\gamma}{2\gamma + \eta N}\right)\theta + \left(\frac{\eta N}{2\gamma + \eta N}\right)\bar{c}t \tag{B3}$$

where $\bar{c}$ is the average marginal cost of imported varieties and N is the number of varieties available to the consumers. This is the equation of interest for our article, and it shows that all else equal an increase in the number of varieties (N) leads to a decrease in A.[26] Since A is the demand parameter, when it is smaller it lowers the price a firm can charge the L consumers abroad and decreases export revenue. The reductions in revenue imply that the marginally profitable exporting firms can no longer compete. In the model, N includes exporters from the home country as well as exporters from a third country. Thus, any increase in competition, be it from a competitor in the home country or from a competitor in a third country, results in less export revenue for all exporters. More importantly, for our empirics, this also implies that, all else equal, we should expect more firms to fail at exporting when competition increases, and this effect should be felt stronger for firms exporting the first year. While not directly shown in the model, if new exporters face a more elastic demand curve then the extra competition would have a disproportionate impact on those firms. Intuitively, first-year exporters may still be attempting to find successful export matches, or may even be in the process of "learning" about their export potential. For all of these reasons, we focus on first-year survival in our empirics.

[26] This assumes that $\bar{c}t < \theta$. Since $A > c_i t$ for all exporters, then it must be that $c_i t < \theta$ for all exporters and $\bar{c}t < \theta$.

Country-level data and variables

Following Besedes and Blyde (2010), we also include in one set of estimations a collection of variables that account for some of the characteristics of origin and destination countries. The first of these is the product of GDP in the origin and the destination country (in natural loga- rithm). This indicator was constructed using data from the World Bank (2017). The exchange rate, expressed as the value of one unit of currency of origin country in terms of destination country, provides a second economic variable. The exchange rates are constructed as cross rates by reference to the United States dollar, using data from the International Monetary Fund (2015).

We also include the following policy-relevant variables: the financial development of the origin country (private credit as a share of GDP in logs, obtained from the World Bank (2016));[27] law and order in the origin country (obtained from the Individual Country Risk Guide Dataset; PRS Group, 2017); and trade agreements. For the latter, we construct an indicator variable for the presence of a signed trade agreement between origin and destination country (using data from Dür et al. (2014)). Such agreements can be bilateral arrangements or due to a larger multi- lateral trade treaty.[28]

[27] Besedes and Blyde (2010) use as an indicator of financial development the addition of private credit and stock market capitalization, both as a share of GDP. Because data on stock market capitalization is missing for four out of the six countries in our analysis, we instead decided to use private credit as a share of GDP in our model.

[28] Our indicator of trade agreements has several limitations. First, we have information on the year in which the treaty was signed, but not on whether that treaty ended. We also construct our variable based in the year in which the treaty was signed, which might not be the same year in which the treaty went into effect. We assume a value equal to zero if there is no treaty recorded in the database of Dür et al. (2014).