Success and failure of African exporters*

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Abstract

Using a novel dataset with transaction-level level exports from Malawi, Mali, Senegal and Tanzania, we explore the determinants of the survival of firm-product-destination combinations past the first year after entry on export markets. We confirm earlier findings linking export survival to initial volumes. We also find that survival correlates with

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diversification (or experience) at the extensive margin: a firm-product-destination combination is more likely to survive if the firm ships more products to that destination, or if it ships that product to more destinations, suggesting synergies within the firm. Most strikingly, we find significant evidence of cross-firm synergies: a firm-product-destination is more likely to survive, the more firms *from the same country* export the same product to the same destination. However preliminary, these results may suggest a case for export promotion at the national level.

1 Introduction

In their seminal work on export survival, Besedes and Prusa (2006) showed that the median duration of export spells[1] was only two years. This striking finding suggested that it might be useful to think of export expansion at a 'sustainability margin' alongside the traditional intensive and extensive margins. It also suggested, albeit indirectly, that targeting the sustainability margin would be particularly important if getting into export markets involved sunk costs (as suggested by the work of Das, Robert and Tybout 2007), because the short survival of export spells implied repeated entry and hence duplication of sunk costs.

Moreover, Besedes and Prusa (2007) and others have shown that cross-country variation in the extensive margin explains little of the variation in export growth compared to the intensive and sustainability margins, suggesting that those two might be good targets for export promotion. It is thus important for the design of export-promotion policies to search for robust and policy-related determinants of export survival. The present paper contributes to that search.

At the product level, the determinants of export survival have been explored by a small but growing literature. Besedes and Prusa (2006) used two panels of U.S. imports, one spanning 1972-88 with tariff-schedule data, the other spanning the 1989-2001 period with 10-digit data (the Feenstra-NBER dataset). In both cases, they found that half of all trade relationships lasted only one year and three quarters lasted three years or less. Once censoring was taken into account, median duration was two years. Most strikingly, this pattern of short duration was robust to aggregation at HS6, even though one would expect interruptions to be smoothed out by aggregation. They also found negative duration dependence, meaning that the hazard rate fell as export spells grew older. This finding, however, has been recently contested by Brenton, Saborowsky and von Uexhull (2010).[2] In terms of survival determinants, Besedes and Prusa (2006) found that industrial-country exports

[1] Meaning periods during which U.S.-bound bilateral flows at a highly disaggregated product level went on without interruptions of more than one year.

[2] Brenton et al. argue that the assumption of proportional hazards, which is needed for Cox regressions to be valid, typically does not hold in export-duration samples (this can be verified using a Schönfeld test). Using the alternative Prentice-Gloeckler (1978) estimator, they find no duration dependence. Brenton et al.'s critique applies to the quasi-entirety of the export-survival literature.

lasted longer, and so did exportsof machinery, a finding confirmed by the analysis of Asian trade flows by Obashi (2010).

Besedes and Prusa (2006) explore the determinants of export survival further by testing the implications of a search model proposed by Rauch and Watson (2003) in which importers search for low-cost suppliers and exporters invest optimally in production capacity in the face of moral hazard (risk of non-payment). The model implies that, in general, smaller initial transactions have a lower life expectancy; however, differentiated goods, where moral hazard is highest, involve both smaller initial transactions *and* longer life expectancy.

The model's predictions are upheld by Cox regressions on U.S. import data using Rauch's (1999) index of product differentiation as a regressor. That is, the hazard rate is 23% higher for homogenous products than for differentiated ones, although initial transactions are 40% to 350% larger. In related work, Besedes (2008) also finds supports for the Rauch-Watson hypotheses on a restricted sample of Rauch-differentiated products where he proxies search costs by the number of potential suppliers and reliability by income levels.

Evidence from non-U.S. trade flows largely confirms the early findings. The determinants of export duration were explored by Nitsch (2009) using Cox regressions on a ten-year panel of German imports at the HS8 level. He found that gravity variables (distance, exporter GDP, common language, common border, etc.) influenced the duration of trade flows pretty much the same way they influenced trade volumes. Interestingly, he found that the short duration of trade flows held even when flows below 10'000 euros were excluded. Molina and Fugazza (2009) extended the exploration to a nine-year panel of HS6 bilateral trade flows between 96 countries using, as regressors, gravity variables and time required for export procedures (based on the World Bank's *Doing Business* surveys) as proxies for fixed costs. Besides usual findings on the effect of gravity variables and income levels, they found that fixed costs reduced survival.[3]

A similar exercise was carried out on Asian trade flows by Obashi (2009) with largely convergent results. In particular, the 2-to-3 year median survival seems to hold across all samples studied. Obashi also found that vertical

[3]This is unintuitive: in microeconomics, the shut-down point depends on average *variable* costs, not on fixed costs. However the fixed export costs they consider are incurred for each transaction, although they do not depend on transaction size. They are therefore not really fixed when looking at flows aggregated to the annual level.

trade relationships (involving the sale of semi-finished product) have hazard rates one-third lower than those involving the sale of final goods, and that they are less sensitive to trade costs (e.g. distance or exchange-rate fluctuations).

A smaller number of recent papers have made use of the growing availability of firm-level datasets to shed new light on the determinants of export survival. For instance, Görg et al. (2008) tested the implications of the heterogeneous-firm model of Bernard et al. (2006) on a rich panel of 2,043 Hungarian firms spanning the transition from centrally-planned to market economy (1992-2003). Their data contained firm characteristics and exports at the firm-HS6 level. They found large product turnover during the period as firms constantly rearranged their product portfolios. They also found longer survival for products located close to the firm's core competencies and to the country's comparative advantage. These results are consistent with those of Iacovone and Javorcik (2010) who showed the importance of churning at the firm level in response to exogenous opportunities provided by increased globalization.

Alvarez and López (2008) used Tobit regressions to study the determinants of industry-level rates of entry and exit into exporting using a 10-year panel of 5'000 Chilean plants. They found that within-industry heterogeneity, measured (inter alia) by the dispersion of firm-level productivity levels, played an important role in explaining firm turnover in and out of exporting. By contrast, trade costs, factor intensities, and exchange-rate fluctuations were found to have only marginal impacts. Carballo and Volpe (2008) used a 6-year panel of firm-level Peruvian exports at the HS10 level to explore how diversification strategies (in terms of products and markets) affected the survival of firm-level exporting activity. They found that both geographical and product-wise diversification raised survival, but geographical diversification more so—presumably because it proxies for product quality.

We build on this literature and use transaction-level data obtained directly from customs in a sample of African countries (Malawi, Mali, Senegal and Tanzania) to revisit the issue of export survival at the firm level. Our sample of countries is selected essentially on the basis of data availability and reliability.[4] We aggregate transaction-level data to annual totals, and define

[4]The data must of course be taken cautiously, as export transactions are imperfectly monitored by customs (exports typically bring no revenue) and African customs suffer from weak statistical capabilities. As long as the resulting measurement errors affect our main outcome variable, namely survival, these only introduce noise without biasing estimates.

our primary sample unit (PSU) as a (product x firm x destination x starting year) quartet. For such a quartet, we define survival, our dependent variable, as a dummy variable equal to one when the quartet has positive trade value for more than a year. We adopt this binary definition of survival essentially because our panels are too short to carry out a full-fledged survival analysis. This has a cost and a benefit. On one hand, we lose information, as a two-year spell is treated as equivalent to a 4-year one; but, on the other hand, we gain robustness, as the probability of wrongly treating a two-or-more year spell as a one-year one is fairly low.

Our regressions all include bilateral (origin-destination), industry (HS2) and time effects, as well as a number of variables constructed to identify synergy and scale effects.

In spite of the noisy data, we find strikingly robust results across our sample of four countries. First, like Eaton et al. (2008), we find that export spells that survive tend to grow. For instance, in Senegal, products that entered a market in 2001 and survived till 2008 had reached, by then, four times their entry volume.

Second, synergy effects —positive spillovers due to the existence of other firms exporting the same product to the same destination— are significant at the 1% level in all four countries, as are scale/experience effects. For a Senegalese exporter, for instance, the 2001 first-year average survival probability of 22% would rise by eight percentage points to 30% if the number of national competitors selling the same HS6 product on the same destination market were to double from the baseline 21 to 42.

Third and perhaps most importantly for policy implications, those synergies seem to be truly national. We test for this by including in our regression equation the number of firms exporting the same product to the same destination but from other countries (for instance, for Senegal we use Malawi, Mali and Tanzania), as a "placebo" synergy. The placebo effect is never significant, suggesting that it is really the mass of exporters from the *same* country that drives this finding.

Lastly, the market and product experience a firm possesses when it launches a new product-market combination matter for its survival. *Market* experience is proxied by the number of products the firm already exports on that market. *Product* experience is the number of destinations to which the firm already exports that product. [5] Market and product experience both con-

[5] Product experience can alternatively be thought of as a proxy for the product's quality

tribute significantly to the probability of survival beyond the first year.

Our results help explain a finding highlighted in Easterly, Resheff and Schwenkenberg (2009); namely, that national export success often takes the form of 'big hits', with one narrow export item suddenly growing rapidly. If a sufficient number of exporters target one market simultaneously, our results imply that their chances of surviving increase, possibly triggering a virtuous cycle of entry, survival and growth.

From a policy perspective, our findings provide a rationale for using public funds to promote national exports abroad. The synergy we identify is akin to external economies of scale, as the presence of same country-same product competitors enables each exporter to amortize market entry costs over longer runs. However, these economies of scale may not be sufficiently visible and understood to induce incumbent exporters to provide assistance to entrants, leading to a market failure. Similarly, in the presence of imperfect capital markets, it may not be feasible for exporters to fully internalize the experience and scale effects. Public intervention, in the form of export promotion, matching grants, or the provision of key complementary inputs, could help overcome these market failures.

The paper is organized as follows: Section 2 presents a few stylized facts using a recent survey of African exporters conducted by the World Bank as part of the African exporter survival project. Section 3 describes the data. Section 4 discusses estimation issues and results, and section 5 concludes.

2 Data

2.1 Stylized facts from a World Bank survey

Preliminary indications on how African exporters venture and survive (or not) on foreign markets can be gleaned from a 2009 survey on African export survival conducted by the International Trade Department of the World Bank in four African countries.[6] The survey, which had three sections (basic information on the firm, constraints on survival, and opportunities and plans for future expansion), asked exporters specific questions on their initial entry into and survival on export markets. On the basis of the information pro-

and international recognition.

[6]The countries are Malawi, Mali, Senegal and Tanzania. See Appendix 1 for more background information on the survey.

Figure 1: Figure

Figure 2: Figure

vided, respondents were classified into three categories: (i) current exporters, (ii) past exporters (who failed), and (iii) intermittent exporters.

Roughly two thirds of the respondents (a bit more among regular exporters) identified their first client through relatives, friends, intermediaries and suppliers. More formal or technology-related channels (e.g. trade fairs or online research) came only second, and only a fifth of the initial contacts were made through export promotion agencies or exporters' associations. This highlights the importance of personal networks–a theme largely developed in the writings of James Rauch.

Product experience, whether through domestic or foreign sales, appears as a strong driver of geographical export expansion. A majority of respondents reported that their initial export product was one they were already selling domestically, as opposed to starting a new line taylored to the foreign customer's needs. This suggests that experience matters; indirectly, it also suggests a natural 3-step expansion strategy: first the domestic market, then regional markets with similar preferences (so domestically sold products can be tried there), finally more differentiated markets. This is consistent with results in Cadot, Carrère and Strauss-Kahn (2009) which showed that the survival of LDC exports was higher when export to OECD markets was preceded by a small number of years of exports to regional markets. Moreover, when asked whether their most recent export product in a given destination was a new one or one that had previously been exported elsewhere, respondents overwhelmingly indicated the latter. When asked how the opportunity to export a new product came about in the first place, the majority of regular exporters answered that they were approached by an existing buyer asking for a new product, suggesting that *export* experience matters beyond domestic experience.

Finally, in an open question about constraints on export (or export expansion in the case of the current exporters), respondents overwhelmingly (x%) identified access to finance as the main factor limiting their operations (figure **??**). Moreover, the percentage was higher (x%) among past (failed) exporters, suggesting that credit constraints are not just a perception, but a reality effectively hurting the survival of exports.

2.2 Customs data

Our dataset is generated from raw customs files containing export flows at the transaction level. The files were provided by the customs administrations of Malawi, Mali, Senegal and Tanzania. Each file contains information on products exported at the highest level of disaggregation of the HS code used by these administrations: 10-digit for Mali and Senegal and 8-digit for Malawi and Tanzania. In addition to product information, each file contains information on destination market, FOB shipment value, net weight, port used and date of transaction. Individual firm identification was replaced by arbitrary ID codes so as to preserve confidentiality. We aggregated transactions up to annual totals at the 6-digit level, the standard level used in cross-country comparisons.

For consistency, whenever possible we filtered out years with different port coverage. For instance, for Malawi we have information from 2004 onward; however, as fewer ports were covered in 2004 than in other years, we excluded 2004 from our sample for that country. Sample periods are 2005-2008 for Malawi and Mali, 2000-2008 for Senegal, and 2003-2008 for Tanzania.

Table **??** gives descriptive statistics. Tanzania has the largest number of exporters (1'359), followed by Malawi (856), Senegal (715), and Mali (280); however, they are less diversified than those of other countries in our sample in terms of markets. Mali's exporters are, on average, the most diversified in terms of products.

Let f be a firm, d a destination, p a product (at HS6), t the starting year of an export spell, and v^c_{fpdt} the dollar value of exports of product p to destination d in calendar year t by firm f from country c. Because there are no multi-country firms in our sample, indexing observations by firm eliminates the need to index countries. We aggregate transactions to annual (f, p, d, t) quartets, our primary sample unit.

Table 1: Descriptive statistics

	Nr firms	Nr prod.	Nr dest.	Nr prod/firm		Nr dest/firm		Nr firms/prod		Nr firms/dest		v_{fpdt} of entry (USD)	
				Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Mali	280	575	99	2.54	2	3.89	2	1.89	1	7.18	2	219,694	5,373
Malawi	856	932	102	1.57	1	4.10	2	3.76	1	13.19	3	106,475	571
Senegal	715	1,653	100	3.10	1	6.76	2	2.92	2	22.17	5	47,111	3,446
Tanzania	1,359	1,689	137	2.49	1	3.62	1	2.91	1	24.69	7	83,078	2,858

This table shows for each source country: The number of firms, products, destinations, the number of products per firm, number of destination per firm, number of firms per product, number of firms per destination and the value of those firms that entered the export market. All values are computed for the year 2006.

Before turning to survival analysis (next section), a few observations are in point. Following the literature on the intensive and extensive margins (e.g. Evenett and Venables 2003 or Brenton and Newfarmer 2007), we group our primary sample units into new firms, new products (for existing firms), new destinations (for existing firm-products), and continuing firm-product-destinations. Items labeled 'new' refer to units that are present in the data at time t but not at time $t-1$.[7] These groupings create four mutually exclusive categories. The 'new-firm' category includes all product-destination combinations served at time t by an exporter appearing in the data in that year (except the first year). (ii) The 'new-product' category includes all product-destination combinations served at time t by an existing exporter —one that already exported at $t-1$— who did not export that product anywhere at $t-1$. The 'new-destination' category includes all product-destination combinations served at time t by an existing exporter who did not serve that destination with any product at $t-1$. The 'existing product-destination' category includes all product-destination combinations served at time t by an exporter who was also serving that product-destination at $t-1$.

Formally, let $v_{f,t-1}$ stand for f's exports of any product to any destination at $t-1$, $v_{fp,t-1}$ for its exports of product p to any destination, and $v_{fd,t-1}$ for its exports of any product to destination d. Our four categories are

$$\begin{aligned}
\text{NF} &= \{(f,p,d,t)\text{s.t.}v_{fpdt} > 0 \text{ and } v_{f,t-1} = 0\}, \\
\text{NP} &= \{(f,p,d,t)\text{s.t.}v_{fpdt} > 0, v_{f,t-1} > 0 \text{ and } v_{fp,t-1} = 0\}, \\
\text{ND} &= \{(f,p,d,t)\text{s.t.}v_{fpdt} > 0, v_{f,t-1} > 0 \text{ and } v_{fd,t-1} = 0\}, \\
\text{EPD} &= \{(f,p,d,t)\text{s.t.}v_{fpdt} > 0 \text{ and } v_{fpd,t-1} > 0\}.
\end{aligned}$$

The dollar value of export sales in the first three categories can only go from zero at $t-1$ to some positive value at t; these variations add up to the extensive margin. Changes in the dollar value of exports in the last category form the intensive margin.

Figure **??** shows the number of observations per country and their corresponding value, for each of the four categories described above.

[7] Observations in the sample period's initial year are considered left-censored and not used except as lagged values of second-year observations.

Figure 3: Decomposition of observations

Note: This graph classifies each of the origin-firm-product-destination observations into one of four mutually exclusive groups: *New Destination* includes units of existing firms which export an existing product to a new destination; *New Products* includes existing firms that add a product to their portfolio, *New Firms* includes all units from firms that did not export before, while *Continued* includes all other units. The first set of graphs displays the share of observations, and the second set the share of total values of each category.

Looking at export values, existing products sold in existing destinations (i.e. observations for which firm, destination and HS6 at time t are all the same as they were at time t-1) dominate in dollar value, although not always in the count of observations. For example, in Tanzania, continued firm-product-destinations accounted for 90 percent of export value in 2006 but only for 25% of the observation count. This suggests that our countries experiment substantially. This fact is consistent with the findings of Cadot, Carriere and Strauss-Kahn (2010) for low-income countries, Freund and Pierola (2010) for Peru and Iacovone and Javorcik (2010) for Mexico. Continuing firm product destinations make up a relatively small number of export transactions, but a large share of export values. This confirms the findings of Besedes and Prusa (2007) and Brenton and Newfarmer (2007), who also show the importance of the intensive margin in explaining export growth in developing countries (see also Evenett and Venables 2002).

When a firm's product manages to survive on a given destination market beyond the first year, it will grow in volume over time. Conditional on survival, Senegalese firm-product-destinations that appeared in 2001 (we don't know the initial year of those appearing in 2000, the sample's initial year, because they are censored) grew by a factor of over four between 2001 and 2008. Similarly, Tanzanian firm-product-destinations that appeared in 2005 grew by a factor of over three in the sample period (i.e. to 2008).

Table **??** shows the number of firms, firm-products, and firm-product-destinations by a given year of entry and tracks the survival of this cohort over time for each origin country. Naturally, the numbers decrease by attrition. What is remarkable, however, is how large the attrition is in the first year and how quickly it slows down over time. For instance, in Senegal, of the 206 firms that started exporting in 2001, only 84 made it to 2002 (a death rate of 59%); however, of the 24 still around in 2007, only 3 had failed by 2008 (a death rate of 12%).

The third column of that table is derived from the second and shows the survival rate with respect to the previous year (i.e. one minus the annual death rate). Survival rates increase over time. For instance, 59 percent of firms that entered in 2001 dropped out until the next year, while 13 percent of firms that survived until 2007 survive also until 2008. This casual observation is consistent with Besedes and Prusa's decreasing-hazard rate finding (annual death rates are discrete-time approximations to instantaneous hazard rates) although, as noted, this finding must be taken cautiously. Comparing the upper panel (firms) with middle and lower ones (products and product-

Table 2: Survival cohorts

	Senegal Entry:2001			Tanzania Entry:2004			Mali Entry:2005			Malawi Entry:2005		
	Nr	Y-Exit	Exit	Nr	Y-Exit	Exit	Nr	Y-Exit	Exit	Nr	Y-Exit	Exit
Firm												
2001	206											
2002	84	0.59	0.59									
2003	57	0.32	0.72									
2004	40	0.30	0.81	420								
2005	35	0.13	0.83	194	0.54	0.54	273			670		
2006	29	0.17	0.86	118	0.39	0.72	159	0.42	0.42	217	0.68	0.68
2007	24	0.17	0.88	85	0.28	0.80	123	0.23	0.55	154	0.29	0.77
2008	21	0.13	0.90	75	0.12	0.82	103	0.16	0.62	126	0.18	0.81
Product												
2001	2055											
2002	449	0.78	0.78									
2003	192	0.57	0.91									
2004	117	0.39	0.94	2656								
2005	94	0.20	0.95	497	0.81	0.81	1047			3322		
2006	78	0.17	0.96	200	0.60	0.92	305	0.71	0.71	325	0.90	0.90
2007	61	0.22	0.97	106	0.47	0.96	166	0.46	0.84	174	0.46	0.95
2008	54	0.11	0.97	71	0.33	0.97	123	0.26	0.88	127	0.27	0.96
Product destinations												
2001	3326											
2002	718	0.78	0.78									
2003	356	0.50	0.89									
2004	245	0.31	0.93	4908								
2005	167	0.32	0.95	837	0.83	0.83	1391			3828		
2006	129	0.23	0.96	295	0.65	0.94	286	0.79	0.79	509	0.87	0.87
2007	101	0.22	0.97	167	0.43	0.97	122	0.57	0.91	316	0.38	0.92
2008	84	0.17	0.97	113	0.32	0.98	82	0.33	0.94	224	0.29	0.94

Note: In the columns indexed *Nr* we document for each origin country the number of firms products and destinations for the longest available time series. Column *Y-Exit* shows the exit rate (ie. the share of units that left) with respect to the first year, and column *Exit* the exit rate with respect to the entry year.

destinations respectively), there is less stability at more disaggregate levels. These results suggest that there is churning in export products and destinations within firms; in other words, that firms experiment with products and destinations. Thus, Hausman and Rodrik's 'self-discovery' process (Hausman and Rodrik 2003) seems to hold not only at the national level, but also—quite naturally—at the firm level. This pattern is also consistent with the notion that firms face uncertainty about export costs or demand parameters, a notion that is central to the heterogeneous-firms literature.

Finally, the fourth column shows cumulative death rates relative to the first year. In all cases these rates are high, and above 80% in 2008 in most cases (only exception Mali at the firm level). In all four countries, the very high death rates after the first year suggest that a binary coding of survival based on second-year outcomes is a good summary measure of survival.

In sum, the preliminary evidence presented above confirms existing findings about export growth and survival: a) the intensive margin represents the largest share of export growth in terms of values, however these values are concentrated over a small number of transactions and firms; b) there is substantial experimentation in the exporting activity in the form of entry by new firms or the introduction of new products or destinations each year; c) one-year survival rates are low; past the first year, death rates slow down and transaction volumes grow.

3 Estimation strategy

After aggregation of transactions to cumulated annual totals, the primary sample remains a panel, as each firm-product-destination (f, p, d) triplet is observed repeatedly over several years. However, as we are interested in the survival past the first year, the data needs to undertake a second transformation. We define a *new* (f, p, d, t) quartet as one that appears for the first time in the database, and say that this quartet 'survives' if it lasts more than one year. The quartet is then associated to a survival dummy (our dependent variable) equal to one. If it lasts only one year, the survival dummy is set equal to zero for that quartet. If it has already appeared in the sample, we drop it (this concerns only a very small number of observations, since our sample periods are only a few years except for Senegal). Thus, we reduce our panel to a quasi-cross-section, even though each observation has an initial-year tag allowing us to control for calendar time. Doing so allows us to bypass the issue of how long a spell break should be to be considered a 'death', an issue that has been discussed at length in the survival literature and that has no clear-cut answer.

As already noted, firm and country indices are redundant, so we use either a country superscript c or a firm subscript f, but not both, and run our regressions on a pooled cross-country sample.[8] Our dependent variable is

$$s_{fpdt} = \begin{cases} 1 & \text{if } v_{fpdt} > 0, v_{fpd,t-\ell} = 0, \text{ and } v_{fpd,t+1} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

for all $\ell > 0$, and the estimating equation is

$$\Pr(s_{fpdt} = 1) = \phi\left(\mathbf{x}_{fpdt}\beta + \delta_i + \delta_{cd} + \delta_t + u_{fpdt}\right) \quad (2)$$

where ϕ is the probit function and u_{fpdt} is an error term. Fixed effects are by HS2 (δ_i), origin-destination (δ_{cd}), and starting year of the spell (δ_t). The vector of regressors $\mathbf{x}_{fpdt}$ includes measures of the firm's experience with the product and with the destination as well as proxies for agglomeration and market attractiveness. These proxies are counts of (i) n_{ft}, the number of products other than p exported by firm f to any destination; (ii) n_{fdt}, the number of products exported by firm f to destination d; (iii) n_{pdt}, the number of firms exporting product p to destination d; (iv) n_{dt}, the number of products exported to destination d by *all* firms from the same country; and (v) $\ln v_{fpdt}$, the log of the spell's initial value. That is, the notation convention is to omit the index of the dimension over which the count is summed. All counts are put in logs, and we use robust standard errors clustered at the product-destination level throughout.

We estimate equation **??** by probit, reporting marginal effects. Typically, marginal effects of a probit estimation can be interpreted like OLS coefficient, and also in the present case a robustness check reveals that quantitatively the difference between the results from an OLS and a probit regression are small and in most cases not statistically significant.[9]

[8]We also ran, for robustness, separate regressions by origin country. The results of these regressions are available upon request. They are qualitatively similar to those of cross-country (pooled) regressions reported here.

[9]Results of a comparison of OLS and Probit estimates are available upon request.

4 Results

4.1 Baseline

Baseline regression results are shown in Table **??**. All columns report probit marginal effects. OLS results (available upon request) are very similar. Before turning to their detailed interpretation, note that the effects to be discussed are simultaneously present in each regression and so are conditional on each other. Also, note that they must be interpreted as conditional on starting to export in the year for which the equation is estimated. The first column gives baseline results. The second differs from the first in that all right-hand side (RHS) variables are lagged one period. The third and the fourth add one more control each, the share of product p in firm f's export portfolio in the third and origin country c's revealed comparative advantage (RCA) in product p in the fourth.

The first regressor of interest is $\ln n^c_{dt}$, the log of the number of firm-product combinations exported from origin country c to destination country d in year t. If c is Senegal and one Senegalese firm sells two HS6 products in the E.U. and another one sells three, $n^c_{dt} = 5$ for all five observations with $c =$ Senegal and $d =$ E.U. in year t. The effect of this count on survival is insignificant, except in column (2) in which all RHS variables are lagged one period. We discuss the interpretation below.

The second variable reported in Table **??**, $\ln n^c_{pdt}$, counts the number of firms selling the same product in the same destination. The difference between the first and second regressors is that the first counted the number of firm-product combinations in a given origin-destination pair, whereas the second counts the number of firms that sell *a given product*—i.e. direct competitors. The effect is positive and significant at the 1% level in all specifications. That is, more competitors from the same country selling the same product in the same destination together raise each other's survival probability. This is a striking network effect, to which we will come back at some length later on. Ignoring the count nature of the variable, we can approximate its quantitative effect by writing the probability of survival as $\pi_{fpdt} = \Pr(s_{fpdt} = 1)$, so that, using the first column of Table **??**,

$$d\pi_{fpdt} = 0.0792 d \ln n^c_{pdt} = 0.0792 \frac{dn^c_{pdt}}{n^c_{pdt}} \tag{3}$$

Using $\pi_{fpdt} = 0.22$ (from the lower panel of Table **??**) and $n_{pdt} = 22$ as

Table 3: Baseline results

	(1)	(2)	(3)	(4)
n^c_{dt}	-0.00477	-0.0213***	-0.00723	-0.00472
	(0.00594)	(0.00397)	(0.00595)	(0.00594)
n^c_{pdt}	0.0566***	0.0431***	0.0544***	0.0563***
	(0.00283)	(0.00306)	(0.00282)	(0.00285)
n_{fpt}	0.125***	0.0820***	0.125***	0.125***
	(0.00270)	(0.00296)	(0.00269)	(0.0027)
n_{fdt}	0.0375***	0.0224***	0.0478***	0.0375***
	(0.00163)	(0.00152)	(0.00184)	(0.00163)
v_{fpdt}	0.0304***	0.0332***	0.0277***	0.0304***
	(0.000898)	(0.000889)	(0.000921)	(0.000898)
s_{fp}			0.0771***	
			(0.00640)	
RCA				$<$0.0001
				($<$0.0001)
RHS vars lagged	No	Yes	No	No
HS2 FE	Yes	Yes	Yes	Yes
Origin-dest. FE	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
Obs.	57,063	57,063	57,063	57,063

Note: Origin-destination, hs2 and year fixed effects. Robust standard errors clustered by origin-destination-product.

initial values, adding one more exporter gives $d\pi_{fpdt} = 0.036$, or about 3.6 percentage points more in the probability of survival past the first year. A doubling of the number of exporters ($dn_{pdt}/n_{pdt} = 1$) gives $d\pi_{fpdt} = 0.0792$ or about 8 percentage points more in the probability of survival beyond the first year.

Thirdly, we measure two dimensions of the firm's scope or experience. First, we proxy product experience (the experience that firm f has with product p) by counting the number of destinations where that firm exports that product. In log, this is $\ln n_{fpt}$. As discussed above, the notation now omits the origin-country superscript c since the firm subscript f contains origin-country information. Experience with a product significantly raises the probability of survival in all regressions. This may reflect either better information about the cross-country drivers of a product's demand, or, alternatively, the unobserved quality of the firm-product combination (recall that we include HS2 fixed effects, not product fixed effects).

We measure the experience that firm f has with destination d by counting the number of products that it exports to that destination, ($\ln n_{fdt}$). Overall, the effect of destination experience is also positive and significant. However, the magnitudes are different. To see this, suppose that a Senegalese firm adds one product to its average destination where it sells, according to Table **??**, 3.1 products. Then, using again a continuous approximation, $d\pi_{fpdt} = 0.145\, dn_{fdt}/n_{fdt}$. Using $n_{fdt} = 3.1$, adding one more product to destination d (what we call destination experience) raises the probability of survival by $0.145/3.1 = 0.047$, from 0.22 to 0.26. This is small but nevertheless not negligible. Adding one more destination, however (what we call product experience), would raise survival by $0.022/6.76 = 0.003$, (as our average Senegalese firm sells to 6.76 destinations), or one third of one percentage point. Our analysis is at a disaggregated level in terms of products (5'000 products at HS6), so the additional product sold on destination d can be very close to the original; by contrast, destination countries are much fewer, so adding one more shipping destination for product p is a substantial move. Thus, the result that destination experience (one more product shipped to destination d) contributes more to survival than product experience (one more destination for product p) is somewhat surprising, especially in view of the common result in the literature that, at the country level, geographical diversification contributes more to export growth than productwise diversification.

A possible interpretation of this result goes as follows. Suppose that (i) distinct and independent fixed costs must be incurred to enter a new destination and to start exporting a new product, but (ii) economies of scope are stronger in terms of products in one destination than in terms of destinations for one product. That is, once a firm has incurred destination-specific fixed costs to sell, say, boys' swimwear (HS611239) to Germany, it is easier to convince the German buyers to take girls' swimwear (HS611241) as well than to break into the British market with the boys' swimwear, because this would imply getting in touch with different retailers. Pursuing the example, the positive coefficient on n_{fpt} implies that the probability of keeping the relationship with the German buyer alive is slightly higher if the firm is selling him both boys and girls' swimwear than only one of the two. The positive coefficient on n_{fdt} suggests that the probability of keeping the relationship with the German buyer is also higher if the firm is selling boys' swimwear in the UK as well, but that second effect is smaller than the first. (Both are small anyway.)

We control for the export spell's initial value with v_{fpdt}, as it has been shown at the product (multi-firm) level that survival correlates with initial value. This is confirmed at the firm level, although the effect is, again, small. Let $p_{fpdt} = Pr(s_{fpdt} = 1)$ be the first-year probability of survival. The formulation in (**??**) implies that the elasticity of p_{fpdt} to v_{fpdt} is $p\beta_v$. With $p = 1/2$, this gives an elasticity around 0.06. That is, doubling the value at entry raises the probability of surviving the first year by 6%.

Column (2) of table **??** shows that results are essentially the same if all RHS variables are lagged one period, with the exception of n^c_{dt} which turns significant. In that case, the effect is negative. What that means is that more firm-product combinations from a given origin to a given destination are associated with a lower probability of survival past the first year. Given that the effect is significant only in one case, one avoid making too much of it. A natural interpretation is this: Given that we apply origin-destination fixed effects, it picks up only the time-variant component of bilateral shocks, like booms in the destination market. This can be viewed as reflecting crowding into booming markets and exit when the boom is over—which our result suggests comes soon.[10]

[10] If we rerun the exercise without destination fixed effects, the coefficient on this variable turns positive in explaining survival, suggesting that *permanently* more attractive markets are associated with longer survival, which is consistent with our interpretation. This "crowding-in" result is also consistent with a finding by Bussolo, Iacovone, and Molina (2010) who found, using firm-level data from the Dominican Republic, that the reduction

We now turn to the interpretation of the additional controls introduced in columns (3) and (4). The literature on multiproduct firms suggests that they have core and marginal products, and that they have a stronger competitive advantage in the former (see for instance Eckel and Neary (2010) for a theoretical model and Iacovone, Rauch and Winters (2010) for an empirical test of this hypothesis). For each multiproduct firm f and product p, we proxy how close is that product from the firm's 'core' by its share in the firm's export sales. Column (3) of table **??** shows result with that regressor added to the standard specification. Results suggest that it correlates positively with first-year survival probability even when one controls for absolute export value.

Finally, in column (4) of table **??** we control for a potential omitted-variable bias that would arise if country c had a comparative advantage in product p explaining both that it had more exporters of that product (in destination d or elsewhere) *and* that product p had a better survival outlook. As a control for this, we use Balassa's revealed comparative advantage (RCA) index defined, for product p, as

$$RCA_{pc} = \frac{v_{pc}/\sum_p v_{pc}}{v_{pw}/\sum_p v_{pw}} \tag{4}$$

where v_{pc} stands for country c's exports of product p and x_{pw} for world exports of that good. Balassa's index measures the ratio of the share of product p in country c's export basket relative to it share in the world's export basket. The higher it is, the more that country is revealed to have a comparative advantage in that product. To compute this time-invariant measure, we use the mean of exports of the years 1999, 2000 and 2001. Results are robust to the inclusion of that control.

Table **??** shows that the synergy effect picked up by $\ln n_{pdt}^{c}$ disappears when we replace it with a 'placebo synergy', namely $\ln n_{pdt}^{-c}$, the count of firms selling the same product to the same destination but from other countries. We run this exercise for each country separately, while controlling for comparative advantage. This suggests that the synergy is truly national (recall that regressions include bilateral origin-destination fixed effects). As previously, all coefficients reported are probit marginal effects.

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of tariffs following the signature of CAFTA led to overshooting of Dominican exports, followed by retrenchment.

Table 4: Placebo agglomeration exercise

	(1) TZA	(2) SEN	(3) MWI	(4) MLI
n_{dt}	-0.0246**	-0.000153	-0.0438**	0.197***
	(0.0116)	(0.0165)	(0.0193)	(0.0399)
n_{pdt}^{-i}	-0.00105	0.0136	0.0123	0.0579**
	(0.00879)	(0.0116)	(0.00995)	(0.0253)
n_{fpt}	0.102***	0.145***	0.0724***	0.0917***
	(0.00573)	(0.00714)	(0.00972)	(0.0232)
n_{fdt}	0.0258***	0.0507***	0.0141***	0.0443***
	(0.00305)	(0.00420)	(0.00425)	(0.0144)
RCA	3.55e-05	-8.37e-05	4.76e-05	-0.000164
	(2.37e-05)	(5.94e-05)	(4.52e-05)	(0.000186)
v_{fpdt}	0.0375***	0.0343***	0.0178***	0.0465***
	(0.00185)	(0.00228)	(0.00208)	(0.00602)
HS2 FE	Yes	Yes	Yes	Yes
Origin-dest. FE	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes
Obs.	11,482	9,246	3,537	1,313

Note: Year, destination and industry (HS-2) fixed effects used. Robust standard errors are clustered on the level of product-destinations.

4.2 Extensions

The most puzzling effect we document so far is the network effect by which a firm has a higher survival probability if more other firms from the same destination country export the same product to the same destination. In table **??** we explore what may drive this effect through various interactions.

Table 5: Network effect interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
n_{dt}	0.00110	0.00131	-0.00275	-0.0170**	-0.0178**	0.00101	0.00175
	(0.00585)	(0.00585)	(0.00635)	(0.00860)	(0.00858)	(0.00585)	(0.00585)
n_{pdt}	0.0552***	0.0512***	0.0932***	0.0551***	0.0699***	0.0607***	0.0709***
	(0.00437)	(0.00496)	(0.0112)	(0.00364)	(0.00624)	(0.00300)	(0.00362)
n_{fpt}	0.132***	0.132***	0.138***	0.151***	0.151***	0.132***	0.132***
	(0.00290)	(0.00289)	(0.00343)	(0.00374)	(0.00374)	(0.00289)	(0.00289)
n_{fdt}	0.0375***	0.0377***	0.0369***	0.0414***	0.0413***	0.0375***	0.0376***
	(0.00166)	(0.00165)	(0.00183)	(0.00199)	(0.00198)	(0.00166)	(0.00165)
lnv_{fpdt}	0.0305***	0.0307***	0.0290***	0.0322***	0.0321***	0.0305***	0.0304***
	(0.000916)	(0.000918)	(0.00104)	(0.00112)	(0.00112)	(0.000916)	(0.000915)
ρ_p	-0.00610						
	(0.00500)						
$\rho_p \times n_{pdt}$	0.00954*						
	(0.00561)						
r_p		0.0114*					
		(0.00640)					
$r_p \times n_{pdt}$		0.0140**					
		(0.00586)					
κ_f			0.168***				
			(0.0451)				
$\kappa_f \times n_{pdt}$			-0.115***				
			(0.0346)				
Capability 1				0.0113***	0.0170***		
				(0.00285)	(0.00330)		
Cap1$\times n_{pdt}$					-0.00805***		
					(0.00284)		
Capability 2						0.00466	0.0179***
						(0.00419)	(0.00483)
Cap2$\times n_{pdt}$							-0.0241***
							(0.00553)
Obs.	52212	52212	37838	38451	38451	52212	52212

First, this network effect could indicate the presence of information externalities on the demand side. For instance, uncertainty about the quality of a product may be reduced by exposure to other exporters of the same good for the same country. That is, if a supermarket buyer observes colleagues buying green beans from Senegal, he or she may conclude that at least one of them has done some screening of Senegalese green-bean producers and that they are OK. If this hypothesis is true we should find that the network effect is more important for products where quality differences are more important (for horticulture products, quality differences may be partly observed through certification, but residual uncertainty may remain). To investigate this idea we create a measure of cross-sectional unit-value dispersion at the product level, ρ_p, equal to the coefficient of variation of COMTRADE CIF unit values at HS6 across all exporting countries in 2000. We take a higher ρ_p as proxying more heterogenous products products quality-wise.[11] We also interact it with the network effect. We find that the network effect is stronger for products with a high unit-value dispersion, where information is more important; that is, the coefficient on the interaction term $\rho_p \times \ln n_{pdt}$ is positive, although significant only at the 10% level.

Second, the network effect could be related to financial dependence. Consider the following scenario. A Senegalese firm is approached by a US buyer to provide a small trial order of t-shirts. Upon successful delivery and sale, the buyer is happy and contacts again the Senegalese firm for a larger order. Now the Senegalese firm has to ramp up capacity and, for that, it needs support from the bank. But the bank may not take letters of credit from the buyer at face value, because it knows that all sorts of glitches—quality or other—may appear down the line. Experience on the ground suggests that, in sub-Saharan Africa, the bank's response will typically be 'no' irrespective of the guarantees that the exporter shows, and the trade relationship with the US buyer will end before it had a chance to bear fruit. However, if several Senegalese firms already sell t-shirts on the US market, the bank may be more easily convinced that there is something there. If this tale is representative, the network effect should help more for products that are dependant on external (bank) finance than for others. We try to find support for this conjecture by interacting the network effect with Rajan and Zingales' measure of financial dependence at the product level (Rajan and Zingales 1998).[12] We

[11] We explore results on sub-samples split by Rauch's categories in Table **??** below.

[12] Rajan and Zingales' measure of financial dependence is an industry-level variable

construct our r_p variable at the product level by assigning to each product the Rajan-Zingales index of the ISIC code to which that product belong, using concordance tables between HS6 and ISIC3. We indeed find that the interaction term $r_p \times \ln n_{pdt}$ has a positive and significant coefficient.

Another way of verifying the informational-externality conjecture draws on the concept of 'asset tangibility' proposed by Braun (2003).[13] The idea here is that firms with large fixed assets provide good collateral for bank loans. Information asymmetries (adverse selection or moral hazard) are less important with good collateral, so network effects should play a lesser role. This is what we find. Again, we construct an asset-tangibility variable at the product level, κ_p, by assigning to that product the corresponding ISIC3 value of Braun's index. The interaction of asset tangibility (r_p) and the network effect has a negative and significant coefficient, implying that firms belonging to industries with high asset tangibility (essentially capital-intensive industries) are *less* sensitive to the network effect.

The remaining four columns provide a plausibility check for the data and network effect. Our 'capability' variable, cap1, counts the number of products other than p exported by firm f to destination d and belonging to p's broad HS4 category. A firm exporting more stuff of the same kind will have less trouble getting credit from the bank, so the interaction effect is expected to be negative, which it is. The last variable, cap2, is a refinement over cap1 in that we weight products by their proximity to p in the sense of Hausmann-Klinger (2006).[14] The interaction term is again negative.

Finally, in table **??** we look for differences in the strength of the network effect for homogeneous vs.differentiated products using Rauch's classification (Rauch 1999).[15] In all four countries, the negative impact of market

calculated for 27 3-digits ISIC industries and nine 4-digits ones using compustat data for the US. Let k be capital expenditure and x operational cash flow at the firm level. Rajan and Zingales' index for industry j, r_j, is the median value of $(k-x)/k$ across all compustat firms in industry j. Index values, given in Table 1 of Rajan-Zingales (1998), range from -0.45 for tobacco (ISIC 314) to 1.49 for drugs (ISIC 3522).

[13]Braun proxies asset tangibility by the ratio of net property, plant and equipment to market value at the firm level, using US compustat data. The industry-level variable is constructed, like in Rajan-Zingales, by taking the industry median at the ISIC 3-digit level. Index values, given in Table 1 of Braun (2003), range from 0.09 (leather products) to 0.67 (petroleum refineries).

[14]Hausmann and Klinger's measure of proximitiy is essentially a measure of the probability that two goods are exported together by a country.

[15]We bunch reference-priced goods with homogeneous ones.

attractiveness on survival is stronger for homogeneous goods, which is to be expected if those goods are less differentiable and thus exposed to tougher competition. By contrast, results for the network effect are not consistently stronger across countries for one or the other category. Both experience effects however are stronger for heterogeneous goods, in accordance with the idea that those products benefit more from additional information about demand, be it market- or product-specific.

Table 6: Rauch classification

	TZA		SEN		MLI		MWI	
	Homo.	Diff.	Homo.	Diff.	Homo.	Diff.	Homo.	Diff.
n_{dt}	-0.208***	-0.176***	-0.183**	-0.0835	0.447	0.267	-0.00330	0.0406
	(0.0543)	(0.0343)	(0.0792)	(0.0544)	(0.309)	(0.269)	(0.202)	(0.223)
n_{pdt}	0.247***	0.190***	0.225***	0.218***	0.281**	0.368***	0.204***	0.0901*
	(0.0302)	(0.0317)	(0.0264)	(0.0214)	(0.117)	(0.138)	(0.0764)	(0.0496)
n_{fpt}	0.282***	0.347***	0.393***	0.565***	0.361**	0.822***	0.484***	0.894***
	(0.0271)	(0.0278)	(0.0292)	(0.0228)	(0.146)	(0.131)	(0.0908)	(0.173)
n_{fdt}	0.0404***	0.0589***	0.0511***	0.0836***	-0.0887	0.124**	0.0655	0.221***
	(0.0145)	(0.0118)	(0.0169)	(0.00965)	(0.0864)	(0.0603)	(0.0735)	(0.0391)
Constant	0.0479	-0.499	0.358	0.543	1.184	-0.121	-0.145	0.183
	(1.043)	(0.758)	(0.634)	(0.607)	(1.009)	(1.294)	(1.389)	(1.463)
Obs.	6716	10934	7045	17238	568	967	826	3262

Year, destination and industry (HS-2) fixed effects used. Robust standard errors are clustered on the level of product-destinations. Homo. category bundles Rauch's homogenous and reference-priced products.

5 Concluding remarks

Exporters in our set of African countries experiment a lot on export markets, at a low scale and with low survival rates, particularly in the first year. That is, they operate in a difficult environment characterized by very high infant-mortality rates. What determines if they survive the first year or not?

The most striking finding coming out of our firm-level dataset—and which could not be observed on the product-level data used by previous studies of export survival—is that exporters of similar stuff to the same destination exert a *positive* externality on each other. That is, the more they are, the better they survive, as if the size of the herd protected individual members from the dangers of the environment. This finding is surprising, as one might expect that exporters of similar stuff crowd out each other through price competition. Strikingly, the network effect disappears if we measure the network as the number of firms exporting the same stuff from other countries. That is, the network effect is national. We control for omitted-variable bias (supportive infrastructure at the national level or comparative advantage) by including the country's revealed-comparative advantage index as a regressor, without altering the results.

We explore various conjectures that can potentially explain this network effect. We find support for an information-based conjecture whereby access to credit is made easier when many exporters are simultaneously operating in the same sector, from the same country. The conjecture is that an isolated exporter might have difficulty convincing the bank that the risks he faces are manageable given the high churning that characterizes export relations. However, if many operate simultaneously, the bank can observe the success of others and take it as a predictor of its client's potential. We verify this conjecture by interacting our network variable with indicators of dependence on bank finance, asset structure (as a measure of the scope for moral hazard), and scope of activities (as a proxy for capabilities) and find support for it in the sign of the interaction terms.

Our result is suggestive of a potential market failure if exporters fail to internalize the positive externality that they exert on each other. This may be taken as an argument in support of government-sponsored export promotion. However, it may well be that exporters do internalize the externality through mutual-support professional organizations, and the record of government export promotion is uneven, so the policy implications of our findings should be taken cautiously.

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6 Appendix 1

This survey was conducted over a sample of exporters randomly drawn from the customs data in each country, after applying some pre-established guidelines that took into account the following criteria:

- exporting status of the firm,
- its size,
- its location
- the economic sector (at the 2-digit level of the HS Code)

In particular, all the exporters in each country were classified in four groups according to the evolution of their exporting status: a) regular exporters are those exporters with consecutive exports until 2008 (last year covered by the customs data in all four countries), b) past exporters are the exporters who were exporting consecutively for at least two years and then exited the market before 2008, c) intermittent exporters are those who exported erratically during the period included in the sample and finally, d) new exporters are those exporters who appear for the first time in the sample in 2008.

Over 200 firms were contacted in each country; however, due to low cooperation and identification problems with some of the firms, the final sample by country and exporting group is as follows:

Table 7: Survey Responses

Question 1: First time exporters: How was the contact with the first client made?

	MLI	MWI	SEN	TZA	All
Research online	14	11	24	35	21
Third party contact	73	68	77	51	67
Competitors' network	8	12	24	11	14
Trade Fair	20	12	19	34	21
Export Promotion Agency	12	11	5	13	10
Exporters' Association	9	7	8	8	8
Another channel	16	24	5	11	14

Question 2: If the company looked for its buyers, how did it approach them?

	MLI	**MWI**	**SEN**	**TZA**	**All**
Research online	26	31	29	41	32
Third party contact	74	72	76	57	70
Competitors' network	19	18	23	21	20
Trade Fair	40	35	28	52	39
Export Promotion Agency	18	19	11	21	17
Exporters' Association	14	5	6	17	11
Another channel	10	20	15	6	13

Question 3: If the buyers approached the company, how did they approach it?

	MLI	**MWI**	**SEN**	**TZA**	**All**
Company's website	22	30	29	53	33
Old clients of the company	25	28	33	32	30
Third-party contacts	62	75	75	66	69
Competitors' network	14	28	21	26	22
Trade Fair	34	33	20	55	35
Export Promotion Agency	18	21	7	25	18
Another channel	9	22	15	8	13

Question 4: How did the opportunity to export a new product come about?

	MLI	**MWI**	**SEN**	**TZA**	**All**
An existing buyer approached the company	54	46	50	68	54
The company saw saw demand in a buyers' market	33	46	50	56	46
The company saw successful competitors	17	27	13	32	22
Success with selling the product domestically	38	42	44	68	48
Through a third party	46	23	25	35	32
Any other type of opportunity?	17	19	13	6	14