Sequential Exporting and Third-Country Effects of Trade Policy

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June 14, 2019
Preliminary and incomplete

Abstract

How do firms start exporting new products to new markets? In this paper we develop a model of export dynamics with multiproduct firms, where firms are ex ante uncertain about their profitability in different markets and with different products. Exporters learn from their initial export experiences and gradually adjust their sales, number of products and destination countries. Using disaggregated data on French exporters, we find empirical support for our predictions on (export) age-dependent growth, entry and exit. In particular, we find evidence of firms learning within a destination country across different products. Our model also helps rationalize empirical evidence of positive trade policy spillovers (which contrasts with conventional trade diversion effects). We use our framework to show empirically that tariff reductions after the Uruguay Round led to entry in unaffected countries and products. This finding has important implications for our understanding of trade agreements and their design.

JEL Codes: F10; F14; F13
Keywords: Export product dynamics, experimentation, uncertainty, option value, trade liberalization

1 Introduction

Since firm-level trade data became widely available in the late 1990's we have learnt that a high turnover of exporting firms and a substantial contribution of entrants to aggregate export growth in the medium term are common features of these data.[1] These patterns are at odds with now-standard trade models such as the Melitz (2003) model and some of its extensions. In particular existing theories based on self-selection and fixed export startup costs struggle to explain the high failure rates of new exporters (Ruhl and Willis, 2017). These theories have also been proved hard to reconcile with slow export growth and delayed entry in new foreign markets. Because aggregate exports partly respond to changes in trade costs through the number of exporters, the failure to explain these firm dynamics may lead to biased estimates of the gains from trade agreements.

More recent efforts to explain exporter dynamics focusing on ex ante uncertainty and learning have been able to reconcile the theory with these observations (Freund and Pierola, 2010; Albornoz et al., 2012; Nguyen, 2012; Arkolakis, 2016; Arkolakis et al., 2018; Cebreros, 2016). This research programme builds on Industrial Organization models recognizing that learning can help explain age-dependent growth and survival of firms in a market (Jovanovic, 1982), as well as an empirical tradition in management science which identifies knowledge about foreign markets as a key driver of internationalization strategies, such as the 'Uppsala model' of Johanson and Vahlne (1977).

In this paper, we develop a model of learning under uncertainty with multi-product exporters. Just as understanding the number of exporters and the number of markets they access matters to understand aggregate exports, expansion of a firm's product line is another important engine of export growth. The model accounts for potential learning about the profitability of currently exported products in new markets as well as the profitability of new products in current export destinations. Our model rationalizes observed sequential patterns of exporting : new exporters enter with low export sales in one country, then expand or exit altogether depending on success in that first market.

Learning implies that bilateral trade liberalization affects exports to third markets: liberalizing countries may be used as testing grounds for future exports to non-liberalizing countries; perhaps more surprisingly, firms may start exporting to close non-liberalizing countries before entering a distant liberalizing country. Our model can predict how learning creates trade policy spillovers which matter for our understanding of gains from trade agreements, and for their design.

We then proceed to test our model's predictions using a sample of French exports by firm, country, HS6 product and year in the 1993-2006 period. The analysis exploits tariff reductions across products, countries and over time due to Uruguay Round negotiations and the creation of the WTO. These are used to identify exogenous variation in trade costs that affects the value of learning from an export experience. We find support for our trade policy spillover predictions in a number of different econometric specifications.

Related Literature High entry and exit rates and the prominence of short-lived export experiences have been documented in different datasets by Besedes and Prusa (2006), Eaton et al. (2008) and Cebeci et al. (2012), among others. Evidence of high immediate exit rates is particularly important, as it reveals the need to go beyond models that explain entry in foreign markets through productivity improvements, either endogenous or exogenous.

The literature on multiproduct exporters mostly deals with static equilibrium behaviour.[2] Relatively few papers have explored/provided empirical evidence on 'product export dynamics'. A

[1]See Besedes and Prusa (2006) and Eaton et al. (2008) for pioneering contributions.

[2]Prominent multiproduct trade models include Eckel and Neary (2010), Bernard et al. (2011) and Mayer et al. (2014).

notable exception is Bernard et al. (2009), who document the margins of US exports (and imports). They decompose total US export growth in different margins of adjustment of US firms: intensive, entry and exit, adding and dropping products. They find that the latter margin explains a substantial part of US export growth. Another important, more recent exception is Timoshenko (2015). She shows that 'the frequency of product adding and dropping declines the longer firms export to a market', exploiting product data aggregated at the level of the firm. This novel exporter age component in product-switching conditional on size, is consistent with exporters learning about the 'product appeal' of their products (i.e. uncovering demand), and finds from a counterfactual simulation of a reduction in trade costs, that exporters' extensive product margin contribution accounts towards 45% of total export growth, whilst exporter entry only accounts for 2%.

Our work complements a growing literature on individual export dynamics. A first strand of that literature examines the impact of idiosyncratic productivity shocks. Costantini and Melitz (2008) study the transitional dynamics of the Melitz (2003) model after a trade cost change using numerical simulations. Another important example of productivity-driven firm dynamics theory is Arkolakis (2016), who extends the Luttmer (2007) continous-time model of firm growth with random Total Factor Productivity (TFP) shocks to an open economy. Other papers examine persistent TFP shocks more specifically. For instance Das et al. (2007) structurally estimate sunk entry costs in an augmented Melitz (2003) model with autoregressive TFP shocks. Alessandria and Choi (2014) assess the quantitative effects of a tariff reduction in a model with heterogeneous firms, sunk costs, and persistent TFP shocks. Impullitti et al. (2013) examine hysteresis in export status in an open-economy model of firm growth, selection, with idiosyncratic TFP shocks and sunk costs.

In parallel to theories of firm dynamics driven by exogenous TFP shocks, some authors have developed models endogenizing both investment and export decisions. These include investments in R&D as in Atkeson and Burstein (2010) and Bustos (2011); investments in capacity as in Ahn and McQuoid (2017) and Soderbery (2014); investments in a customer base in Fitzgerald et al. (2017); and hiring decisions under matching frictions as in Cosar et al. (2016). These models are in line with evidence of post-liberalization increases in labor productivity and R&D at the plant level (Lileeva and Trefler, 2010) and amenable to structural estimation (Aw et al., 2011).

This paper instead builds on Albornoz et al. (2012, henceforth ACCO) who show that Argentine firms tend to enter sequentially, with a high propensity to enter in their second year of exporting upon an initial success, and a high propensity to exit permanently after a failure in their first market. Their exports also grow faster in that second year than in any subsequent year in any other market. A simple novel model of learning about export profitability was advanced to better rationalise those facts. Other researchers have advanced learning mechanisms to explain firm dynamics in other datasets. As in ACCO some papers examine firms learning about their own future profitability (Freund and Pierola, 2010; Nguyen, 2012; Arkolakis et al., 2018; Cebreros, 2016). Other papers suggest learning from pioneer, rival firms is at work (Segura-Cayuela and Vilarrubia, 2008). Other authors have developed theories of learning with export intermediaries and asymmetric information (Rauch and Watson, 2003; Aeberhardt et al., 2014; Araujo et al., 2016; Eaton et al., 2015). Chaney (2014) offers a theory of export dynamics based on social networks. Because exporters can only reach foreign markets through a sequence of contacts, they build their export destination portfolio gradually.

Finally, our results on trade policy spillovers add to a small but growing literature finding evidence of positive 3rd-country effects of trade policy. Borchert (2007) shows a higher growth of Mexican exports to Latin America in those products where the NAFTA agreement liberalized trade with the US and Canada. Bown and Crowley (2010) and Defever and Ornelas (2016) find that bilateral restrictions to Chinese exports depress exports of the same products to third countries relative to other products or to Indian exporters. Cherkashin et al. (2015) find a positive effect of

EU trade preferences on Bangladeshi knitwear exports to the US.

The rest of the paper is organized as follows. In Section 2 we lay out a model of entry in different countries and product markets where firms learn about their export profitability ex post. Some extensions of the model are relegated to the Appendix. In Section 3 we test predictions of that model for export dynamics at the firm-country-product-year level using a sample of French exporters, including predictions on trade policy spillovers. Section 4 concludes.

2 Model

We extend ACCO along the product dimension to understand the implications of learning and experimentation for the entry decisions of multiproduct firms, as well as for the consequences of trade liberalization. In the model firms face ex ante uncertainty on the profitability of exporting a given product to a given country, and may optimally adopt sequential exporting strategies in both the country and product dimensions.

2.1 Basic structure

A risk-neutral producer has the option of serving two segmented foreign markets, A and B, with either one or two products, a and b. Countries A and B are symmetric except for the unit trade costs that the firm must pay to export there, denoted by τ^A and τ^B, $\tau^A \leq \tau^B$. For simplicity these unit trade costs are assumed to be equal for both products. To sell in each foreign market, the firm also needs to incur in a one-time fixed cost per destination, $F \geq 0$. This corresponds to the costs of establishing distribution channels, designing a marketing strategy, learning about exporting procedures, getting familiar with the institutional and policy characteristics of the country, etc.

Our model maintains the 'core-competency' hypothesis introduced by other work on multiproduct exporters, such as Eckel and Neary (2010). 'Core' product a has a lower unit production cost than 'non-core' product b. We assume that producing b costs $c > 0$ per unit, where c is ex ante known to the firm, while we normalize the unit production costs of product a to zero. Exporters must also pay an *ex ante unknown* export unit cost, $c_v^j, v = a, b$. In addition, we assume that firms must incur a fixed cost f to introduce a 'non-core' product, which is smaller than the fixed cost to enter a foreign destination,[3] i.e. $0 < f < F$.

The producer faces the following demand for each product $v = a, b$ in each market $j = A, B$:

$$q_v^j(p_v^j) = d_v^j - p_v^j, \tag{1}$$

where q_v^j denotes the output sold in destination j for product v, p_v^j denotes its corresponding price, and d_v^j is an ex ante unknown parameter. We therefore allow for uncertainty in both demand and supply parameters.

Let

$$\mu_v^j \equiv d_v^j - c_v^j$$

be a random variable with a continuous cumulative distribution function $G(\cdot)$ on the support $[\underline{\mu}, \overline{\mu}]$. We refer to μ_v^j as the firm's "export profitability" of product v in market j. $\overline{\mu}$ obtains when the highest possible demand intercept ($\overline{d}$) and the lowest possible export unit cost ($\underline{c}$) are realized; $\underline{\mu}$ obtains under the opposite extreme scenario ($d_v^j = \underline{d}$ and $c_v^j = \overline{c}$). The analysis becomes interesting

[3]Our assumption follows recent work by Bernard et al. (2011), Arkolakis et al. (2016), Timoshenko (2015) or Eckel et al. (2016) who assume that non-core products are obtained from adapting a core product. $0 < f < F$ captures the idea that adapting/introducing a non-core product costs less than entering a new market with the core product.

when trade costs are such that, upon the resolution of the uncertainty, it may become optimal to export both, only one, or none of the products to both, only one, or none of the destinations. Accordingly, we assume $\underline{\mu} < \tau^A$—so that exporting may not be worthwhile even if $F = 0$—and $2F^{1/2} + \tau^B + c < \overline{\mu}$. This last condition implies that exporting the non-core product to the more costly market can be profitable. To ensure that equilibrium prices are always strictly positive, we need that $E\mu < 2d_v^j + \tau^j$ for all d_v^j, so we assume throughout the paper that $2\underline{d} + \tau^j > E\mu$ for $j = A, B$.

Our central assumption is that export profitability is correlated over time and across products and markets. This correlation could come from either supply or demand components of uncertainty in the parameter μ, as suggested by our discussion above. To make the analysis as clear and simple as possible, we focus on the limiting case. First, as the definition of μ_v^j without time subscripts indicates, we consider that the μ_v^j's are constant over time. Second, we look at the case where the draws of μ_v^j are perfectly correlated across markets and products: $\mu_v^A = \mu_v^B = \mu_v, v = a, b$. Third, because product a is the exporter's 'core product', it is more profitable: $\mu_b = \mu_a - c$, where $c > 0$ represents the higher constant known unit cost of production of the 'non-core product' b. To ease the exposition, we simply denote by μ the profitability of a firm's core product a and by $\mu - c$ the profitability of a firm's non-core product, expressed in terms of the firm's core one.[4] Each of these assumptions can be relaxed; all of our qualitative results generalize to any strictly positive correlation of export profitabilities across markets, across products and over time.

Together our assumptions imply that entering with a non-core product is always less profitable than entering with a core product, in line with empirical evidence that exporting firms mostly export their core products, e.g. Arkolakis et al. (2018). [5]

To determine optimal entry decisions we evaluate all profits from an *ex ante* perspective, i.e., at their $t = 0$ expected value. We assume that firms do not discount future payoffs, but this has no bearing on our qualitative results. We denote by e_{vt}^j the firm's decision to enter market j with product v at time t, $j = A, B$, $v = a, b$, $t = 1, 2$. Thus, $e_{vt}^j = 1$ if the firm enters market j (i.e. pays the sunk cost) with product v at time t, $e_{vt}^j = 0$ otherwise. Output q_{vt}^j can be strictly positive only if either $e_{vt}^j = 1$ or $e_{vt-1}^j = 1$.

The timing is as follows:

$t = 1$: At period 1, the firm decides whether to enter each market and with which product. If the firm decides to enter market j, it pays the per-destination fixed entry cost F and chooses the quantity of product v to sell there in that period, q_{v1}^j. If the firm decides to export both products, it pays the additional fixed cost f. At the end of period 1, export profits in destination j for product v are realized. If the firm has entered and produced $q_{v1}^j \geq \varepsilon$, where $\varepsilon > 0$ is arbitrarily small, it infers μ from its profit.

$t = 2$: At period 2, if the firm has entered market j with product v at $t = 1$, it decides whether to keep serving that product on that market given the realization of export profits. If so, it chooses how much to sell in that market, q_{v2}^j. If the firm has not entered destination j with product v at $t = 1$, it decides whether to enter that product market. If the firm enters, it

[4] Abstracting from the 'core/non-core' product interpretation of the parameter c, an alternative formally equivalent view is that c captures differences in profitability across products due to differences in tariffs within destinations, $\mu_b = \mu_a - \tau^j : \tau^j \equiv \tau_a^j - \tau_b^j$ for $j = A, B$, when we impose that the difference in tariffs is the same across destinations.

[5] We need that the unit cost difference c between core and non-core products is large enough, i.e. $c > 2(F^{1/2} - f^{1/2}) > 0$. Intuitively, if the unit cost difference is smaller, because it is less costly to adapt a product than to enter a new destination, $f < F$, sometimes the firm may prefer to enter with both products rather than with only the core one. Ruling out this possibility only simplifies the analysis. We also show in the Appendix that allowing for differences in productivity has no qualitative consequence for our main mechanism.

pays F and chooses q^j_{v2}. If the firm decides to produce both qualities, it pays the additional fixed cost f. At the end of period 2, export profits are realized.

Hence, the firm can infer its export profitability parameter μ only by actually engaging in exporting, which requires the firm to pay the fixed entry cost F and sell a strictly positive quantity of one of the products to one of the markets. This is reminiscent of the Jovanovic (1982) model, although a key difference is that we consider entry with different products and/or into several destinations. Clearly, uncovering μ must be costly, or else every firm would, counterfactually, export at least a tiny quantity of each product to gather their export potential. We model this cost as a sunk cost, but this is not necessary for our results. Alternatively, one could specify that a firm needs a minimum scale of experimentation to reliably uncover its true export product profitability. We allow this minimum scale to be an arbitrarily small number (ε) because we require the firm to spend F to sell in a foreign market, but one could for example assume the opposite (i.e. set $F = 0$ and require a larger minimum scale).[6]

In reality, entry may also be "passive," where a foreign buyer posts an order and the exporting firm simply delivers it. Trade in intermediate goods, for example, is often importer-driven, rather than exporter-driven. Thus, in general firms may either deliberately choose to enter a market, or simply wait until they are "found" by a foreign buyer. While our model focuses on the former type of entry, a passive first export product experience could also resolve uncertainty and lead to active expansion of scope and/or across foreign markets. Our empirical findings certainly involve both types of first export product experiences.

2.2 Firm's export decision

There are six undominated entry strategies. The firm may enter both markets simultaneously at $t = 1$ with both products ("Simultaneous multiproduct entry," ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1$)); enter market A with both products and market B with its core product a at $t = 1$, deciding at $t = 2$ whether to expand its scope to product b in market B ("Partially sequential multiproduct entry," ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0$)); enter markets A and B at $t = 1$ with the firm's core product a, deciding at $t = 2$ whether to expand product scope in either or both markets ("Simultaneous monoproduct entry," ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0$)); enter only market A at $t = 1$ with both products, deciding at $t = 2$ whether to enter market B with either product a or both ("Sequential multiproduct entry," ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$)); enter only market A at $t = 1$ with its core product a, deciding at $t = 2$ whether to expand its product scope only in A, and/or entering market B with either product a or both ("Sequential monoproduct entry," ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0$)); or enter neither market.

The other possibilities, of entering both markets only at $t = 2$, of entering market B before market A, and of entering with non-core product b rather than with core product a, need not be considered. The latter two are respectively dominated by (i) entering with product a before product b, since $\mu_b = \mu_a - c < \mu_a$ with $c > 0$ and $f > 0$, and by (ii) entering market A before market B, since $\tau^A \leq \tau^B$. The first possibility is dominated by simultaneous entry at $t = 1$, since by postponing entry the producer is faced with the same problem as in $t = 1$, but is left with a shorter horizon to recoup identical fixed entry costs.

We solve for the firm's decision variables $\{e^j_{v1},\ e^j_{v2},\ q^j_{v1},\ q^j_{v2}\}$ for product $v = \{a, b\}$ using backward induction. We denote optimal quantities in period t under simultaneous entry by $\widehat{q}^j_{vt}$,

[6] More general forms of experimentation are compatible with our main mechanism. For example, Mitaritonna and Akhmetova (2013) develop a model of entry in foreign markets where demand uncertainty takes time to be unveiled, as in Aghion et al. (1991). As a result, producers also need to decide their levels of experimentation.

and under (any) sequential (market or product) entry by $\widetilde{q}_{vt}^{j}$.

2.2.1 Period $t = 2$

(i) *No entry.* The firm does not export, earning zero profit.

(ii) *Simultaneous multiproduct entry* ($e_{a1}^{A} = 1, e_{b1}^{A} = 1; e_{a1}^{B} = 1, e_{b1}^{B} = 1$) When the firm exports to both destinations at $t = 1$, at $t = 2$ it will have inferred its export profitability μ and will choose its export volumes by solving

$$\max_{q_{v2}^{j} \geq 0} \left\{ (\mu_v - \tau^j - q_{v2}^{j}) q_{v2}^{j} \right\}, \; j = A, B; \; v = a, b$$

This yields

$$\widehat{q}_{v2}^{j}(\tau^j) = \mathbf{1}_{\{\mu_v > \tau^j\}} \left(\frac{\mu_v - \tau^j}{2} \right), \tag{2}$$

where $\mathbf{1}_{\{.\}}$ represents the indicator function, here denoting whether $\mu_v > \tau^j$. Second-period output is zero for low μ_v. Profits at $t = 2$, expressed in $t = 0$ expected terms, can then be written as

$$\begin{aligned} V_v(\tau^j) &\equiv \mathbb{E}\left[\max_{q_{v2}^{j} \geq 0} (\mu_v - \tau^j - q_{v2}^{j}) q_{v2}^{j} \right] = \mathbb{E}\left[\mathbf{1}_{\{\mu_v > \tau^j\}} \left(\frac{\mu_v - \tau^j}{2} \right)^2 \right] \\ &= \mathbb{P}(\mu_v > \tau^j) \mathbb{E}\left[\left(\frac{\mu_v - \tau^j}{2} \right)^2 \middle| \mu_v > \tau^j \right] \\ &= \int_{\tau^j}^{\overline{\mu}} \left(\frac{\mu_v - \tau^j}{2} \right)^2 dG(\mu_v), \; j = A, B; \; v = a, b \end{aligned}$$

$V_v(\tau^j)$ is the value of continuing to export product v to market j after product v's profitability in foreign market j has been discovered. If the firm cannot deliver positive profits in a market, it either drops a product or exits altogether to avoid further losses. Otherwise, the firm tunes up its product output choice to that market.

(iii) *Partially sequential multiproduct entry* ($e_{a1}^{A} = 1, e_{b1}^{A} = 1; e_{a1}^{B} = 1, e_{b1}^{B} = 0$) When the firm exports its core product a to both destinations and its non-core product b to destination A in $t = 1$, at $t = 2$ it will have inferred its export profitability μ. Thus, q_{v2}^{j} is again given by (2): $\widetilde{q}_{v2}^{j}(\tau^j) = \widehat{q}_{v2}^{j}(\tau^j) = \mathbf{1}_{\{\mu_v > \tau^j\}} \left(\frac{\mu_v - \tau^j}{2} \right)$, generating second-period profit $V_v(\tau^j)$, for $(v, j) = \{(a, A), (a, B), (b, A)\}$. Otherwise, if the firm cannot deliver positive profits in a market, it exits market j to avoid further losses.

The firm chooses to enter market B with product b at $t = 2$ if the operational profit is larger than the fixed cost f to introduce it, given that the cost to enter market B has already been sunk. This will be the case when the firm realizes that it is profitable to do so:

$$\left(\frac{\mu_b - \tau^B}{2} \right)^2 \geq f. \tag{3}$$

Hence, the firm's decision to expand its product scope in market B at $t = 2$ is

$$e_{b2}^{B}(\tau^B) = 1 \Leftrightarrow \mu_b \geq 2f^{1/2} + \tau^B \Leftrightarrow \mu \geq 2f^{\frac{1}{2}} + \tau^B + c. \tag{4}$$

Thus, defining $f_2^B(\tau^B)$ as the f that solves (3) with equality, the firm enters with product b market B at $t = 2$ if $f \leq f_2^B(\tau^B)$. It is straightforward to see that $f_2^B(\tau^B)$ is strictly decreasing in τ^B.

If the firm introduces product b in market B, it will choose q_{b2}^B much like it chooses q_{b2}^A, adjusted for market B's specific trade cost, τ^B. However, conditional on $e_{b2}^B = 1$, we know that $\mu_b \geq 2f^{1/2} + \tau^B > \tau^B$. Therefore, the firm sets $\tilde{q}_{b2}^B(\tau^B) = \left(\frac{\mu_b - \tau^B}{2}\right)$.

Expressed in $t = 0$ expected terms, the firm's profit from (possibly) sequentially expanding its product scope (to product b in market B at $t = 2$) corresponds to

$$\begin{aligned}
W_b(\tau^B; f) &\equiv \mathbb{E}\left[\max\left\{\max_{q_{b2}^B \geq 0}(\mu_b - \tau^B - q_{b2}^B)q_{b2}^B - f, 0\right\}\right] \\
&= \mathbb{E}\left[\mathbf{1}_{\{\mu_b > 2f^{1/2}+\tau^B\}}\left\{\left(\frac{\mu_b - \tau^B}{2}\right)^2 - f\right\}\right] \\
&= \mathbb{P}(\mu_b > 2f^{1/2} + \tau^B)\mathbb{E}\left[\left(\frac{\mu_b - \tau^B}{2}\right)^2 - f \,\middle|\, \mu_b > 2f^{1/2} + \tau^B\right] \\
&= \int_{2f^{1/2}+\tau^B}^{\overline{\mu}} \left[\left(\frac{\mu_b - \tau^B}{2}\right)^2 - f\right] dG(\mu_b) \\
&= \left\{V_b(\tau^B) - \int_{c+\tau^B}^{2f^{1/2}+c+\tau^B} \left(\frac{\mu - c - \tau^B}{2}\right)^2 dG(\mu)\right\} - \\
&\quad -f\left[1 - G(2f^{1/2} + c + \tau^B)\right].
\end{aligned}$$

Function $W_b(\tau^B; f)$ represents the value of sequentially exporting product b to market B after learning its product profitability , expressed in terms of the profitability of the core product μ. The expression in curly brackets represents the (ex ante) expected gross profit from entering market B at $t = 2$ with product b. The other term represents the product fixed cost from entering B with product b times the probability that entry in that product market is profitable.

Thus, the return from first entering destination A with product b includes the value of waiting to subsequently become an informed exporter of product b to destination B, avoiding the costs from directly "testing" that product market. In the presence of uncertainty and the irreversible product cost f, the possibility of delaying entry into market B corresponds to a real option. If profits were not correlated across destinations, there would not be any gain from delaying entry into B with product b and $W_b(\tau^B; f)$ would collapse to the unconditional expectation of profits for product b in market B, as in $t = 1$. The difference between these two values, which is the value of the real option, would then be zero. While we focus on the case of perfect correlation, it should be clear that as long as the correlation is positive, the value of the option remains strictly positive.

(iv) *Simultaneous monoproduct entry* ($e_{a1}^A = 1, e_{b1}^A = 0; e_{a1}^B = 1, e_{b1}^B = 0$). When the firm exports its core product a to both destinations in $t = 1$, at $t = 2$ it will have inferred its export profitability μ. Thus, q_{a2}^j is again given by (2): $\tilde{q}_{a2}^j(\tau^j) = \hat{q}_{a2}^j(\tau^j) = \mathbf{1}_{\{\mu_a > \tau^j\}}\left(\frac{\mu_a - \tau^j}{2}\right)$, generating second-period profit $V_a(\tau^j)$. Otherwise, if the firm cannot deliver positive profits in a market it exits market j to avoid further losses.

The firm then considers whether to expand its product scope in either market A, or B, or both. Since profitability is perfectly correlated across markets, but the trade cost of A is smaller than that of B, $\tau^A \leq \tau^B$, a necessary condition to expand the firm's product scope is:

$$\left(\frac{\mu_b - \tau^A}{2}\right)^2 \geq f. \tag{5}$$

Hence, the firm's decision to expand its product scope in market A at $t = 2$ is

$$e_{b2}^A(\tau^A) = 1 \Leftrightarrow \mu_b \geq 2f^{1/2} + \tau^A \Leftrightarrow \mu \geq 2f^{1/2} + \tau^A + c. \tag{6}$$

Thus, defining $f_2^A(\tau^A)$ as the f that solves (5) with equality, the firm enters with product b market A at $t = 2$ if $f \leq f_2^A(\tau^A)$. It is straightforward to see that $f_2^A(\tau^A)$ is strictly decreasing in τ^A.

If the firm introduces product b in market A, it will choose q_{b2}^A much like it chooses q_{b2}^A, adjusted for market A's specific trade cost, τ^A. However, conditional on $e_{b2}^A = 1$, we know that $\mu_b \geq 2f^{1/2} + \tau^A > \tau^A$. Therefore, the firm sets $\widetilde{q}_{b2}^A(\tau^A) = \left(\frac{\mu_b - \tau^A}{2}\right)$.

Expressed in $t = 0$ expected terms, the firm's profit from (possibly) sequentially expanding its product scope (to product b in market A at $t = 2$) corresponds to $W_b(\tau^A; f)$, as defined above. And similarly for destination B, $W_b(\tau^B; f)$. Therefore, expressed in $t = 0$ expected terms, the firm's profit from (possibly) expanding the product scope in either A or both markets at $t = 2$ corresponds to:

$$\begin{aligned}
W(\tau^A, \tau^B; f) &\equiv \mathbb{E}\left[\mathbf{1}_{\{\mu > 2f^{1/2} + \tau^A + c\}} \left\{ \begin{array}{c} \left[\left(\frac{\mu - c - \tau^A}{2}\right)^2 - f\right] + \\ + \mathbf{1}_{\{\mu > 2f^{1/2} + \tau^B + c\}} \left[\left(\frac{\mu - c - \tau^B}{2}\right)^2 - f\right] \end{array} \right\}\right] \\
&= \left\{ V_b(\tau^A) - \int_{\tau^B}^{2f^{1/2} + \tau^A} \left(\frac{\mu_b - \tau^A}{2}\right)^2 dG(\mu_b) \right\} - f\left[1 - G(2f^{1/2} + c + \tau^A)\right] + \\
&\quad + W_b(\tau^B; f) \\
&\equiv W_b(\tau^A; f) + W_b(\tau^B; f).
\end{aligned}$$

(v) *Sequential multiproduct entry* ($e_{a1}^A = 1, e_{b1}^A = 1; e_{a1}^B = 0, e_{b1}^B = 0$). When the firm exports products $v = a, b$ to country A in $t = 1$, at $t = 2$ it will have inferred its export profitability μ. Thus, q_{v2}^A is again given by (2): $\widetilde{q}_{v2}^A(\tau^A) = \widehat{q}_{v2}^A(\tau^A) = \mathbf{1}_{\{\mu_v > \tau^A\}} \left(\frac{\mu_v - \tau^A}{2}\right)$, generating second-period profit $V_v(\tau^A), v = a, b$. Otherwise, if the firm cannot deliver positive profits in a product, it exits to avoid further losses.

The firm chooses to enter market B at $t = 2$ if the operational profit is greater than the sunk cost to enter that market. Since the firm can enter with both products but product a is more profitable than product b,[7] a necessary condition to enter is that the firm's export profitability in its core product a covers the sunk entry cost[8]:

$$\left(\frac{\mu - \tau^B}{2}\right)^2 \geq F. \tag{7}$$

[7]Notice that $\frac{\mu_a - \tau^B}{2} \equiv \frac{\mu - \tau^B}{2} > \frac{\mu - c - \tau^B}{2} \equiv \frac{\mu_b - \tau^B}{2}$ if $c > 0$. Hence $\left(\frac{\mu - \tau^B}{2}\right)^2 > \left(\frac{\mu - c - \tau^B}{2}\right)^2 > \left(\frac{\mu - c - \tau^B}{2}\right)^2 - f$ provided that $f > 0$ (second inequality) and $c < \mu - \tau^B$ (first inequality), granting that optimal output of product b is non-negative.

[8]Here is where the condition $c > 2(F^{1/2} - f^{1/2})$ is relevant. In principle, the firm could enter B with *both* products a and b. Instead of (7), the relevant necessary condition would require that total operating profits be large than the sunk entry cost:

$$\left(\frac{\mu - \tau^B}{2}\right)^2 + \left(\frac{\mu - \tau^B - c}{2}\right)^2 - f \geq F$$

in which case the firm's entry decision would be:

$$e_{v2}^B(\tau^B) = 1, v = a, b \Leftrightarrow \mu \geq \left[2(F + f) - (c/2)^2\right]^{1/2} + \tau^B + c/2.$$

Condition $c > 2(F^{1/2} - f^{1/2})$ obtains from imposing that condition (7) dominates the condition above for simultaneous

Hence, the firm's entry decision in market B with product a at $t=2$ is

$$e_{a2}^{B}(\tau^{B}) = 1 \Leftrightarrow \mu \geq 2F^{1/2} + \tau^{B}. \tag{8}$$

Thus, defining $F_2^B(\tau^B)$ as the F that solves (7) with equality, the firm enters market B at $t=2$ if $F \leq F_2^B(\tau^B)$. It is straightforward to see that $F_2^B(\tau^B)$ is strictly decreasing in τ^B. In addition, the firm will find it worth to expand the product scope and introduce product b in market B at $t=2$ if condition (4) above is met.

Therefore, if the firm enters market B, it will choose q_{v2}^B much like it chooses q_{v2}^A, adjusted for market B's specific trade cost, τ^B. However, conditional on $e_{a2}^B = 1$, we know that $\mu > 2F^{1/2} + \tau^B > \tau^B$. Similarly, conditional on $e_{b2}^B = 1$, we know that $\mu_b > 2f^{1/2} + \tau^B > \tau^B$. Therefore, the firm sets $\widetilde{q}_{v2}^B(\tau^B) = \frac{\mu_v - \tau^B}{2}$ for $v = a, b$.

Expressed in $t=0$ expected terms, the firm's profit from (possibly) entering market B at $t=2$ corresponds to

$$\begin{aligned}
W(\tau^B; F, f) &\equiv \mathbb{E}\left[\mathbf{1}_{\{\mu > 2F^{1/2}+\tau^B\}}\left\{\begin{array}{c}\left[\left(\frac{\mu-\tau^B}{2}\right)^2 - F\right] + \\ +\mathbf{1}_{\{\mu > 2f^{1/2}+\tau^B+c\}}\left[\left(\frac{\mu-c-\tau^B}{2}\right)^2 - f\right]\end{array}\right\}\right] \\
&= \int_{2F^{1/2}+\tau^B}^{\overline{\mu}} \left[\left(\frac{\mu-\tau^B}{2}\right)^2 - F\right] dG(\mu) + \\
&\quad + \int_{2f^{1/2}+\tau^B+c}^{\overline{\mu}} \left[\left(\frac{\mu-c-\tau^B}{2}\right)^2 - f\right] dG(\mu) \\
&= \left\{V_a(\tau^B) - \int_{\tau^B}^{2F^{1/2}+\tau^B}\left(\frac{\mu-\tau^B}{2}\right)^2 dG(\mu)\right\} - F\left[1 - G(2F^{1/2}+\tau^B)\right] + \\
&\quad + W_b(\tau^B; f) \\
&\equiv W_a(\tau^B; F) + W_b(\tau^B; f).
\end{aligned}$$

Function $W(\tau^B; F, f)$ represents the value of exporting to market B after learning its profitability in foreign markets by entering market A first. The first term, $W_a(\tau^B; F)$, represents the (ex ante) expected gross profit from entering market B at $t=2$ with the core product a, net of the fixed cost from entering B times the probability that entry with product a in that market is profitable. The second term, $W_b(\tau^B; f)$, captures the (ex ante) expected net profit from entering market B at $t=2$ expanding the firm's scope to the non-core product b.

Thus, the return from first entering destination A includes the value of waiting to subsequently become an informed exporter to destination B, avoiding the costs from directly "testing" that market. In the presence of uncertainty and the irreversible entry cost F and product adaptation cost f, the possibility of delaying market and product entry into market B corresponds to a real option. If profits were not correlated across destinations and products, there would not be any gain from delaying entry into B and $W(\tau^B; F, f)$ would collapse to the unconditional expectation of profits in market B, as in $t=1$. The difference between these two values, which is the value of

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product entry in market B in $t=2$, i.e.

$$2F^{1/2} + \tau^B > \left[2(F+f) - (c/2)^2\right]^{1/2} + \tau^B + c/2$$

the real option, would then be zero. While we focus on the case of perfect correlation, it should be clear that as long as the correlation is positive, the value of the option remains strictly positive.

(vi) *Sequential monoproduct entry*: ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0$) When the firm exports product a to country A in $t = 1$, at $t = 2$ it will have inferred its export profitability μ. Thus, q^A_{a2} is again given by (2): $\widetilde{q}^A_{a2}(\tau^A) = \widehat{q}^A_{a2}(\tau^A) = \mathbf{1}_{\{\mu>\tau^A\}} \left(\frac{\mu-\tau^A}{2}\right)$, generating second-period profit $V_a(\tau^A)$. Otherwise, if the firm cannot deliver positive profits in a product, it exits to avoid further losses.

The firm chooses then whether to enter either market A at $t = 2$ with product b, and whether to enter market B with product a or b or both at $t = 2$. The former corresponds to the option to expand product scope in a market, and was defined under case (ii) but when applied to market A instead, $W_b(\tau^A; f)$. The latter corresponds to the option of Sequential multiproduct entry, examined under case (v) above, $W(\tau^B; F, f) = W_a(\tau^B; F) + W_b(\tau^B; f)$. Therefore, and expressed in $t = 0$ expected terms, the firm's profit from (possibly) entering market A at $t = 2$ with product b or market B with either product a or b or both at $t = 2$ corresponds to

$$\begin{aligned}
W(\tau^A, \tau^B; F, f) &\equiv \mathbb{E}\left[\begin{array}{c} \mathbf{1}_{\{\mu>2f^{1/2}+\tau^A+c\}}\left[\left(\frac{\mu-c-\tau^A}{2}\right)^2 - f\right] + \\ +\mathbf{1}_{\{\mu>2F^{1/2}+\tau^B\}}\left\{\begin{array}{c} \left[\left(\frac{\mu-\tau^B}{2}\right)^2 - F\right] + \\ +\mathbf{1}_{\{\mu>2f^{1/2}+\tau^B+c\}}\left[\left(\frac{\mu-c-\tau^B}{2}\right)^2 - f\right] \end{array}\right\} \end{array}\right] \\
&\equiv W_b(\tau^A; f) + W(\tau^B; F, f) \\
&= W_b(\tau^A; f) + W_a(\tau^B; F) + W_b(\tau^B; f).
\end{aligned}$$

Function $W(\tau^A, \tau^B; F, f)$ represents the value of the option of sequentially exporting product b to market A and sequentially entering market B with either or both products after learning the core product's profitability by entering market A first.

2.2.2 Period $t = 1$

(i) *No entry.* The firm does not export, earning zero profit.

(ii) *Simultaneous multiproduct entry* ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1$). A firm exporting to both destinations at $t = 1$ chooses q^A_{v1} and q^B_{v1} to maximize gross profits:

$$\begin{aligned}
\Psi^{(\text{ii})}(q^A_{a1}, q^A_{b1}, q^B_{a1}, q^B_{b1}; \tau^A, \tau^B) \equiv & \sum_{j=A,B} \sum_{v=a,b} \int_{\underline{\mu}}^{\overline{\mu}} (\mu - c\mathbf{1}_{\{v=b\}} - \tau^j - q^j_{v1}) q^j_{v1} dG(\mu) + \\
& + \max\left\{\mathbf{1}_{\{q^A_{a1}>0\}}, \mathbf{1}_{\{q^A_{b1}>0\}}, \mathbf{1}_{\{q^B_{a1}>0\}}, \mathbf{1}_{\{q^B_{b1}>0\}}\right\}\left[\sum_{j=A,B} \sum_{v=a,b} V_v(\tau^j)\right],
\end{aligned} \tag{9}$$

where superscript (ii) stands for "simultaneous product and market" entry. The first term corresponds to the firm's period 1 per-destination $j = A, B$ operational profits for products $v = a, b$ -expressed in terms of the profitability of the core product a. The second term denotes how much the firm expects to earn in period 2, depending on whether either $q^A_{v1} > 0$ or $q^B_{v1} > 0$, for $v = a, b$ (recall that for simplicity we set the rate of time discount to zero). Since exporting to one market reveals information about the firm's export profitability in both markets and products, it is enough to have exported a positive amount of a product v in period 1 to either destination.

Maximization of (9) yields outputs

$$\widehat{q}_{v1}^{A}(\tau^{A}) = \mathbf{1}_{\{E\mu>\tau^{A}+c\mathbf{1}_{\{v=b\}}\}}\left(\frac{E\mu-c\mathbf{1}_{\{v=b\}}-\tau^{A}}{2}\right)+\mathbf{1}_{\{v=a\}}\mathbf{1}_{\{E\mu\leq\tau^{A}+c\mathbf{1}_{\{v=b\}}\}}\varepsilon, \tag{10}$$

$$\widehat{q}_{v1}^{B}(\tau^{B}) = \mathbf{1}_{\{E\mu>\tau^{B}+c\mathbf{1}_{\{v=b\}}\}}\left(\frac{E\mu-c\mathbf{1}_{\{v=b\}}-\tau^{B}}{2}\right), \tag{11}$$

where $\varepsilon > 0$ is an arbitrarily small number. To understand these expressions, notice that there are five possibilities that depend on parameter values. If $E\mu > \tau^B + c$, $q_{v1}^{j} = \frac{E\mu-c\mathbf{1}_{\{v=b\}}-\tau^{j}}{2}$ for $j = A, B$ and $v = a, b$ is clearly optimal. If $\tau^B + c \geq E\mu > \tau^B$, $q_{a1}^{j} = \frac{E\mu-\tau^{j}}{2}$ for $j = A, B$ and $q_{b1}^{A} = \frac{E\mu-c-\tau^{A}}{2}$, $q_{b1}^{B} = 0$ are the best choices. Depending on $c \gtreqless \tau^B - \tau^A$ we have two [mutually exclusive] possibilities: (1) if $c \leq \tau^B - \tau^A$ then $\tau^B \geq E\mu > \tau^A + c$ and $q_{v1}^{A} = \frac{E\mu-c\mathbf{1}_{\{v=b\}}-\tau^{A}}{2}$, $q_{v1}^{B} = 0$ for $v = a, b$ is the best choice. (2) If $c > \tau^B - \tau^A$ then $\tau^A + c \geq E\mu > \tau^B$ and $q_{a1}^{j} = \frac{E\mu-\tau^{j}}{2}$, $q_{b1}^{j} = 0$ for $j = A, B$ is the best choice.[9] When $\tau^A + c \geq E\mu > \tau^A$, setting $q_{a1}^{A} = \frac{E\mu-\tau^{A}}{2}$, $q_{b1}^{A} = 0$ and $q_{v1}^{B} = 0$ for $v = a, b$ is optimal. Finally, if $E\mu \leq \tau^A$, setting $q_{v1}^{A} = q_{v1}^{B} = 0$ for $v = a, b$ may appear optimal. However, inspection of (9) makes clear that a small but strictly positive $q_{a1}^{A} = \varepsilon > 0$ dominates that option, since $\lim_{\varepsilon\to 0}\Psi^{(\text{ii})}(\varepsilon, 0, 0, 0; \tau^A, \tau^B) = \sum_{j=A,B}\sum_{v=a,b} V_v(\tau^j) > 0$. Clearly, setting $q_{v1}^{A} = q_{v1}^{B} = 0$ for $v = a, b$ forgoes the benefit from uncovering a valuable signal of the firm's export profitability.

Define[10]

$$\Psi_v(\tau^j) \equiv \mathbf{1}_{\{E\mu>\tau^{j}+c\mathbf{1}_{\{v=b\}}\}}\left(\frac{E\mu-c\mathbf{1}_{\{v=b\}}-\tau^{j}}{2}\right)^2 + V_v(\tau^j)$$

Evaluating (9) at the optimal output choices (10), (11) and (2), we obtain the firm's expected gross profit from simultaneous entry:

$$\Psi^{(\text{ii})}(\tau^A, \tau^B) \equiv \lim_{\varepsilon\to 0^+}\Psi^{(\text{ii})}(\widehat{q}_{a1}^{A}(\tau^A), \widehat{q}_{b1}^{A}(\tau^A), \widehat{q}_{a1}^{B}(\tau^B), \widehat{q}_{b1}^{B}(\tau^B); \tau^A, \tau^B) = \sum_{j=A,B}\sum_{v=a,b}\Psi_v(\tau^j). \tag{12}$$

(iii) *Partially sequential multiproduct entry:* $(e_{a1}^{A} = 1, e_{b1}^{A} = 1; e_{a1}^{B} = 1, e_{b1}^{B} = 0)$. At $t = 1$, a firm that enters market A with both products and market B with only product a chooses q_{a1}^{A}, q_{b1}^{A} and

[9]To allow for simultaneous product entry into one destination, we assume that the per unit cost to expand the product scope is smaller than the diference in per unit trade costs, i.e. that the unit cost difference between core and non-core products c is not bigger than the difference in tariffs across destinations, $c \leq \tau^B - \tau^A$. In the opposite case, $c > \tau^B - \tau^A$, the exporter does not consider entry into destination A with products a and b at $t = 1$.

[10]Notice that it is possible for a firm that expects $E\mu > \tau^A$ to uncover a realization of its profitability $\mu < \tau^A$, 'discovering' that selling to destination A is not profitable, i.e. $\widehat{q}_{a1}^{A} = \frac{E\mu-\tau^{A}}{2} > 0$ is ex-ante optimal because expected gross profits, $\max_{q_{a1}^{A}} E[(\mu - \tau^A - q_{a1}^{A})q_{a1}^{A}]$, are positive, $(\frac{E\mu-\tau^{A}}{2})^2 > 0$; yet, ex-post realized gross profits are negative, $(\mu - \tau^A - \frac{E\mu-\tau^{A}}{2})(\frac{E\mu-\tau^{A}}{2}) < 0$. This is a consequence of the condition according to which the firm cannot uncover its profitability without actually engaging into producing and selling to a destination, and is in stark contrast to what happens in models of firm heterogeneity a la Melitz (2003), where firms have uncovered their profitability prior to sinking the fixed cost of exporting, or in models of multiproduct firms a la Eckel and Neary (2010), where product scope only depends on ex-ante known supply side differences in unit production costs.

q_{a1}^B to maximize

$$\begin{aligned}\Psi^{(\text{iii})}(q_{a1}^A, q_{b1}^A, q_{a1}^B, 0; \tau^A, \tau^B) \;\; \equiv \;\; & \sum_{v=a,b} \int_{\underline{\mu}}^{\overline{\mu}} (\mu - c\mathbf{1}_{\{v=b\}} - \tau^A - q_{v1}^A) q_{v1}^A dG(\mu) + \\ & + \int_{\underline{\mu}}^{\overline{\mu}} (\mu - \tau^B - q_{a1}^B) q_{a1}^B dG(\mu) + \\ & + \max \left\{ \mathbf{1}_{\{q_{a1}^A > 0\}}, \mathbf{1}_{\{q_{b1}^A > 0\}}, \mathbf{1}_{\{q_{a1}^B > 0\}} \right\} \times \\ & \times \left[\sum_{v=a,b} V_v(\tau^A) + V_a(\tau^B) + W_b(\tau^B; f) \right], \qquad (13)\end{aligned}$$

where superscript (iii) stands for entry with strategy (iii). The first two terms correspond to the firm's period 1 per-destination $j = A, B$ operational profits for products $v = a, b$ -expressed in terms of the profitability of the core product a. Terms three and four denote how much the firm expects to earn in period 2, depending on whether either $q_{v1}^A > 0$ for $v = a, b$, or $q_{a1}^B > 0$. A strictly positive quantity $q_{b1}^A > 0$ allows the firm to make a more informed entry decision in market B with product b at $t = 2$, according to (4). Clearly, the solution to this program is $\widetilde{q}_{v1}^A(\tau^A) = \widehat{q}_{v1}^A(\tau^A)$ for $v = a, b$, as in (10), and $\widetilde{q}_{a1}^B(\tau^B) = \widehat{q}_{a1}^B(\tau^B)$ as in (11). Evaluating (13) at these optimal output choices, we obtain the firm's expected profit from "simultaneous market and sequential non-core product" entry:

$$\begin{aligned}\Psi^{(\text{iii})}(\tau^A, \tau^B) \;\; & \equiv \;\; \lim_{\varepsilon \to 0^+} \Psi^{(\text{iii})}(\widetilde{q}_{a1}^A(\tau^A), \widetilde{q}_{b1}^A(\tau^A), \widetilde{q}_{a1}^B(\tau^B), 0; \tau^A, \tau^B) \\ & = \;\; \sum_{v=a,b} \Psi_v(\tau^A) + \Psi_a(\tau^A) + W_b(\tau^B; f). \qquad (14)\end{aligned}$$

(iv) *Simultaneous monoproduct entry* ($e_{a1}^A = 1, e_{b1}^A = 0; e_{a1}^B = 1, e_{b1}^B = 0$). At $t = 1$, a firm that simultaneously enters both markets with product a chooses q_{a1}^A and q_{a1}^B to maximize

$$\begin{aligned}\Psi^{(\text{iv})}(q_{a1}^A, 0, q_{a1}^B, 0; \tau^A, \tau^B) \;\; \equiv \;\; & \sum_{j=A,B} \int_{\underline{\mu}}^{\overline{\mu}} (\mu - \tau^j - q_{a1}^j) q_{a1}^j dG(\mu) + \\ & + \max \left\{ \mathbf{1}_{\{q_{a1}^A > 0\}}, \mathbf{1}_{\{q_{a1}^B > 0\}} \right\} \sum_{j=A,B} [V_a(\tau^j) + W_b(\tau^j; f)], \qquad (15)\end{aligned}$$

where (iv) stands for "simultaneous market in core product" entry strategy (iv). The first term corresponds to the firm's period 1 per-destination $j = A, B$ operational profits for products a, and the second denotes how much the firm expects to earn in period 2 from sequentially expanding the product scope to either or both markets, depending on whether either $q_{a1}^A > 0$ or $q_{a1}^B > 0$. A strictly positive quantity of the core product in both markets allows the firm to make a more informed entry decision with product b at $t = 2$, according to (6). The solution to this program is $\widetilde{q}_{a1}^j(\tau^j) = \widehat{q}_{a1}^j(\tau^j)$ for $j = A, B$, as in (10) and (11). Evaluating (15) at these optimal output choices, we obtain the firm's expected profit from "simultaneous market in core product" entry:

$$\Psi^{(\text{iv})}(\tau^A, \tau^B) \equiv \lim_{\varepsilon \to 0^+} \Psi^{(\text{iv})}(\widetilde{q}_{a1}^A(\tau^A), 0, \widetilde{q}_{a1}^B(\tau^B), 0; \tau^A, \tau^B) = \sum_{j=A,B} [\Psi_a(\tau^j) + W_b(\tau^j; f)]. \qquad (16)$$

(v) *Sequential multiproduct entry* ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$). At $t = 1$, a firm that enters market A with both products a and b, chooses q^A_{a1} and q^A_{b1} to maximize

$$\begin{aligned} \Psi^{(\mathrm{v})}(q^A_{a1}, q^A_{b1}, 0, 0; \tau^A, \tau^B) \equiv & \sum_{v=a,b} \int_{\underline{\mu}}^{\overline{\mu}} (\mu - c\mathbf{1}_{\{v=b\}} - \tau^A - q^A_{v1}) q^A_{v1} dG(\mu) + \\ & + \max\left\{\mathbf{1}_{\{q^A_{a1}>0\}}, \mathbf{1}_{\{q^A_{b1}>0\}}\right\} \times \\ & \times \left[\sum_{v=a,b} V_v(\tau^A) + W_a(\tau^B; F) + W_b(\tau^B; f)\right], \end{aligned} \tag{17}$$

where superscript (v) stands for "sequential market" entry strategy (v). The first term corresponds to the firm's period 1 per-product $v = a, b$ operational profits in market A. The second and third denote how much the firm expects to earn in period 2 from sequentially entering market B with either or both products, depending on whether either $q^A_{a1} > 0$ or $q^A_{b1} > 0$. A strictly positive quantity of either product in market A allows the firm to make a more informed entry decision with either or both products at $t = 2$, according to (8). The solution to this program is $\widetilde{q}^A_{v1}(\tau^A) = \widehat{q}^A_{v1}(\tau^A)$ for $v = a, b$, as in (10). Evaluating (17) at these optimal output choices, we obtain the firm's expected profit from "sequential market" entry:

$$\begin{aligned} \Psi^{(\mathrm{v})}(\tau^A, \tau^B) & \equiv \lim_{\varepsilon \to 0^+} \Psi^{(\mathrm{v})}(\widetilde{q}^A_{a1}(\tau^A), \widetilde{q}^A_{b1}(\tau^A), 0, 0; \tau^A, \tau^B) \\ & = \sum_{v=a,b} \Psi_v(\tau^A) + W_a(\tau^B; F) + W_b(\tau^B; f). \end{aligned} \tag{18}$$

(vi) *Sequential monoproduct entry* ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0$). At $t = 1$, a firm that enters market A with product a chooses q^A_{a1} to maximize

$$\begin{aligned} \Psi^{(\mathrm{vi})}(q^A_{a1}, 0, 0, 0; \tau^A, \tau^B) \equiv & \int_{\underline{\mu}}^{\overline{\mu}} (\mu - \tau^A - q^A_{a1}) q^A_{a1} dG(\mu) + \\ & + \mathbf{1}_{\{q^A_{a1}>0\}} [V_a(\tau^A) + W_b(\tau^A; f) + W_a(\tau^B; F) + W_b(\tau^B; f)], \end{aligned} \tag{19}$$

where (vi) stands for "sequential market and product" entry strategy (vi). The first term corresponds to the firm's period 1 operational profits in market A with its core product. The second denotes how much the firm expects to earn in period 2 from sequentially entering market A with product b, $W_b(\tau^A; f)$, and/or market B with product a, $W_a(\tau^B; F, f)$, or b, $W_b(\tau^B; F, f)$, but only iff $q^A_{a1} > 0$, i.e. a strictly positive quantity of product a in destination A allows the firm to make a more informed entry decision with either or both products at $t = 2$. The solution to this program is $\widetilde{q}^A_{a1}(\tau^A) = \widehat{q}^A_{a1}(\tau^A)$, as in (10). Evaluating (19) at this optimal output choice, we obtain the firm's expected profit from "sequential market and product" entry:

$$\begin{aligned} \Psi^{(\mathrm{vi})}(\tau^A, \tau^B) & \equiv \lim_{\varepsilon \to 0^+} \Psi^{(\mathrm{vi})}(\widetilde{q}^A_{a1}(\tau^A), 0, 0, 0; \tau^A, \tau^B) = \\ & = \Psi_a(\tau^A) + W_b(\tau^A; f) + W_a(\tau^B; F) + W_b(\tau^B; f). \end{aligned} \tag{20}$$

Just as in ACCO, we have that some firms will "test" foreign markets before fully exploring them (or exiting them altogether).

Experimentation arises even when the variable trade cost is large enough to render period-1 expected operational profits negative in all markets, and despite the existence of sunk costs to export. Intuitively, the firm can choose to incur the sunk cost and a small initial operational loss because it *might* be competitive with its core *as well as with its non-core products* in that foreign market as well as in others; the return from the initial sale allows the firm to find out whether it actually is.

2.2.3 Entry strategy

We can now fully characterize the firm's entry strategy. We have six undominated entry strategies. The net profit of each strategy depends on the fixed costs to enter a new destination, F and to expand product scope within a destination, f, corresponding to cases (i) to (vi) above:

(i) The firm does not enter any export market with any product at $t = 1$ ($e^A_{a1} = 0, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0$), making zero net profits, $\Pi^{(i)}_{(0,0,0,0)} = 0$.

(ii) Using (12), the firm's net profit from Simultaneous multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1$), $\Pi^{(ii)}_{(1,1,1,1)}$, is

$$\Pi^{(ii)}_{(1,1,1,1)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + \Psi_b(\tau^A) + \Psi_b(\tau^B) - 2F - 2f. \tag{21}$$

(iii) In turn, we have from (14) that the firm's net profit from Partially sequential multiproduct entry, ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0$), $\Pi^{(iii)}_{(1,1,1,0)}$, is

$$\Pi^{(iii)}_{(1,1,1,0)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + \Psi_b(\tau^A) + W_b(\tau^B; f) - 2F - f. \tag{22}$$

(iv) The net profit of Simultaneous monoproduct entry ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0$) from (16) is equal to

$$\Pi^{(iv)}_{(1,0,1,0)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + W_b(\tau^A; f) + W_b(\tau^B; f) - 2F. \tag{23}$$

(v) The net profit of Sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$) from (18) equals

$$\Pi^{(v)}_{(1,1,0,0)} = \Psi_a(\tau^A) + \Psi_b(\tau^A) + W_a(\tau^B; F) + W_b(\tau^B; f) - F - f. \tag{24}$$

(vi) And finally, the net profit of Sequential monoproduct entry ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0$) from (20) is given by

$$\Pi^{(vi)}_{(1,0,0,0)} = \Psi_a(\tau^A) + W_b(\tau^A; f) + W_a(\tau^B; F) + W_b(\tau^B; f) - F. \tag{25}$$

Net profits decrease linearly with the magnitudes of both fixed costs f and F, so that the optimal entry strategies can be naturally ranked.[11] To solve this two-dimensional optimization

[11] The net profits associated with each of the strategies (i)-(vi) are linear decreasing functions of f, F or both. They also decrease in f and F indirectly through the real option values, $W_b(\tau^j; f)$ and $W_a(\tau^B; F)$, which are both strictly decreasing in f and/or F:

$$\begin{aligned} \frac{\partial}{\partial f} W_b(\tau^j; f) &= 1 - G(2f^{1/2} + \tau^j + c) < 0, j = A, B, \\ \frac{\partial}{\partial F} W_a(\tau^B; F) &= 1 - G(2F^{1/2} + \tau^B) < 0. \end{aligned}$$

In addition, notice that for each and every possible entry strategy (.), because the firm's product profitability is continuously distributed in the interval $[\underline{\mu}, \overline{\mu}]$, $\frac{\partial^2}{\partial F \partial F}\Pi^{(.)}(F) = \min\{0, -g(2F^{1/2} + \tau^B)F^{-1/2}\} = 0, \forall(.)$ since $g(.) = 0$ when evaluated at any particular point within the interval $[\underline{\mu}, \overline{\mu}]$. And the same argument applies to $\frac{\partial^2}{\partial f \partial f}\Pi^{(.)}(f) = 0, \forall(.)$.

problem it is useful to define two fixed cost thresholds: f^{Mu} and $f^{Mo} > f^{Mu}$, where superscript Mu denotes 'multiproduct' while Mo denotes 'monoproduct' (entry strategy); F^{Sm} and $F^{Sq} > F^{Sm}$, with superscript Sm means 'simultaneous' while Sq stands for 'sequential' (market entry). These thresholds partition the domain of the entry decisions in nine different regions within which only one of each of the six entry strategies is optimal, as conveyed in Figure 1 and summarized in Proposition 1.

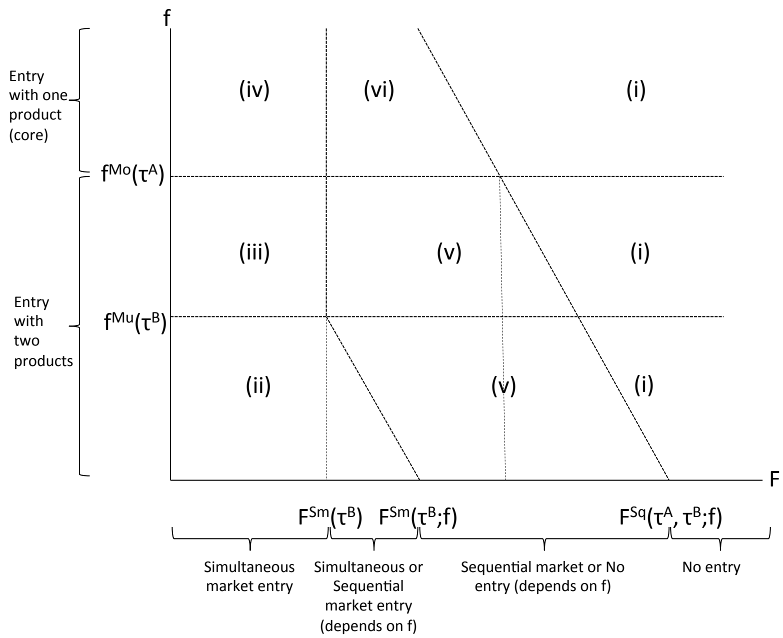

Figure 1: Optimal entry strategies, depending on the fixed product scope and entry costs, f and F.

Proposition 1 fully characterizes the firm's export decision.

Proposition 1 *(i) There are values F^{Sq} and F^{Sm}, with $F^{Sq} > F^{Sm} \geq 0$, such that at $t = 1$ the firm enters both markets A and B if $F < F^{Sm}$, enters only market A if $F \in [F^{Sm}, F^{Sq}]$, and enters neither market if $F > F^{Sq}$. Moreover, $F^{Sm} > 0$ iff $E\mu > \tau^B$. When $F \in [F^{Sm}, F^{Sq}]$, at $t = 2$ the firm enters market B if it learns that condition (8) is satisfied. (ii) There are values f^{Mu} and f^{Mo}, with $f^{Mo} > f^{Mu} \geq 0$, such that at $t = 1$ the firm enters in both markets A and B with both products a and b if $f < f^{Mu}$, enters both markets with product a and market A with product b if $f \in [f^{Mu}, f^{Mo}]$, and enters with only product a in A or both markets if $f > f^{Mo}$. Moreover, $f^{Mu} > 0$ iff $E\mu > \tau^B + c$. When $f \in [f^{Mu}, f^{Mo}]$, at $t = 2$ the firm enters market B with product b if it learns that condition (4) is satisfied. Since trade costs τ^A and τ^B differently affect the four thresholds, and market entry thresholds depend on the fixed cost to expand product scope within them, we can denote the thresholds as $f^{Mo}(\tau^A)$, $f^{Mu}(\tau^B)$, $F^{Sm}(\tau^B; f)$ and $F^{Sq}(\tau^A, \tau^B; f)$.*

Proof. See Appendix A.1. ■

The intuition for these results is simple. Along the market destination dimension, by construction $\tau^A \leq \tau^B$. So, if the firm ever enters any foreign market, it will enter market A. Since there are gains from resolving the uncertainty about export profitability, entry in market A, if it happens, will take place in the first period. Provided that the firm enters country A, it can also enter country B in the first period or wait to learn its export profitability before going to market B. If the firm enters market B at $t = 1$, it earns the expected operational profit in that market in the first period. Naturally, this can be optimal only when the firm expects its operational profit in B to be positive ($E\mu > \tau^B$). By postponing entry the firm forgoes that profit but saves the sunk entry cost if it realizes that its export profitability is not sufficiently high. The size of the sunk cost has no bearing on the former, but increases the latter. Hence, the higher the sunk cost to export, the more beneficial is waiting before sinking F in the less profitable market, B. And similarly along the product dimension: since by construction the core product is more profitable than the non-core one, $\mu \equiv \mu_a > \mu_b \equiv \mu - c, c > 0$, the firm has the option to postpone expanding the product scope until $t = 2$ at the cost of foregoing $t = 1$ expected profits in the non-core product, but saving the certainty of sinking f until profitability is known to be worth it.

An important question that we examine empirically below is which dimension is more relevant in the data: do firms enter a foreign new destination and expand the product scope there before moving to another destination, or do they first expand geographically and only then expand the product scope? As apparent from Figure 1, the former pattern of sequential entry is optimal for high market entry but low product scope fixed costs, i.e. strategy (v). The latter corresponds to the case where market entry fixed costs are low, while the cost to expand the product scope within a destination are high, i.e. strategy (iv). Setting $f = \gamma F, \gamma \in (0, 1)$ allows us to write the fixed costs to expand the product scope thresholds f^{Mo} and f^{Mu} in terms of the fixed entry cost F, F^{Mo} and F^{Mu}, and visualize the net profit functions on a two-dimensional graph without loss of generality.[12] The following Corollary to Proposition 1 derives those thresholds and shows that there is a unique value of γ for which the net profit of expanding the product scope within a destination –strategy (iv)– is equal to the net profit of first expanding geographically before expanding the product scope –strategy (v)–,

Corollary 1 *When $f = \gamma F, \gamma \in (0, 1)$, the fixed costs to expand product scope f^{Mo} and f^{Mu} can be uniquely expressed implicitely in terms of the fixed entry cost F by*

$$f^{Mu}(\tau^B) \equiv \gamma F^{Mu}(\tau^B) : \Psi_b(\tau^B) = W_b(\tau^B; \gamma F^{Mu}(\tau^B)) + \gamma F^{Mu}(\tau^B), \forall \gamma \in (0, 1) \quad (26)$$

$$f^{Mo}(\tau^A) \equiv \gamma F^{Mo}(\tau^A) : \Psi_b(\tau^A) = W_b(\tau^A; \gamma F^{Mo}(\tau^A)) + \gamma F^{Mo}(\tau^A), \forall \gamma \in (0, 1) \quad (27)$$

Furthermore there is a unique value of γ, γ', equating the net profits of the entry strategies (iv) and (v) such that 1. for high enough fixed costs to expand the product scope, $\gamma > \gamma'$ (denoted $\overline{\gamma}$), expanding first the product scope within a destination –strategy (iv)– is optimal; 2. for low enough fixed costs to expand the product scope, $\gamma < \gamma'$ (denoted $\underline{\gamma}$), expanding geographically across markets with the core product only –strategy (v)– is optimal.

Proof of Corollary 1. When $f = \gamma F, \gamma \in (0, 1)$, the net profit functions (21) and (22) defining f^{Mu} are:

$$\Pi^{(\text{ii})}_{(1,1,1,1)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + \Psi_b(\tau^A) + \Psi_b(\tau^B) - 2(1 + \gamma)F. \quad (28)$$

$$\Pi^{(\text{iii})}_{(1,1,1,0)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + \Psi_b(\tau^A) + W_b(\tau^B; \gamma F) - (2 + \gamma)F. \quad (29)$$

[12] It is without loss of generality as long as the assumption that the fixed cost to expand the product scope is smaller that the fixed entry cost to enter a new destination, $f < F$, holds.

And therefore, condition (26) obtains from equating the net profits of stategies (ii) and (iii) in:

$$\Pi^{(\mathrm{ii})}_{(1,1,1,1)} = \Pi^{(\mathrm{iii})}_{(1,1,1,0)} + \Psi_b(\tau^B) - W_b(\tau^B;\gamma F) - \gamma F.$$

Proceeding similarly for f^{Mo}, noting that the net profit function (23) is now given by:

$$\Pi^{(\mathrm{iv})}_{(1,0,1,0)} = \Psi_a(\tau^A) + \Psi_a(\tau^B) + W_b(\tau^A;\gamma F) + W_b(\tau^B;\gamma F) - 2F, \tag{30}$$

condition (27) obtains from equating the net profits of stategies (iv) and (iii) in:

$$\Pi^{(\mathrm{iv})}_{(1,0,1,0)} = \Pi^{(\mathrm{iii})}_{(1,1,1,0)} - \Psi_b(\tau^A) + W_b(\tau^A;\gamma F) + \gamma F.$$

Finally, to see that there is a unique value of γ that equates the net profits of strategies (iv) and (v), where

$$\Pi^{(\mathrm{v})}_{(1,1,0,0)} = \Psi_a(\tau^A) + \Psi_b(\tau^A) + W_a(\tau^B;F) + W_b(\tau^B;\gamma F) - F - \gamma F, \tag{31}$$

notice from

$$\Pi^{(\mathrm{iv})}_{(1,0,1,0)} = \Pi^{(\mathrm{v})}_{(1,1,0,0)} + \Psi_a(\tau^B) - W_a(\tau^B;F) - F - \Psi_b(\tau^A) + W_b(\tau^A;\gamma F) + \gamma F$$

that equating (30) and (31) is equivalent to

$$\Psi_a(\tau^B) - W_a(\tau^B;F) - F = \Psi_b(\tau^A) - W_b(\tau^A;\gamma F) - \gamma F$$

where the left-hand side of the equality is independent of γ whilst the right hand side is decreasing in γ. It therefore follows that there is a unique $\gamma' \in (0,1)$ where the equality holds for all values of the fixed entry cost F. Recalling from Proposition 1 that the left hand side of the above equality takes value zero when $F = F^{Sm}(\tau^B)$ according to expression (51), whilst the right hand side takes value zero when $F = \gamma F^{Mo}(\tau^A)$ according to expression (27), we can further establish that:

$$\begin{aligned} F^{Sm}(\tau^B) &= \gamma F^{Mo}(\tau^A) \Longleftrightarrow \gamma = \gamma' \\ F^{Sm}(\tau^B) &> \gamma F^{Mo}(\tau^A) \Longleftrightarrow \gamma > \gamma' \\ F^{Sm}(\tau^B) &< \gamma F^{Mo}(\tau^A) \Longleftrightarrow \gamma < \gamma' \end{aligned}$$

■

The intuition behind Corollary 1 is pretty simple: for low values of the fixed cost to expand the product scope ($\gamma < \gamma'$, denoted $\underline{\gamma}$), it is optimal for a firm that enters a new destination (say A) with its core product a to expand the product scope there conditional on surviving, before entering a new destination (say B) –strategy (v)–, as it can be seen in Figure 2.

On the other hand, for high values of the fixed cost to expand the product scope ($\gamma > \gamma'$, denoted $\overline{\gamma}$), it is optimal for a firm that enters a new destination (say A) with its core product a and survives there, to first enter another destination (say B) with the same product (a) rather than expanding the product scope in destination A –strategy (iv)–. This second case is conveyed in Figure 3. Which of these two broad cases is more prevalent is the actual behaviour of exporters is what remains to be ascertained from the data.[13]

[13] Notice from Figure 1 that for a given firm, depending on parameter values for c and f, either "Sequential multiproduct entry" -strategy (v)- or "simultaneous market in core product entry" -strategy (iv)- is dominant: both strategies never co-exist. When the unit cost of the non-core product, $c > \tau^B - \tau^A$, and the fixed cost to expand product scope in market A, $F - f \leq \left(\frac{E\mu - \tau^B}{2}\right)^2 - \left(\frac{E\mu - c - \tau^A}{2}\right)^2$, are sufficiently high, the "sequential market entry" strategy (v) is dominated by strategy (iv), "simultaneous market in core product entry." In all other cases, "sequential market entry" dominates, i.e. whenever $c \leq \tau^B - \tau^A$ or if $c > \tau^B - \tau^A$ but the fixed cost to expand product scope is sufficiently low relative to the fixed cost of entering market B, $F - f > \left(\frac{E\mu - \tau^B}{2}\right)^2 - \left(\frac{E\mu - c - \tau^A}{2}\right)^2$. In terms of ex-ante profitability $E\mu$, the firm adopts a "sequential market entry" over a "simultaneous market entry with the core product" if $E\mu \geq \frac{2(F-f)}{c+\tau^A-\tau^B} + \frac{c+\tau^A+\tau^B}{2}$. Otherwise, the firm prefers to adopt a "simultaneous market in core product entry" strategy.

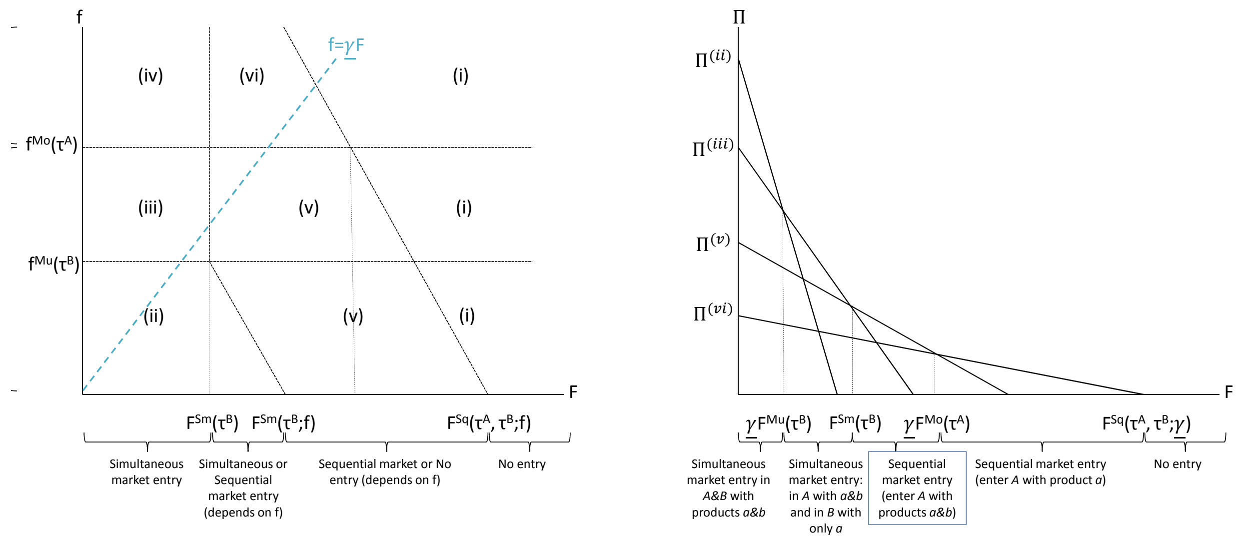

Figure 2: Optimal entry strategies (left panel) and net profits from optimal entry strategies at $t = 1$ (right panel) when $f = \underline{\gamma}F$

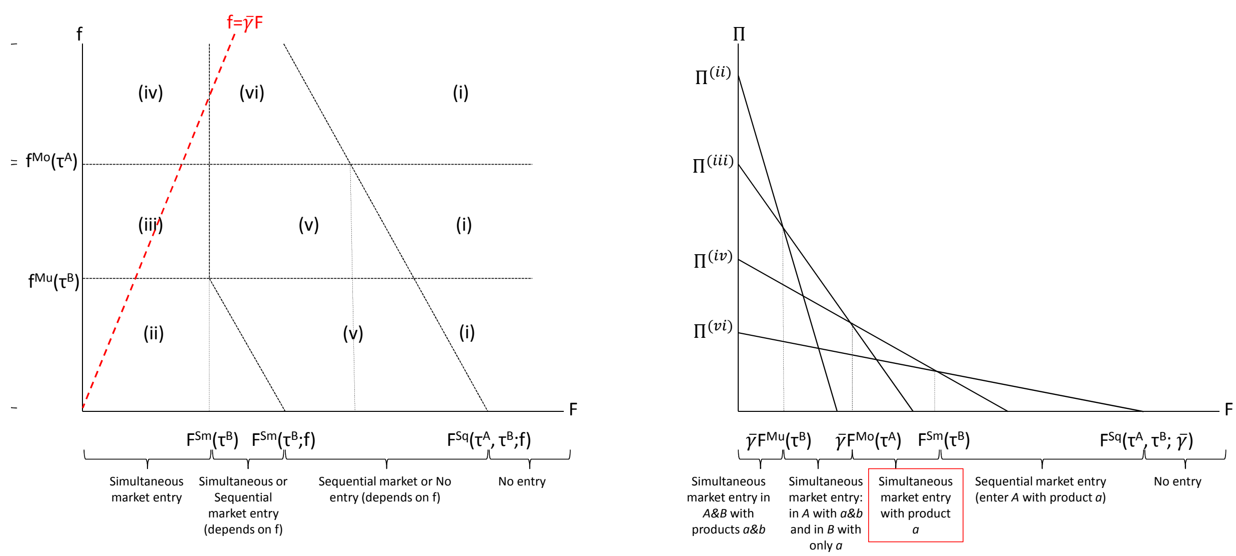

Figure 3: Optimal entry strategies (left panel) and net profits from optimal entry strategies at $t = 1$ (right panel) when $f = \overline{\gamma}F$

Our analysis, as reflected in Figure 1, is for a single firm with a generic productivity level. But it is not difficult to see how the results would extend to firms with different levels of productivity. Essentially, varying productivity levels would shift the thresholds defining sequential and simultaneous entry in foreign markets, for both monoproduct and multiproduct entry strategies. Higher productivity increases the expected profits from entering foreign markets simultaneously with both products, sequentially with either one or both products, as well as the expected profits from exporting at all. Hence the more productive a firm is, the higher its sunk cost thresholds will be, implying that more productive firms are more likely to export, and to start exporting many products simultaneously to multiple destinations. We show this formally in Appendix A.2.

2.3 Trade Policy Implications

Our empirical analysis below strongly suggests that correlation of firms' export profitabilities over time and across products and destinations is an important ingredient of firms' export decisions. Does that matter? Should we care? We argue that we should. In addition to providing new insights on firms' decisions to export and their dynamic behavior in foreign markets, the mechanism we propose also implies that the impact of trade policy on trade flows is more nuanced (and potentially much larger) than standard trade theories suggest. This opens new perspectives from which we can understand and assess the benefits of trade policy coordination across countries, as in regional and multilateral trade agreements. Our mechanism also uncovers dynamic effects of trade policy, which have been relatively neglected by researchers. To make these contributions clear, we examine the effects of trade liberalization in a simple extension of the model that includes many firms/sectors.

Consider a continuum of total mass one of firms with heterogeneous sunk costs of exporting, F, and of expanding the product scope, f. Let F follow a continuous c.d.f. $H(F)$ on the support $[0, \infty)$, and let f follow a continuous c.d.f. $U(f)$ on the same support. As before, for each firm ex ante profitability follows $G(\mu)$. Let $h(\cdot), u(\cdot)$ and $g(\cdot)$ denote the p.d.f.s of $H(\cdot), U(\cdot)$ and $G(\cdot)$, respectively. We assume that F, f and μ are independently distributed. Assuming independence is analytically very convenient. In particular, it implies an equivalence between having a single firm (as in the basic model) and a continuum of monopolists. In what follows we express all relevant outcomes in terms of the profitability of the core product a for simplicity.

The number of potential firms in Home is exogenous and normalized to one. The total number of exporters of products $v = a, b$ to market $j = A, B$ in period $t = 1, 2$, M_{vt}^{j}, follows from Proposition 1 and Corollary 1 in the main text. There we saw that there are two main cases, depending on the size of the the fixed cost to enter a new destination (say B), F, relative to the fixed cost to expand product scope, f, corresponding broadly to two different optimal entry sequences. When the relative cost to expand the product scope in a destination is high ($f = \overline{\gamma}F, \overline{\gamma} \in (0, 1)$), firms optimally expand geographically first and only then expand their product scope. Instead, when it is relatively low ($f = \underline{\gamma}F, \underline{\gamma} \in (0, 1)$), they first expand their product scope conditional on surviving, and only then they expand geographically entering a new destination. Since the conclusions are similar, we only develop here the analysis corresponding to the last case, illustrated in Figure 2 in the main text, and report on the main differences in footnotes where relevant:

- $M_{a1}^{A} = H\left[F^{Sq}(\tau^{A}, \tau^{B}; \gamma)\right]$ firms export product a to market A at $t = 1$;
- $M_{b1}^{A} = H\left[\gamma F^{Mo}(\tau^{A})\right]$ firms export product b to market A at $t = 1$;
- $M_{a1}^{B} = H\left[F^{Sm}(\tau^{B})\right]$ of firms export product a to market B at $t = 1$;
- $M_{b1}^{B} = H\left[\gamma F^{Mu}(\tau^{B})\right]$ of firms export product b to market B at $t = 1$;

- $M_{a2}^{A} = H\left[F^{Sq}(\tau^{A}, \tau^{B}; \gamma)\right]\left[1 - G(\tau^{A})\right]$ firms export their core product a to market A at $t = 2$, all of which already exported it at $t = 1$;

- $M_{b2}^{A} = H\left[\gamma F^{Mo}(\tau^{A})\right]\left[1 - G(\tau^{A})\right] + \int_{\gamma F^{Mo}}^{F^{Sq}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{A})\right] dH(F)$ firms export their non-core product b to market A at $t = 2$. The first term corresponds to continuing multiproduct exporters, whilst the second captures monoproduct firms that expand their product scope there at $t = 2$;

- $M_{a2}^{B} = H\left[F^{Sm}(\tau^{B})\right]\left[1 - G(\tau^{B})\right] + \int_{F^{Sm}}^{\gamma F^{Mo}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)$ firms export product a to market B at $t = 2$. The first term corresponds to continuing exporters; the second, to destination A multiproduct firms that expand geographically into B with their core product a;

- $M_{b2}^{B} = H\left[\gamma F^{Mu}(\tau^{B})\right]\left[1 - G(\tau^{B})\right] + \int_{\gamma F^{Mo}}^{F^{Sm}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)$ firms export product b to market B at $t = 2$. The first term corresponds to surviving multiproduct exporters, i.e. global firms. The second are destination A multiproduct firms that expand their product scope in destination B after uncovering there their core product a export profitability; ([14])

- $1 - H\left[F^{Sq}(\tau^{A}, \tau^{B}; \gamma)\right]$ firms do not export.

Quantities of products $v = a, b$ sold in markets $j = A, B$ at $t = 1$ follow $\widehat{q}_{v1}^{j}$, and sold at $t = 2$ by new and old exporters, follow the corresponding expressions developed in the main text.

Let us then look at the effects of a $t = 1$ permanent decrease in trade cost τ^{j} on export levels. Consider first the intensive margin. Clearly, a fall in τ^{A} increases product sales of current exporters to A at $t = 1$ without affecting sales to B, while a fall in τ^{B} has symmetric immediate effects. At $t = 2$, export levels rise for surviving exporters. This is counterbalanced by a negative composition effect: the new entrants (and newly introduced products) benefiting from lower trade costs operate at a lower-than-average scale. The overall intensive margin effect is therefore generally ambiguous (see further below).

The most interesting and novel features of the model regard however the extensive margin effects of trade liberalization. As a first step, we determine how variable trade costs affect the market entry and product scope thresholds $f^{Mo}(\tau^{A}) \equiv \gamma F^{Mo}(\tau^{A})$, $f^{Mu}(\tau^{B}) \equiv \gamma F^{Mu}(\tau^{B})$, $F^{Sm}(\tau^{B})$ and $F^{Sq}(\tau^{A}, \tau^{B}; \gamma)$.

[14] When instead we consider the case illustrated in Figure 3 in the main text, because the fixed cost to expand the product scope is relatively high $-f = \overline{\gamma}F, \overline{\gamma} \in (0, 1)-$, firms first expand geographically across markets before expanding their product scope within destinations. That has no effect in the definitions of the masses of firms exporting each product to each destination in period $t = 1$, M_{v1}^{j}, nor in the mass of firms exporting their core product to destination A in period $t = 2$, M_{a2}^{A}, but affects the remaining masses at $t = 2$ as follows:

- $M_{b2}^{A} = H\left[\gamma F^{Mo}(\tau^{A})\right]\left[1 - G(\tau^{A})\right] + \int_{\gamma F^{Mo}}^{F^{Sm}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{A})\right] dH(F)$ firms export product b to market A at $t = 2$. The first term corresponds to continuing multiproduct exporters, whilst the second captures monoproduct firms that expand their product scope there at $t = 2$;
- $M_{a2}^{B} = H\left[F^{Sm}(\tau^{B})\right]\left[1 - G(\tau^{B})\right] + \int_{F^{Sm}}^{F^{Sq}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)$ firms export product a to market B at $t = 2$. The first term corresponds to continuing monoproduct exporters; the second, to new monoproduct entrants;
- $M_{b2}^{B} = H\left[\gamma F^{Mu}(\tau^{B})\right]\left[1 - G(\tau^{B})\right] + \int_{\gamma F^{Mo}}^{\gamma F^{Mu}}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)$ firms export product b to market B at $t = 2$. The first term captures continuing multiproduct exporters, i.e. global firms. The second are destination A multiproduct firms that expand their product scope in destination B after uncovering there their core product a export profitability;

Lemma 1 *Variable trade costs for products a and b in markets A and B affect the fixed cost thresholds as follows:*

- $\frac{d(\gamma F^{Mu})}{d\tau^A} = 0;$
- $\frac{d(\gamma F^{Mu})}{d\tau^B} = -\frac{\mathbf{1}_{\{E\mu>\tau^B+c\}}(\frac{E\mu-\tau^B-c}{2})+\int_{\tau^B+c}^{2\left[\gamma F^{Mu}\right]^{1/2}+\tau^B+c}(\frac{\mu-\tau^B-c}{2})dG(\mu)}{G(2[\gamma F^{Mu}]^{1/2}+\tau^B+c)} < 0.$
- $\frac{d(\gamma F^{Mo})}{d\tau^A} = -\frac{1_{\{E\mu>\tau^A+c\}}\left(\frac{E\mu-\tau^A+c}{2}\right)+\int_{\tau^A+c}^{\overline{\mu}}(\frac{\mu-\tau^A-c}{2})dG(\mu)+\int_{2[\gamma F^{Mo}]^{1/2}+\tau^A+c}^{\overline{\mu}}(\frac{\mu-\tau^A-c}{2})dG(\mu)}{2-G(2[\gamma F^{Mo}]^{1/2}+\tau^A+c)} < 0;$
- $\frac{d(\gamma F^{Mo})}{d\tau^B} = 0;$
- $\frac{dF^{Sm}}{d\tau^A} = 0;$
- $\frac{dF^{Sm}}{d\tau^B} = -1_{\{E\mu>\tau^B\}}\frac{\left(\frac{E\mu-\tau^B}{2}\right)+\int_{\tau^B}^{2\left[F^{Sm}\right]^{1/2}+\tau^B}\left(\frac{\mu-\tau^B}{2}\right)dG(\mu)}{G(2[F^{Sm}]^{1/2}+\tau^B)} \leq 0;$
- $\frac{dF^{Sq}}{d\tau^A} = -\frac{\left[\mathbf{1}_{\{E\mu>\tau^A\}}\left(\frac{E\mu-\tau^A}{2}\right)+\int_{\tau^A}^{\overline{\mu}}\left(\frac{\mu-\tau^A}{2}\right)dG(\mu)+\int_{2f^{1/2}+\tau^A+c}^{\overline{\mu}}(\frac{\mu-\tau^A-c}{2})dG(\mu)\right]}{2-G\left(2[F^{Sq}]^{1/2}+\tau^B\right)} < 0;$
- $\frac{dF^{Sq}}{d\tau^B} = -\frac{\left[\int_{2[F^{Sq}]^{1/2}+\tau^B}^{\overline{\mu}}\left(\frac{\mu-\tau^B}{2}\right)dG(\mu)+\int_{2f^{1/2}+\tau^B+c}^{\overline{\mu}}(\frac{\mu-\tau^B-c}{2})dG(\mu)\right]}{2-G\left(2[F^{Sq}]^{1/2}+\tau^B\right)} < 0.$

Proof of Lemma 2. See Appendix A.4. ■

We can now establish the extensive margin effects of trade liberalization in countries A and B in both the short and the long runs.

Proposition 2 *Trade liberalization in a country has qualitatively different effects on (product and market) entry in the short and long runs, and encourages entry in other countries and/or with other products. Specifically, and from the ex-ante perspective of $t = 0$,*

a) A decrease in τ^A at $t = 1$, holding τ^B fixed:

1. *increases the number of both Home exporters and exported products to A at $t = 1$ and at $t = 2$;*
2. *has no effect on Home exports to B at $t = 1$, but increases the number of both Home exporters and exported products to B at $t = 2$.*

b) A decrease in τ^B at $t = 1$, holding τ^A fixed and such that τ^B remains larger than τ^A:

1. *increases the number of both Home exporters and exported products to A at $t = 1$ and $t = 2$;*
2. *increases the number of both Home exporters and exported products to B at $t = 1$ and $t = 2$.*

Proof. See Appendix A.4 ■

Proposition 4 has four elements. First, it shows that trade liberalization has immediate as well as delayed effects on trade flows. This distinction is especially important given economists' typical focus on the static gains from trade; our analysis indicates that we should not disregard lagged responses of trade flows to trade barriers. Second, the Proposition shows that trade liberalization in a country induces entry into other countries. Third, it shows that this induced entry in other markets is always present in the long run, but not necessarily in the short run. Fourth, 'induced entry' is to be understood of firms into new markets but also of new products by already exporting firms that expand their product scope within destinations without necessarily entering new ones.

To see this more intuitively, consider first the short run. A lower τ^A makes early entry in market A more appealing, as expected, but so does a lower τ^B, because it increases the profits from potentially entering market B at $t = 2$. By contrast, while τ^B directly affects the decision to enter market B at $t = 1$, τ^A plays no direct role in that decision. The reason is that the choice between entering markets sequentially or simultaneously is unaffected by τ^A. Conversely, in the long run there is no asymmetry and cross-market effects are always present. As variable trade costs fall, firms' potential future gains from learning their export product profitabilities increase. As a result, more firms choose to engage in exporting. Among those new exporters, a fraction will find it profitable to enter other destinations in the future.

Hence, Proposition 4 implies that trade liberalization in a country creates trade externalities to other countries.

It is also important to note that our structure abstracts from several channels through which trade liberalization can affect firms (e.g. by changing the number of active firms), some of which may interact with the forces we highlight here. Still, as long as sequential product entry remains optimal for some firms, the nature of our main policy implications would not be qualitatively altered.

2.4 Testable Predictions

Our model is parsimonious in many dimensions. For example, we assume that firms learn fully about their profitability about product v in foreign market j by selling product v', $v' \neq v$, or in market j', $j' \neq j$. In reality, the correlation of export profitabilities across products or markets is surely less than perfect. However, if it is not negligible, the main messages of the model remain intact. The same is true about the correlation of export profitabilities in a given market or product over time. Effectively, our running hypothesis is that firms extract the highest informational content from their first export experience. The implications of the model should be interpreted accordingly. Similarly, to derive explicit testable predictions, one would need to extend the model to $V > 2$ products, $T > 2$ periods and $N > 2$ foreign countries. **We show this formally in the Online Appendix.** Since those proofs are conceptually straightforward, here we discuss only informally how they follow from our setup. We keep the convention that $\tau^A = \min\{\tau^j\}$, $j = A, ..., N$, so that market A is the first the firm enters at $t = 1$.

2.4.1 Predictions on Export Dynamics

The model implies, first, that conditional on survival we should expect faster intensive margin export growth when firms are learning their export profitabilities—i.e. with their core (or first export) product and right after they enter their first foreign market. The reason is simple. Since export profitability is uncertain for a firm before it starts exporting, first-year exports are on average relatively low. If the firm anticipates positive variable profit with its core product in its first market, it produces according to this expectation. If the firm stays there in the second period, or if it expands its product scope there, it must be because its uncovered export potential is indeed relatively high ($\mu > \tau^A$). Since the relevant distribution of μ becomes a truncation of the original one, conditional on survival firms on average expand sales of their core product in their first market. If the firm had entered that market just to learn about its export potential there (and to potentially benefit from expanding its product scope there and in other destinations in the future), the firm initially produces just the minimum necessary for effective learning and the same argument applies even more strongly. On the other hand, once the uncertainty about export profitability has been resolved, there is no reason for further changes in sales, and there should be no growth in export volumes in the years following this discovery period. Similarly, since the profitability of the firm in its first export destination conveys all information about export profitability in other products and destinations, there is no reason for export growth in markets other than the firm's first either:

Prediction 1 *Conditional on survival, the growth rate of exports to a market is on average higher between the first and second periods for the first (core) product in the first foreign market served by the firm than in subsequent (non-core) products, markets or later in the firm's first market.*

Proof. See Appendix A.3. ■

Obviously, our model abstracts from a range of shocks that are likely to affect firms' export volumes; we discuss and seek to control for them in our empirical analysis. We also adopt the strong assumption that a firm's export profitability is perfectly correlated across products, markets and time. If the correlation were positive but imperfect, it would imply strictly positive first-to-second year product export growth in every market the firm expands to and survives. Accordingly, the hypothesis we test is that firms learn *more* about their export profitability when they start serving their first country with their first product, relative to early years in their subsequent countries and products.

The second implication of the model relates to entry patterns. Once a firm starts exporting, it will uncover its export profitability. Some new exporters will realize that their export profitabilities are sufficiently high and decide to expand in the next period to other markets and products where they anticipate positive profits. By contrast, experienced exporters have already learnt enough about their export profitability, and therefore have already made their entry decisions in the past:

Prediction 2 *Conditional on survival, new exporters are more likely to either enter other foreign markets or to add new products (or both) than experienced ones.*

Proof. See Appendix A.3. ■

Again, the message from our basic model is extreme, as it abstracts from other motives for expansion to different foreign markets—which we seek to control for in our empirical analysis. But it highlights our central point, that (surviving) new exporters have an *additional* reason to expand.

The third implication of the model refers to the exit patterns of exporting firms. Because an experienced exporter is better informed about its own export profitability than a new exporter, the latter is more likely than the former to find out that it is not worthwhile to keep serving a market. Critically, the model implies that this is also true when comparing firms that have just entered a given foreign destination, but when this is the first foreign market for one firm and not for the other. Generally, while many (un-modeled) factors can cause a firm to abandon a foreign destination, the model shows that being a new exporter creates an *additional* motivation to do so, in expected terms:

Prediction 3 *Exit rates of exporters are on average higher between the first and second years of exporting the first (core) product in the first country, relative to early years in subsequent (non-core) products and markets, or later in the firm's first product-country.*

Proof. See Appendix A.3. ■

2.4.2 Predictions on Trade Policy Spillovers

We now consider the implications of the model for the effect of tariff changes on export dynamics. We start by looking at the entry pattern of exporting firms. According to Proposition 4, trade liberalization in a country induces entry into other countries either with the same (core) or with a different (non-core) product, both in the short and in the long runs:

Prediction 4 (Impact on unconditional entry) *Trade liberalization in a third country encourages immediate entry in other countries and/or with other products, particularly for new exporters exporting their first (core) product to their first export destination.*

Proof. See Appendix A.4. ■

Of course tariff reductions in market A also increase the probability to export there in period t, i.e. ,

$$\frac{d\Pr(e_{vt}^{iA}=1)}{d\tau^A}=\sum_v \frac{dm_{vt}^A}{d\tau^A}=\begin{bmatrix} u(H[F^{Sq}])h[F^{Sq}]\frac{dF^{Sq}}{d\tau^A}+ \\ +u[f^{Mo}]H[F^{Sq}(\tau^A,\tau^B;f^{Mo})]\frac{df^{Mo}}{d\tau^A}+ \\ +\int_0^{f^{Mo}(\tau^A)} h(F^{Sq})\frac{dF^{Sq}}{d\tau^A}dU(f) \end{bmatrix}<0$$

since each of the additive terms is negative, according to Lemma 2 and Proposition 2. Therefore to test Prediction 4 we control for own-country tariff reductions. Also note that because tariff changes tend to be persistent in time, we also condition on the effect of one period lagged tariff changes in destination j and in third countries $j\prime \neq j$ in econometric specification [35].

Prediction 4 establishes that trade liberalization in a third country increases the ex-ante option value of entering a new destination or expanding the product scope in a previously entered destination (or both). As such, Prediction 4 refers to the effects of a third-country trade liberalization on the unconditional entry of firms, i.e. from an ex-ante perspective. We now show that it also amplifies the extensive margin decisions of firms conditional on entry identified in Predictions 2 and 3, but not the intensive margin one, Prediction 7. We view the latter as a natural placebo for the novel third-country trade policy predictions as implied by our model.

Prediction 5 (Impact on conditional entry) *Conditional on survival, new exporters are more likely to either enter other foreign markets or to add new products (or both) than experienced ones as a consequence of trade liberalization in a non-trading partner country.*

Proof. See Appendix A.4. ■

Notice that both sequential export destination and product entry in B as a consequence of trade liberalization in the nearby country A are 'delayed' (or long run) third country effects, i.e. an additional 'model based' foundation for the inclusion of a one-period lagged third-country tariff change in our unconditional entry econometric specification [35]

We now turn to exit. Prediction 3 states that the probability that firm i will exit a particular export market j with product $v = p$ in period t ($Exit_{ijpt} = 1$) is higher if the firm exported for the first time in $t-1$. We now show that new exporters and newly introduced (non-core) products are even more likely to exit following a trade liberalization in a non-partner third country.

Prediction 6 (Impact on exit) *As a consequence of trade liberalization in a non-trading partner country, the exit rates of exporters are on average higher between the first and second years of exporting the first (core) product in their first export destination, relative to early years in subsequent (non-core) products and markets, or later in the firm's first product-country.*

Proof. See Appendix A.4. ■

We finally turn to third country trade liberalization effects on the intensive margin growth of exports.

Prediction 7 (Impact on growth) *Conditional on survival, the growth rate of exports of a product to a market is on average unaffected by trade liberalization in a non-trading partner country.*

Proof. See Appendix A.4. ■ This prediction will be used as a placebo test in our empirical application.

3 Empirical Evidence

We now test the predictions of the model. We start by describing the data.

3.1 Data

Data sources We use French Customs data which document the value of all export transactions in euros between 1993 and 2006 by firm, HS6 product, destination country and year.

We choose to define products at the HS6 level, as opposed to more disaggregated levels, to exploit tariff data for a large number of potential destination countries. To deal with revisions of the HS classification, we concord product categories using data from Beveren et al. (2012), who use a version of the Pierce and Schott (2012) algorithm. We match this dataset with standard gravity regression covariates from the CEPII Gravity dataset used in Head et al. (2010). Finally, we exclude countries with less than 5% of all French exports in order to reduce the size of our dataset.

For computational reasons we focus on a *random sample of 30% of all firms*.[15] The resulting sample has 6,814,109 firm-country-product-year observations, with 228,513 firms, 88 countries, 4211 concorded HS6 products and 14 years.

Data on import tariffs come from the UN COMTRADE database. More precisely, we use applied MFN tariffs applicable to French/EU exporters at the HS6 product level.

Variables Our empirical investigation of export dynamics features three main dependent variables: growth of export sales, entry in and exit from foreign markets. All three variables are measured at the firm-country-product-year ($ijpt$) level. Denote by x_{ijpt} the recorded sales of French firm i in country j of HS6 product p in year t. $Growth_{ijpt}$ equals the annual growth rate of firm-country-product exports, measured in FOB value or:

$$Growth_{ijpt} = \ln(x_{ijpt}) - \ln(x_{ijpt-1}). \tag{32}$$

[15] As explained below, our analysis of entry requires the construction of very large datasets. Building an entry dataset with all firms would generate over 2bn observations.

$Exit_{ijpt}$ is a binary variable that takes value one when the firm-country-product has positive exports in the previous year $t-1$, but no exports in the current year t:

$$Exit_{ijpt} = \begin{cases} 1 & \text{if } x_{ijpt} = 0 \text{ and } x_{ijpt-1} > 0 \\ 0 & \text{if } x_{ijpt} > 0 \text{ and } x_{ijpt-1} > 0 \end{cases} \tag{33}$$

$Entry_{ijpt}$ is a binary variable that takes value one when a firm-country-product has positive exports in the current year t and none in the previous year $t-1$. [16]

$$Entry_{ijpt} = \begin{cases} 1 & \text{if } x_{ijpt} > 0 \text{ and } x_{ijpt-1} = 0 \\ 0 & \text{if } x_{ijpt} = 0 \text{ and } x_{ijpt-1} = 0 \end{cases} \tag{34}$$

Given our definition of non-entry we must expand our dataset to *include firm-product-country-year observations which are never actually observed in the customs data*. More precisely, for all observed firm-product pairs we span over all possible countries and years.[17] These artificial observations allow us to exploit cross-country variation in entry in a firm-product-year triple, especially in relation with prior history in this country. Our goal is to analyze not just the timing of firms' entry in their observed destinations, but also why they choose the subset of countries we observe. Finally, we exclude all post-entry observations, in the sense that firm-product-country triples with $Entry_{ijpt} = 1$ leave the sample from $t+1$ onwards.

Our theory suggests that export dynamics depend on past export experience through learning effects. To capture this dependence we create four variables. FY_{ijpt} takes value one when firm i exports product p to market j in year t, but not in year $t-1$, and zero otherwise. In contrast, FY_{it} takes value one when firm i exports its first-ever product to it first-ever market in year t (in other words, the firm has exporting age 1). FM_{ij} takes value one if j is the first country firm i exports to (this may apply to several countries), and zero otherwise. FP_{ip} takes value one if p is the first product that firm i exports (this may apply to several products), and zero otherwise.

Our gravity control variables are quite standard. They include four continuous variables: population-weighted distance to France ($distw$), population (pop_d), GDP (gdp_d) and GDP per capita ($gdpcap_d$); and nine binary variables: contiguity with France ($contig$), common official language ($comlang\_off$), past colonial ties ($col45$, $colony$), GATT/WTO membership ($gatt_d$), Regional Trade Agreement with the EU (rta), common legal origin ($comleg$), common currency ($comcur$) and ACP membership (acp).[18]

3.2 Descriptive statistics

Aggregate statistics In the full sample, French exports of goods grew 155.14% in current values, from 152.7bn euros in 1993 to 389.6bn euros in 2006. This is summarized in Figure 4.

This growth was very uneven across product categories, as shown by Table 1. Throughout our sample the main export product categories were Machinery and Mechanical Appliances, Vehicles and Chemicals. But the highest growth rates were experienced in the Arms and Ammunition, Mineral Products and Works of Art Sections. In contrast, exports of agricultural products, textiles and some raw materials experienced the lowest growth rates.

[16] These definitions imply that some $Entry_{ijpt} = 1$ observations capture re-entry, while some $Exit_{ijpt} = 1$ observations capture temporary exit.

[17] Implicitly we assume that the relevant set of products a firm considers for exports is the one it eventually exports. This is the best we can do in the absence of data on domestic sales by product.

[18] See Head et al. (2010) and references therein for more details on the definition of these variables.

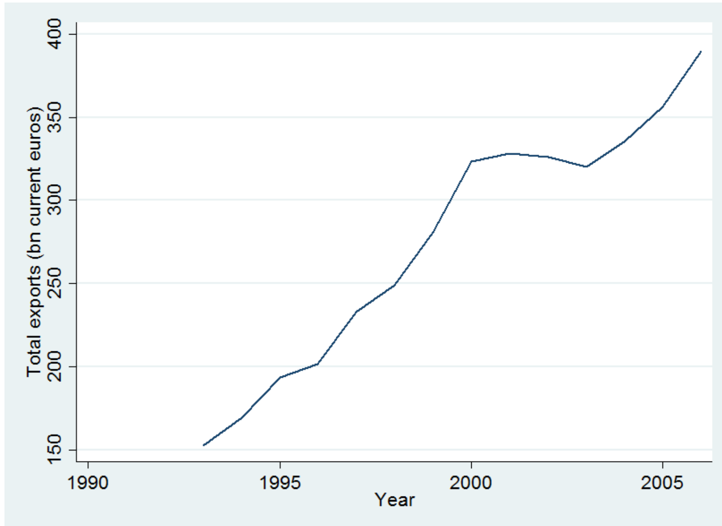

Figure 4: Total French exports, 1993-2006

Table 1: Breakdown of total goods exports by HS Section.

HS Section	1993 Exports (current EUR bn)	2006 Exports (current EUR bn)	Growth rate (%)
LIVE ANIMALS; ANIMAL PRODUCTS	7.16	10.2	+42.0
VEGETABLE PRODUCTS	7.35	9.51	+29.3
ANIMAL OR VEGETABLE FATS AND OIL ...	.38	.85	+122.2
FOODSTUFFS, BEVERAGES AND TOBACCO	9.92	21.8	+120.2
MINERAL PRODUCTS	3.99	17.43	+337.2
CHEMICALS	17.91	56.04	+213.0
PLASTICS AND ARTICLES THEREOF...	7.97	21.11	+164.8
RAW HIDES AND SKINS, LEATHER...	1.23	3.55	+188.7
WOOD AND ARTICLES OF WOOD...	.99	2.52	+154.2
PULP OF WOOD...	3.855	8.365	+117.0
TEXTILES AND TEXTILE ARTICLES	7.13	12.81	+79.64
FOOTWEAR, HEADGEAR, UMBRELLAS...	.75	1.51	+101.9
ARTICLES OF STONE, PLASTER, CEMENT...	2.87	4.78	+66.62
NATURAL OR CULTURED PEARLS...	.95	2.42	+153.7
BASE METALS AND ARTICLES...	11.61	33.30	+186.9
MACHINERY AND MECHANICAL APPLIANCES	34.98	85.38	+144.1
VEHICLES, AIRCRAFT, VESSELS...	26.33	78.01	+196.3
OPTICAL, PHOTOGRAPHIC INSTRUMENTS...	4.55	13.16	+189.0
ARMS AND AMMUNITION; PARTS...	.06	.32	+459.1
MISCELLANEOUS MANUFACTURED ARTICLES	2.48	5.67	+128.4
WORKS OF ART, COLLECTORS' PIECES	.23	0.92	+308.0

The geographical breakdown of French exports of goods also changed during the sample period. Table 2 shows the 10 main export destinations in 1993 and 2006 and their respective shares of total French exports. Unsurprisingly neighboring European countries and large economies such as the US, Japan and China feature prominently. French exports became more dispersed during the sample period, with a fall in the export shares of Germany and the UK and a rise in the shares of Spain, Switzerland, China and Poland.

Table 2: Exports to France's Top 10 Destinations (current billion euros) and Share of Total Exports in 1993 and 2006

	1993			2006		
	Country	Exports	Share (%)	Country	Exports	Share (%)
1.	Germany	31.2	20.4	Germany	61.6	15.8
2.	United Kingdom	16.9	11.1	Spain	38.1	9.77
3.	Italy	16.8	11.0	Italy	35.2	9.03
4.	United States	12.7	8.32	United Kingdom	32.9	8.45
5.	Spain	12.0	7.84	Belgium	28.8	7.40
6.	Netherlands	8.66	5.67	United States	26.3	6.76
7.	Japan	3.52	2.31	Netherlands	16.0	4.10
8.	Portugal	2.79	1.83	Switzerland	10.4	2.68
9.	Sweden	1.83	1.20	China	8.09	2.07
10.	Algeria	1.81	1.19	Poland	6.99	1.79

We next report changes in world tariffs during our sample period. That period follows the successful completion of the Uruguay Round of GATT negotiations and covers the accession of China and other important economies to the WTO, which succeeded the GATT in 1995. Figure 5 provides a comparison between unweighted average HS6 tariffs in 1994 and 2006. Overall it reveals a pattern of reduction in the world average tariff in most product categories. Some of those reductions were sizeable. However, we also observe some *increases* in world average tariffs from a 1994 level of zero. Most of these increases in world averages come from extended data coverage in high-tariff reporting countries in late years.

Indidivual statistics We now turn to exporter behavior. Learning models predict that exit rates out of exporting decrease with exporting age, and that survivors expand gradually. We provide descriptive statistics to support those predictions.

Figure 6 describes the Kaplan-Meier estimated survival function, where age is defined at the firm-product-country spell level. The figure conveys the idea that exit rates are at their highest in the first year of exporting (nearly 50%), but fall sharply with age. This echoes earlier findings on exit rates out of exporting.[19]

Figure 7 shows the contribution of exporters of various cohorts to total exports. The figure reveals that the contribution of each cohort of new exporters increases sharply initially, then declines slowly.

We investigate new exporters' gradual expansion in more detail by examining the addition of new products and countries. Table 3 shows how the number of products and destination countries

[19] For instance Aeberhardt et al. (2014) find a similar pattern in the same French data at a more disaggregated level (firm-country exports)

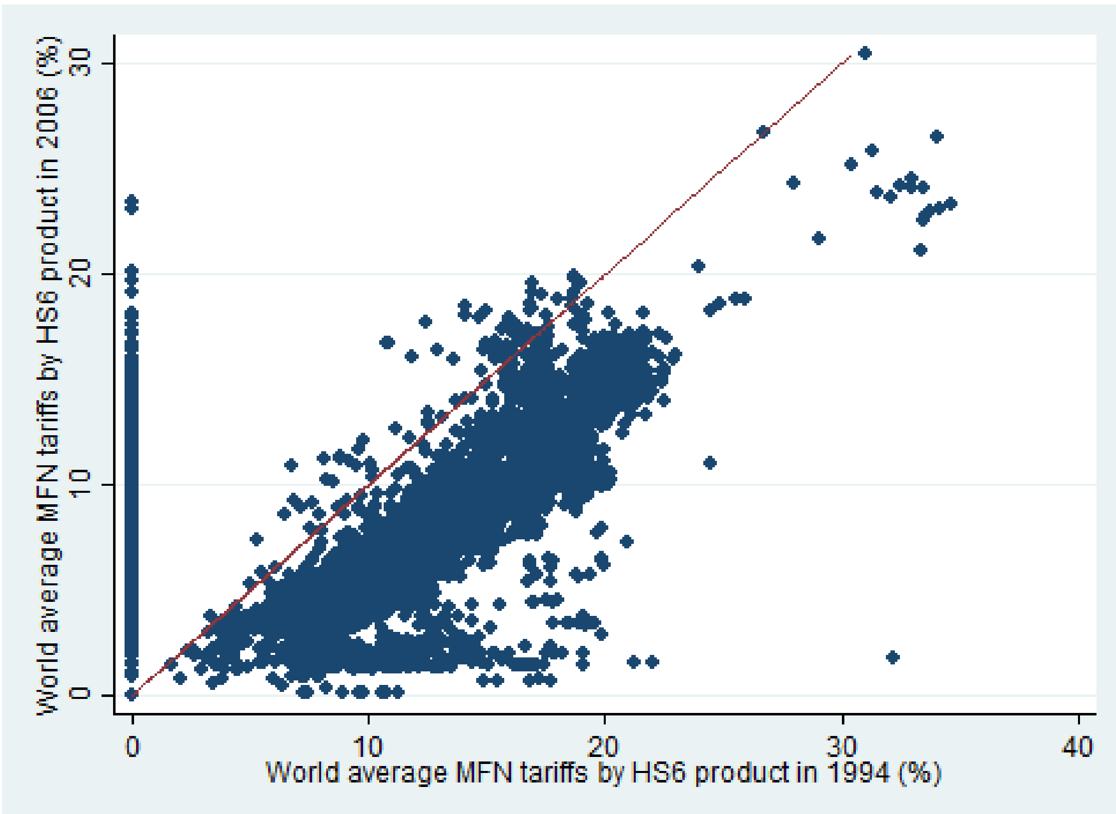

Figure 5: Unweighted world average MFN applied tariffs at the HS6 product level in 1994 and 2006 (%).

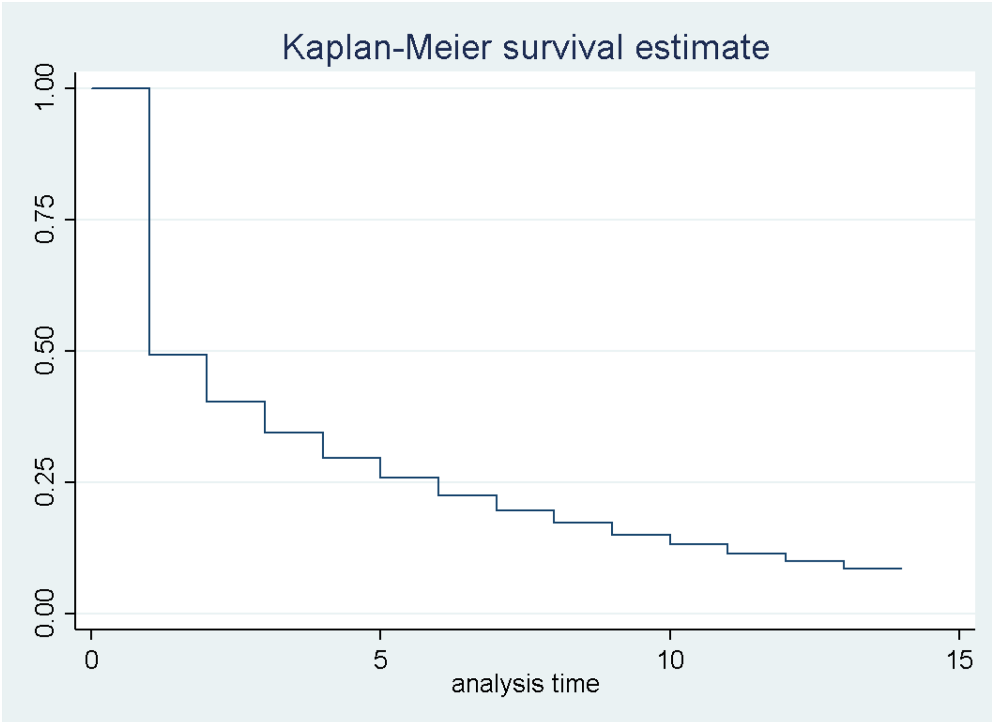

Figure 6: Survival function by firm-country-product exporting spell age.

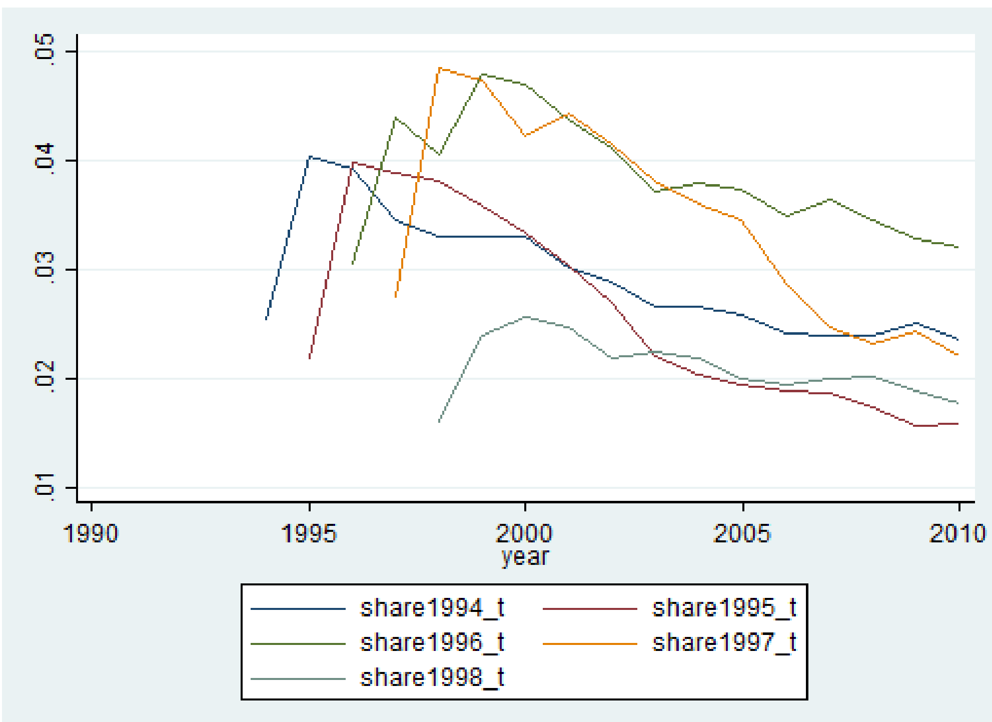

Figure 7: Contribution of exporters of various cohorts to total exports

varies across cohorts of active exporters. The median age 1 active exporter sells 1 product to 1 country, while the median age 5 active exporter sells 2 products to 2 countries. To make sure those descriptives reflect individual dynamics rather than selective exit, we compute the same statistic on the subsample of firms who survive at least 5 years. The median and average number of products and countries rise gradually in that subpopulation, too.

Table 3: Number of products and countries by exporting age among new active exporters (upper panel) and new active exporters that survive at least 5 years (lower panel)

All new exporters

	Number of products		*Number of countries*		*Number of product-country pairs*		
age	mean	median	mean	median	mean	median	N
1	1.907	1	1.518	1	2.722	1	324004
2	3.857	2	2.796	1	7.167	2	115820
3	4.325	2	3.168	1	8.472	2	91595
4	4.650	2	3.452	1	9.465	2	76099
5	4.915	2	3.641	2	10.305	3	64543

All new exporters reaching age 5 or higher

	Number of products		*Number of countries*		*Number of product-country pairs*		
age	mean	median	mean	median	mean	median	N
1	2.600	1	2.004	1	4.289	1	87665
2	4.546	2	3.293	1	8.860	2	58206
3	5.000	2	3.612	2	10.096	3	57261
4	5.212	2	3.827	2	10.821	3	58290
5	4.915	2	3.641	2	10.305	3	64543

Finally, Figure 8 describes the number of product-country pairs by exporting age in further detail. We break down product-country pairs in four categories: pairs involving initial products *and* initial countries (FMFP)[20]; pairs involving new products in initial countries (FMOP); pairs involving initial products in new countries (OMFP); and pairs involving new products in new countries (OMOP). Again, the left panel applies to the whole sample while the right panel applies to firms surviving at least 5 years.Figure 8 shows that the main margin of expansion initially is adding products in the initial destination(s). Entry in new markets with either current or new products takes more time. However, after five years adding new products in new markets becomes the most important margin of expansion.

3.3 Evidence of Learning Mechanisms

In this subsection we test Predictions 1-3. This extends results by ACCO to the product dimension, in addition to adding more disaggregated data.

[20] These FMFP pairs include but are not limited to the initial pairs. Some firms enter simultaneously in different destinations with different products. Conditional on surviving, those firms tend to sell the same products to the other initial destinations, effectively completing the matrix of product-country pairs.

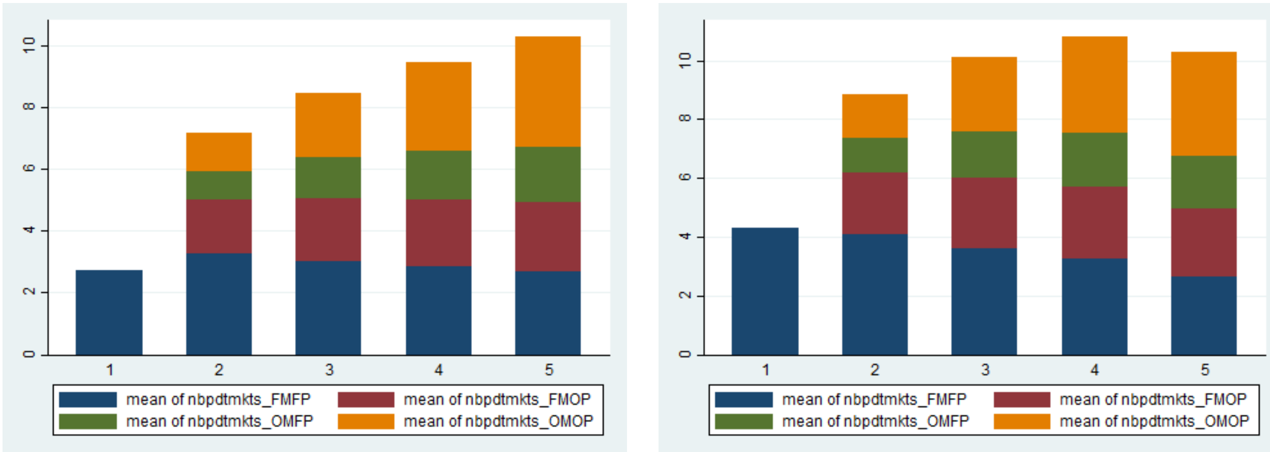

Figure 8: Number of product-countries by age: all exporters (left) and exporters surviving 5 years or more (right). FM: first market. FP: first product. OM: other market. OP: other product

3.3.1 Export growth regressions

Prediction 1 states that, conditional on survival, a firm's export growth is highest in its second year of exporting its first export product to its first destination. To test this prediction, we examine whether export growth is higher in the second year of an exporting spell, and even more so when that exporting spell involves the first product and the first country the firm exports to. More precisely, we estimate the following equation:

$$\begin{aligned}\Delta \log X_{ijpt} = \alpha_0 + \alpha_1 FY_{ijp,t-1} + \alpha_2 \left(FY_{ijp,t-1} \times FM_{ij}\right) + \alpha_3 FM_{ij} + \alpha_4 \left(FY_{ijp,t-1} \times FP_{ip}\right) \\ + \alpha_5 FP_{ip} + \alpha_6 \left(FM_{ij} \times FP_{ip}\right) + \alpha_7 \left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + u_{ijpt},\end{aligned} \tag{35}$$

where $\Delta \log X_{ijpt}$ is the growth rate of the value of exports between t and $t-1$ by firm i in product p and market j, $FY_{ijp,t-1}$ is a dummy indicating whether firm i exported product p to destination j in $t-1$ for the first time, FM_{ij} indicates whether j is the firm's first export market and FP_{ip} takes value 1 if p is firm i's first ever exported product. G_{jt} is a vector of gravity variables. $\{FE\}$ is a battery of fixed effects described below.

The sample excludes all firms exporting in 1993 in order to focus on new exporters.Note also that $\Delta \log X_{ijpt}$ is only defined for consecutive observations X_{ijpt} and X_{ijpt-1}, which further restricts the sample. All results are conditional on survival.

Prediction 1 suggests positive coefficients for the interaction terms, i.e. $\alpha_7 > 0$, $\alpha_2 > 0$ and $\alpha_4 > 0$. We also include FP_{ip}, FM_{ij} and $FY_{ijp,t-1}$ by themselves, because there could be other reasons that make growth distinct in the first product exported, the first export market of a firm, or in the firm's first periods of activity in a foreign market, respectively.[21] Of course, many other factors can

[21] Firstly the coefficient on $FY_{ijp,t-1}$ could be significant due to a 'partial year effect' that is unrelated to our prediction. Bernard et al. (2017) show that correcting for the overestimation of first year sales growth rates amongst surviving firms doubles the contribution of exporters' extensive (entry and exit) margins to total export growth. In addition, 'Partial-year effects reduce the number of products sold abroad in the first year of exporting and overstate the growth in number of exported products and their share in sales between years one and two.' Secondly we control for FM_{ij} and FP_{ip} in our analysis as there may be confounding factors that imply a consistently higher or lower intensive margin growth in firms' first markets.

affect a firm's export growth to a market, such as the general conditions of the destination country, its current economic situation, and the firm and its products' own distinguishing characteristics. To account for those factors, we include a wide range of fixed effects, denoted by $\{FE\}$ in (35), and in some specifications we add standard gravity equation covariates. The fixed effects include year, destination—or alternatively, year-destination— firm and product fixed effects.[22] Firm fixed effects control for all systematic differences across firms that do not change over time and affect export growth (firm-specific export growth trends). Destination fixed effects and gravity variables subsume export market characteristics. In these and all subsequent regressions, standard errors are clustered by firm.

Table 4: Conditional export growth rate regressions

VARIABLES	(1) OLS xg	(2) OLS xg	(3) firm FE xg	(4) firm FE xg	(5) firm c t FE xg	(6) firm c t FE xg	(7) p t FE xg
FYLY	0.318***	0.318***	0.377***	0.372***	0.348***	0.347***	0.327***
	(0.0172)	(0.0176)	(0.0195)	(0.0199)	(0.0193)	(0.0191)	(0.0176)
FYLYFM	-0.0166	-0.0131	-0.00628	-0.00546	-0.00793	-0.00867	-0.0140
	(0.0198)	(0.0200)	(0.0214)	(0.0217)	(0.0216)	(0.0213)	(0.0200)
FM	0.000282	-0.00590	0.0126	0.00178	-0.00647	-0.00594	0.00475
	(0.0109)	(0.0111)	(0.0125)	(0.0125)	(0.0121)	(0.0121)	(0.0108)
FYLYFP	-0.0429**	-0.0422**	-0.0404*	-0.0403*	-0.0478**	-0.0477**	-0.0450**
	(0.0186)	(0.0189)	(0.0208)	(0.0212)	(0.0211)	(0.0209)	(0.0188)
FP	0.0307***	0.0302***	0.0410***	0.0385***	0.0326**	0.0323**	0.0230***
	(0.00843)	(0.00839)	(0.0131)	(0.0134)	(0.0132)	(0.0131)	(0.00867)
FMFP	-0.0491***	-0.0495***	0.00187	0.000517	-0.0144	-0.0152	-0.0489***
	(0.0116)	(0.0117)	(0.0131)	(0.0131)	(0.0135)	(0.0134)	(0.0118)
FYLYFMFP	0.184***	0.182***	0.266***	0.263***	0.258***	0.256***	0.187***
	(0.0240)	(0.0243)	(0.0261)	(0.0265)	(0.0266)	(0.0262)	(0.0245)
lx						-1.01e-09	
						(6.33e-10)	
Observations	867,010	850,538	867,010	850,538	867,010	867,010	867,010
R-squared	0.0140	0.0144	0.0853	0.0863	0.0863	0.0867	0.0207
F	447.4	167.4	537.4	196.1	45.28	45.72	190.0

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Columns 1 and 2 of Table 4 report OLS estimates of (35), while Columns 3-6 present firm fixed effects estimates with a battery of country, product and time dummies. We find a consistently positive and significant coefficient for $FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}$, α_7. The growth rate of exports is between 18 and 26 percentage points higher in the first year of a firm's first spell, relative to the first year of other spells involving the same product or country. Going further, the coefficients for $FYLYFP$ and $FYLYFM$ show that early growth is not systematically higher in the first market in other products or in the first product in other markets. However we also test the hypothesis that $\alpha_1 + \alpha_2 + \alpha_4 + \alpha_7 > 0$, which finds support in all specifications. First-time exporters experience higher growth rates in their second year relative to more experienced exporters in a more advanced

[22]Results are likely to differ across industries. But since each firm in our sample belongs to a single sector, sector fixed effects would be perfectly collinear with, and therefore controlled for, by the firm fixed effects.

year of any exporting spell. This is consistent with our model, where the former growth rate is positive due to learning, while the latter growth rate should be zero.

3.3.2 Conditional Entry Regressions

Our model also predicts that conditional on surviving their first-ever export entry, firms are more likely to start immediately exporting the same product to another country or a different product to the same country (Prediction 2). We test this prediction by estimating the following linear probability model:

$$\begin{aligned} Entry_{ijpt} = {} & \beta_0 + \beta_1 FY_{i,t-1} + \beta_2 \left(FY_{i,t-1} \times FM_{ij}\right) + \beta_3 FM_{ij} + \beta_4 \left(FY_{i,t-1} \times FP_{ip}\right) \\ & + \beta_5 FP_{ip} + \beta_6 \left(FM_{ij} \times FP_{ip}\right) + \beta_7 \left(FY_{i,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + v_{ijpt}, \end{aligned} \tag{36}$$

where $Entry_{ijpt}$ is a binary variable that takes value one if firm i *enters* destination j with product p at time t, and zero otherwise. $FY_{i,t-1}$ equals one if firm i is in the second (consecutive) year of its export history. All other covariates are defined as above.

Prediction 2 applies to *conditional* entry, i.e. entry by exporters with successful prior entry. Testing that prediction requires a special sample. In Section we explained in detail the construction of $Entry_{ijpt}$ and the corresponding sample, in particular how the dataset is expanded to include $ijpt$ quadruples with no recorded trade flows. Furthermore, to deal with conditional entry we exclude firms exporting in the first year of our sample ('old' exporters) and firms exporting in a single year. We also exclude the country (countries) of the first entry from the country choice set.

Prediction 2 implies that we expect $\beta_2 > 0$ and $\beta_4 > 0$.[23] Table 5 reports the results of OLS and fixed-effects estimation of (36). Results are fairly consistent across all specifications. As expected, the coefficients of $FYLYFM$ and $FYLYFP$ are both positive and highly significant: entry rates are about 3 percentage points higher when a firm expands product scope in its first market, and 0.2 percentage points higher when it starts exporting its first product to a new destination.

3.3.3 Exit Regressions

A third prediction of our model is that exit from foreign markets is more likely among fledgling exporters than experienced exporters, everything else equal. Exit rates should be higher immediately after the first-ever export experience, relative to later years in the same product-country or the first year in other product-country exports spells (Prediction 3). This prediction applies to our whole sample, including exporters that were active in 1993. We test it by estimating the following equation:

$$\begin{aligned} Exit_{ijpt} = {} & \gamma_0 + \gamma_1 FY_{ijp,t-1} + \gamma_2 \left(FY_{ijp,t-1} \times FM_{ij}\right) + \gamma_3 FM_{ij} + \gamma_4 \left(FY_{ijp,t-1} \times FP_{ip}\right) \\ & + \gamma_5 FP_{ip} + \gamma_6 \left(FM_{ij} \times FP_{ip}\right) + \gamma_7 \left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + w_{ijpt}, \end{aligned} \tag{37}$$

In equation (37), Prediction 3 can be translated as $\gamma_7 > 0$. Table 6 displays our estimates. We use a simple linear probability model in columns (1), (2), (5), (6) and (7), while we use firm fixed

[23] Since our sample does not include postentry observations one might think that the interaction term $(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip})$ is always equal to zero. However, some firms may sell two products to two different markets in a first year, then sell both products to both markets in the second year. This admittedly rare event in our sample explains that the coefficient β_7 is well identified, although our theoretical framework does not allow us to predict its sign.

Table 5: Conditional entry regressions

VARIABLES	(1) OLS Entry	(2) OLS Entry	(3) firm FE Entry	(4) firm FE Entry	(5) firm c t FE Entry	(6) firm c t FE Entry	(7) p t FE Entry
FYLY	0.000331***	0.000550***	-0.000117***	0.000101***	-0.000438***	-0.000434***	0.000645***
	(3.82e-05)	(3.74e-05)	(3.64e-05)	(3.50e-05)	(5.46e-05)	(5.56e-05)	(5.74e-05)
FYLYFM	0.0357***	0.0354***	0.0354***	0.0351***	0.0352***	0.0352***	0.0356***
	(0.00117)	(0.00119)	(0.00122)	(0.00123)	(0.00122)	(0.00121)	(0.00118)
FM	0.0216***	0.0191***	0.0226***	0.0197***	0.0188***	0.0188***	0.0218***
	(0.000656)	(0.000590)	(0.000433)	(0.000429)	(0.000422)	(0.000424)	(0.000630)
FYLYFP	0.00216***	0.00215***	0.00209***	0.00210***	0.00208***	0.00208***	0.00204***
	(6.14e-05)	(6.22e-05)	(6.29e-05)	(6.39e-05)	(6.47e-05)	(6.51e-05)	(6.29e-05)
FP	0.000723***	0.000738***	0.00199***	0.00204***	0.00200***	0.00200***	0.000467***
	(3.40e-05)	(3.50e-05)	(4.34e-05)	(4.44e-05)	(4.37e-05)	(4.37e-05)	(3.45e-05)
FMFP	0.00502***	0.00470***	0.00473***	0.00436***	0.00439***	0.00439***	0.00496***
	(0.000899)	(0.000878)	(0.000756)	(0.000763)	(0.000755)	(0.000755)	(0.000879)
FYLYFMFP	-0.0298***	-0.0297***	-0.0302***	-0.0301***	-0.0302***	-0.0302***	-0.0298***
	(0.00139)	(0.00138)	(0.00138)	(0.00137)	(0.00137)	(0.00137)	(0.00139)
lx						0	
						(0)	
Observations	248,850,184	237,210,749	248,850,184	237,210,749	248,850,184	248,850,184	248,850,184
R-squared	0.00934	0.0122	0.0123	0.0152	0.0155	0.0155	0.00972
F	1273	.	2168	.	508.3	.	536.8

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

effects in columns (3) and (4). Specifications (5) and (6) add country and year dummies while specification (7) adds product and year dummies. In all but the firm fixed-effects specifications we find a positive and highly significant coefficient for $\gamma_7 > 0$. Depending on the specification, exit rates are found to be about 5 to 11 percentage points higher in the second year of the first export spell, relative to other years and other spells. This is to be compared with a 26.4% exit probability when all indicators are nil. The negative coefficients in Columns (3) and (4) indicate that our results are driven by single-observation firms, who are by construction excluded from the estimation of a firm fixed-effects model.

Finally, as an additional check we test the hypothesis that $\gamma_1 + \gamma_2 + \gamma_4 + \gamma_7 > 0$. We find support for this hypothesis across all seven specifications, suggesting that exit rates are unusually higher in the first year of export spells even for experienced exporters, which is consistent with a variant of our model with imperfect correlation.

Table 6: Exit regressions

VARIABLES	(1) OLS Exit	(2) OLS gravity Exit	(3) firm FE Exit	(4) firm FE gravity Exit	(5) c t FE Exit	(6) c t FE Exit	(7) p t FE Exit
FY	0.323***	0.289***	0.208***	0.193***	0.279***	0.278***	0.297***
	(0.00193)	(0.00198)	(0.00160)	(0.00157)	(0.00204)	(0.00203)	(0.00195)
FYFM	-0.0131***	-0.0116***	0.000776	0.00705***	-0.00178	-0.00223	-0.00998***
	(0.00274)	(0.00258)	(0.00223)	(0.00227)	(0.00259)	(0.00261)	(0.00258)
FM	-0.00150	-0.00834**	-0.0199***	-0.0220***	-0.0145***	-0.0122***	-0.00956***
	(0.00364)	(0.00346)	(0.00201)	(0.00204)	(0.00346)	(0.00323)	(0.00320)
FYFP	-0.0888***	-0.0813***	-0.0628***	-0.0651***	-0.0716***	-0.0714***	-0.0813***
	(0.00212)	(0.00207)	(0.00176)	(0.00174)	(0.00201)	(0.00201)	(0.00203)
FP	-0.0639***	-0.0844***	-0.0813***	-0.0915***	-0.0931***	-0.0934***	-0.0642***
	(0.00277)	(0.00254)	(0.00185)	(0.00179)	(0.00243)	(0.00241)	(0.00247)
FMFP	-0.0302***	-0.0264***	-0.0417***	-0.0395***	-0.0166***	-0.0159***	-0.0287***
	(0.00340)	(0.00324)	(0.00220)	(0.00226)	(0.00312)	(0.00309)	(0.00303)
FYFMFP	0.0611***	0.0566***	-0.0576***	-0.0588***	0.102***	0.101***	0.105***
	(0.00304)	(0.00296)	(0.00325)	(0.00330)	(0.00315)	(0.00317)	(0.00311)
lx						-6.15e-11***	
						(0)	
Observations	6,608,278	6,478,128	6,608,278	6,478,128	6,608,278	6,608,278	6,608,278
R-squared	0.117	0.137	0.262	0.272	0.189	0.190	0.182
N	6.608e+06	6.478e+06	6.608e+06	6.478e+06	6.608e+06	6.608e+06	6.608e+06
F	11827	.	8252	.	2109	.	5634
r2	0.117	0.137	0.262	0.272	0.189	0.190	0.182

Standard errors clustered by firm in parentheses.

3.4 Evidence of Trade Policy Spillovers

Section 2.4.2 showed that our model has strong predictions for the implications of trade policy on export dynamics in third countries: namely entry, exit and entry conditional on prior export success (Predictions 4-6). As a placebo test we further investigate trade policy effects on export growth in third countries, which according to our model should be nil (Prediction 7).

3.4.1 Impact on (Unconditional) Entry

We first test Prediction 4, which states that current entry in a country is correlated with contemporaneous reductions in rest-of-the-world (ROW) average tariffs.

We must test this prediction on a sample that includes firm-product-country-year observations which are never actually observed in the customs data. As with our estimation (36), we care not just about the timing of entry but also why firms choose the subset of countries we observe. We build an entry sample following the same steps as in Section 3.3.2, with one important difference: we now keep first entry observations in the sample. This is Prediction 2, which we tested then, focuses on entry *conditional on initial export success*. In contrast, Prediction 4, which we test now, states that positive trade policy spillovers are stronger for first-time entrants.

We estimate the following model:

$$\begin{aligned} Entry_{ijpt} = {} & \beta_1 FY_{it} + \beta_2 \left(FY_{it} \times FM_{ij}\right) + \beta_3 FM_{ij} + \beta_4 \left(FY_{it} \times FP_{ip}\right) \\ & + \beta_5 FP_{ip} + \beta_6 \left(FM_{ij} \times FP_{ip}\right) + \beta_7 \left(FY_{it} \times FM_{ij} \times FP_{ip}\right) + \\ & + \beta_8 \Delta \ln t_{-jpt} + \beta_9 \Delta \ln t_{-jpt} \times \left(FY_{it} \times FM_{ij} \times FP_{ip}\right) + G_{jt} + \{FE\} + v_{ijpt}, \end{aligned} \tag{38}$$

where $Entry_{ijpt}$ is defined as explained above, t_{jpt} is the tariff levied by country j on French exports of product p, Δt_{-jpt} represents the percentage change in the average ROW tariff between $t-1$ and t (see below) and G_{jt} are gravity control variables. Prediction 4 implies that $\beta_9 < 0$.

To measure t_{jpt} we use applied MFN tariffs at the HS6 product level from the UNCTAD-TRAINS database. We define two empirical counterparts to t_{-jpt}:

$$ROWt_{jpt} = \sum_{c \neq j} \frac{1}{N_c - 1} t_{cpt} \tag{39}$$

$$ROWtDist_{jpt} = \sum_{c \neq j} \frac{\frac{1}{dist_{cj}}}{\sum_{c \neq j} \frac{1}{dist_{cj}}} t_{cpt} \tag{40}$$

where $dist_{cj}$ is distance between countries c and j. The unweighted average $ROWt$ is chosen for simplicity. The average weighted by proximity to the destination country j ($ROWtDistj$) captures the idea that third-country effects operating through learning will matter more for countries geographically closer to country j. In an extended model allowing for imperfectly correlated export profitability across destinations, it would be natural to assume that profits are more correlated among destinations close to each other. Therefore upon learning in country j one would expect a greater option value of entering countries close to j, all else equal. We would then expect tariff cuts near j to have the strongest impact on entry in j for experimentation purposes.[24]

Results are reported in Tables 7 and 8. Each Table has the same structure. Columns (1) reports simple OLS estimates. Columns (2) and (3) report fixed-effects estimates, where an individual is a firm in Column (3) and a firm-year in Column (4). The specification in Column (3) also has year dummies. Columns (5) and (6) report estimates of regressions with product-year dummies and country-year dummies, respectively. The β_9 coefficient is negative in all specifications, as expected. A percentage point fall in (unweighted) average ROW tariffs for product p raises the entry probability of first-time entry with product p by 10pp, relative to later entry or entry by old exporters. The effect is about half as large when we weigh ROW tariffs by proximity to destination instead.

[24] As a robustness check we run similar regressions with a tariff average weighted by proximity to France, the home country. Results are shown in Appendix A.6.

Table 7: (Unconditional) Entry and Changes in Unweighted ROW Tariff Averages

VARIABLES	(1) OLS Entry	(2) i t FE Entry	(3) it FE Entry	(4) pt FE Entry	(5) ct FE Entry
FYFM	-0.0179***	-0.0180***	0.00504***	-0.0181***	-0.0183***
	(0.000410)	(0.000424)	(0.00179)	(0.000411)	(0.000408)
FYFP	0.000839***	0.000674***	-0.00769***	0.000468***	0.000561***
	(3.37e-05)	(4.13e-05)	(0.000325)	(3.55e-05)	(3.41e-05)
FYFMFP	0.531***	0.530***	0.539***	0.532***	0.530***
	(0.00775)	(0.00777)	(0.00780)	(0.00766)	(0.00775)
FYFMDROWt_cpt	0.000799**	0.000726	0.00102	0.00103***	0.000414
	(0.000363)	(0.000718)	(0.00453)	(0.000384)	(0.000376)
FYFPDROWt_cpt	-0.000172***	-0.000185**	-0.000657	-3.23e-05	-0.000136**
	(6.15e-05)	(8.59e-05)	(0.000906)	(7.44e-05)	(5.94e-05)
FYFMFPDROWt_cpt	-0.0994***	-0.0997***	-0.0977***	-0.0994***	-0.0983***
	(0.0225)	(0.0224)	(0.0219)	(0.0222)	(0.0225)
LDROWt_cpt	0.000522***	0.000164***	0.000266***	-0.000808***	0.000362***
	(7.31e-05)	(6.19e-05)	(7.98e-05)	(0.000176)	(6.17e-05)
Observations	165,091,585	165,091,585	165,091,585	165,091,585	166,830,091
R-squared	0.161	0.165	0.183	0.163	0.162
N	1.650e+08	1.650e+08	1.650e+08	1.650e+08	1.670e+08
F	.	.	.	.	920.1
r2	0.161	0.165	0.183	0.163	0.162

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: (Unconditional) Entry and Changes in ROW Tariff Averages Weighted by Distance to Destination

	(1)	(2)	(3)	(4)	(5)
		i			
	OLS	t FE	it FE	pt FE	ct FE
VARIABLES	Entry	Entry	Entry	Entry	Entry
FYFM	-0.0180***	-0.0181***	0.00498**	-0.0182***	-0.0185***
	(0.000411)	(0.000440)	(0.00209)	(0.000413)	(0.000412)
FYFP	0.000807***	0.000637***	-0.00769***	0.000437***	0.000532***
	(3.38e-05)	(4.17e-05)	(0.000335)	(3.58e-05)	(3.45e-05)
FYFMFP	0.537***	0.535***	0.544***	0.537***	0.536***
	(0.00799)	(0.00802)	(0.00818)	(0.00789)	(0.00801)
DROWt_distc_cpt	-0.000418***	-0.000175***	-0.000177***	-0.000417***	0.000363***
	(4.84e-05)	(6.12e-05)	(6.54e-05)	(7.98e-05)	(6.86e-05)
FYFMDROWt_distc_cpt	0.000850***	0.000682	-0.00104	0.00137***	0.00187***
	(0.000166)	(0.000689)	(0.00459)	(0.000198)	(0.000196)
FYFPDROWt_distc_cpt	0.000460***	0.000581***	0.000618	0.000485***	0.000458***
	(4.74e-05)	(6.45e-05)	(0.000511)	(4.89e-05)	(4.49e-05)
FYFMFPDROWt_distc_cpt	-0.0452**	-0.0458**	-0.0450**	-0.0455**	-0.0446**
	(0.0185)	(0.0185)	(0.0186)	(0.0184)	(0.0185)
Observations	165,091,585	165,091,585	165,091,585	165,091,585	166,830,091
R-squared	0.161	0.165	0.183	0.162	0.162
N	1.650e+08	1.650e+08	1.650e+08	1.650e+08	1.670e+08
F	.	.	.	.	915.7
r2	0.161	0.165	0.183	0.162	0.162

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.4.2 Impact on Exit

We estimate the following model:

$$\begin{aligned} Exit_{ijpt} =& \gamma_1 FY_{ijpt} + \gamma_2 \left(FY_{ijpt} \times FM_{ij}\right) + \gamma_3 FM_{ij} + \gamma_4 \left(FY_{ijpt} \times FP_{ip}\right) \\ &+ \gamma_5 FP_{ip} + \gamma_6 \left(FM_{ij} \times FP_{ip}\right) + \gamma_7 \left(FY_{ijpt} \times FM_{ij} \times FP_{ip}\right) \\ &+ \gamma_8 \Delta \ln t_{jpt} + \gamma_9 \Delta \ln t_{-jpt} + \gamma_{10} \left(\Delta \ln t_{-jpt} \times FY_{ijpt} \times FM_{ij} \times FP_{ip}\right) \\ &+ G_{jt} + \{FE\} + w_{ijpt} \end{aligned} \tag{41}$$

where $Exit_{ijpt}$ is defined as in (37), t_{jpt} is the applied MFN tariff levied by country j on French exports of product p, Δt_{-jpt} represents the percentage change in the average ROW tariff between $t-1$ and t (see below) and G_{jt} are gravity control variables.

We expect $\gamma_{10} < 0$. Results are shown in Tables 9-10. All three tables have the same structure. In Column 1 we estimate a basic linear probability model. In Columns 2 and 3 we control for idiosyncratic shocks by introducing firm and year fixed effects (Column 2) and firm-year fixed effects (Column 3). In Column 4 we control for unobserved heterogeneity across products with product-year fixed effects. In Column 5 we omit gravity controls but add country-year dummies to capture any destination country shocks, such as exchange rate movements, business cycles, etc. Finally in Column 6 we add firm and product dummies to that specification (controlling for firm-product unobserved heterogeneity is unfortunately not computationally feasible). Standard errors are clustered at the firm level.

We find partial support for our hypothesis. In 9 of our 12 regressions we find a negative sign for γ_{10}, but the coefficient is only statistically significant in half of the cases. Results depend markedly on which ROW average tariff is used. As expected specifications with firm fixed effects, which rule out single-observation firms, are the least supportive of our hypothesis.

3.4.3 Impact on Conditional Entry

We now test the prediction on conditional entry. Formally we estimate an extension of (36) that includes lagged changes in ROW tariffs.[25]

$$\begin{aligned} Entry_{ijpt} =& \beta_1 FY_{i,t-1} + \beta_2 \left(FY_{i,t-1} \times FM_{ij}\right) + \beta_3 FM_{ij} + \beta_4 \left(FY_{i,t-1} \times FP_{ip}\right) \\ &+ \beta_5 FP_{ip} + \beta_6 \left(FM_{ij} \times FP_{ip}\right) + \beta_7 \left(FY_{i,t-1} \times FM_{ij} \times FP_{ip}\right) \\ &+ \beta_8 \Delta \ln t_{-jpt-1} + \beta_9 \left(\Delta \ln t_{-jpt-1} \times FY_{i,t-1} \times FM_{ij}\right) + \beta_{10} \left(\Delta \ln t_{-jpt-1} \times FY_{i,t-1} \times FP_{ip}\right) \\ &+ G_{jt} + \{FE\} + v_{ijpt}, \end{aligned} \tag{42}$$

Prediction 5 implies $\beta_{10} < 0$, namely that a fall in the tariff of product p increases the likelihood of successful first-time exporters of product p entering elsewhere with that product. Notice that we do not have a clear prediction on β_9, the coefficient for $(\Delta \ln t_{-jpt-1} \times FY_{ijp,t-1} \times FM_{ij})$. That coefficient captures the additional likelihood that successful first-time exporters enter their first market with a second product p' as a result of a fall in the tariff of p' elsewhere. In our model export profitability is perfectly correlated across products. Once the firm has sold product p it

[25] As in model (36) the $(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip})$ coefficient is identified thanks to a very special set of exporters. These firms first export different products to several countries, then introduce some of the original products in those of the original countries where the products haven't yet been exported. Our theory does not have predictions for those firms, so we do not interact this term with tariff changes in our regressions. Again, only a very small fraction of firms in our sample follows this sort of exporting pattern.

Table 9: Exit and Changes in Unweighted ROW Tariff Averages

	(1)	(2)	(3)	(4)	(5)	(6)
						ct
		i				i
	OLS	t FE	it FE	pt FE	ct FE	p FE
VARIABLES	Exit	Exit	Exit	Exit	Exit	Exit
FYFM	0.00239	0.0306***	0.00745***	0.00342	-0.00356	0.0216***
	(0.00293)	(0.00262)	(0.00262)	(0.00276)	(0.00287)	(0.00252)
FYFP	-0.0613***	-0.0400***	-0.0542***	-0.0566***	-0.0531***	-0.0304***
	(0.00242)	(0.00213)	(0.00218)	(0.00233)	(0.00239)	(0.00210)
FYFMFP	0.0713***	-0.0530***	0.0501***	0.0641***	0.0639***	-0.0586***
	(0.00400)	(0.00412)	(0.00496)	(0.00382)	(0.00395)	(0.00387)
DROWt_cpt	0.00952***	-0.0313***	-0.0364***	-0.0228***	-0.0325***	-0.0273***
	(0.00235)	(0.00201)	(0.00266)	(0.00390)	(0.00230)	(0.00196)
FYFMFPDROWt_cpt	-0.00778	-0.00713	0.0303***	0.0207**	0.0162*	-0.00447
	(0.00836)	(0.00638)	(0.00788)	(0.00822)	(0.00840)	(0.00634)
Observations	4,002,873	4,002,873	4,002,873	4,002,873	4,014,606	4,014,606
R-squared	0.112	0.305	0.465	0.200	0.169	0.321
N	4.003e+06	4.003e+06	4.003e+06	4.003e+06	4.015e+06	4.015e+06
F	.	.	.	.	2263	.
r2	0.112	0.305	0.465	0.200	0.169	0.321

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Exit and Changes in ROW Tariff Averages Weighted by Distance to Destination

	(1)	(2)	(3)	(4)	(5)	(6)
						ct
		i				i
	OLS	t FE	it FE	pt FE	ct FE	p FE
VARIABLES	Exit	Exit	Exit	Exit	Exit	Exit
FYFM	0.00257	0.0304***	0.00710***	0.00331	-0.00392	0.0214***
	(0.00292)	(0.00262)	(0.00262)	(0.00276)	(0.00287)	(0.00252)
FYFP	-0.0639***	-0.0398***	-0.0540***	-0.0566***	-0.0528***	-0.0302***
	(0.00242)	(0.00213)	(0.00218)	(0.00233)	(0.00239)	(0.00210)
FYFMFP	0.0796***	-0.0524***	0.0519***	0.0667***	0.0669***	-0.0580***
	(0.00405)	(0.00424)	(0.00513)	(0.00377)	(0.00391)	(0.00396)
DROWt_distc_cpt	0.0122***	-0.0344***	-0.0374***	-0.0296***	-0.0311***	-0.0323***
	(0.00214)	(0.00215)	(0.00291)	(0.00360)	(0.00282)	(0.00229)
FYFMFPDROWt_distc_cpt	-0.0617***	-0.00395	-0.0231***	-0.0311***	-0.0328***	-0.00459
	(0.00951)	(0.00662)	(0.00698)	(0.00890)	(0.00917)	(0.00639)
Observations	4,002,873	4,002,873	4,002,873	4,002,873	4,014,606	4,014,606
R-squared	0.118	0.305	0.465	0.200	0.169	0.321
N	4.003e+06	4.003e+06	4.003e+06	4.003e+06	4.015e+06	4.015e+06
F	.	.	.	.	2272	.
r2	0.118	0.305	0.465	0.200	0.169	0.321

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

learns its profitability in exporting p' in its first destination and elsewhere. Its willingness to add product p' to the first market (captured by $FY_{ijp,t-1} \times FM_{ij} = 1$) should not depend on ROW tariffs on product p. In reality, profitability might be imperfectly correlated across products. If so we would expect $\beta_9 < 0$ because firms still learn from adding products to the first destination about their profitability for these new products elsewhere.

Estimation results shown in Tables 11-12 consistently support our prediction. Each column reports results from the same specification as in Tables 9-10 Firms exporting in $t-1$ for the first time are more likely to enter in t with the same product whenever ROW tariffs for that product have fallen between $t-2$ and $t-1$. Coefficients have the expected sign in all specifications, irrespective of how we aggregate ROW tariffs, and are statistically significant in all specifications (at the 1% level in 8 of the 12 cases).

Table 11: Conditional Entry and Changes in Unweighted ROW Tariff Averages

	(1)	(2)	(3)	(4)	(5)
		i			
	OLS	t FE	it FE	pt FE	ct FE
VARIABLES	Entry	Entry	Entry	Entry	Entry
FYLYFM	0.0373***	0.0369***	0.0424***	0.0377***	0.0370***
	(0.00125)	(0.00122)	(0.00130)	(0.00124)	(0.00125)
FYLYFP	0.00398***	0.00433***	0.00351***	0.00363***	0.00386***
	(0.000175)	(0.000163)	(0.000202)	(0.000179)	(0.000177)
FYLYFMFP	0.0168***	0.0162***	0.0176***	0.0168***	0.0171***
	(0.00210)	(0.00203)	(0.00205)	(0.00210)	(0.00213)
LDROWt_cpt	0.000344***	0.000255**	0.000173	-0.00244***	0.000438***
	(0.000108)	(0.000118)	(0.000138)	(0.000512)	(0.000124)
FYLYFMLDROWt_cpt	-0.00669**	-0.00618*	-0.00762**	-0.00680**	-0.00676**
	(0.00338)	(0.00324)	(0.00307)	(0.00338)	(0.00338)
FYLYFPLDROWt_cpt	-0.00157**	-0.00135*	-0.00279***	-0.00212***	-0.00189**
	(0.000735)	(0.000737)	(0.000975)	(0.000732)	(0.000738)
Observations	76,060,824	76,060,824	76,060,824	76,060,824	77,181,223
R-squared	0.013	0.020	0.030	0.015	0.014
N	7.610e+07	7.610e+07	7.610e+07	7.610e+07	7.720e+07
F	.	.	.	.	326.4
r2	0.0129	0.0199	0.0299	0.0154	0.0143

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3.4.4 Impact on Growth (placebo test)

Our predictions on tariff spillovers rely entirely on the extensive margin: firm entry and exit, adding or dropping products, entering or exiting destinations. Our theory predicts that tariff cuts have no impact on growth in third countries, only on the probability to enter.[26]

We can therefore run a placebo test by introducing third country tariffs in the estimating model

[26] Admittedly if we relaxed the assumptions of constant returns technologies and segmented markets third country tariffs could stimulate individual growth, but they would also create a composition effect going in the opposite direction. For that reason we consider that prediction to be fairly robust.

Table 12: Conditional Entry and Changes in ROW Tariff Averages Weighted by Distance to Destination

VARIABLES	(1) OLS Entry	(2) i t FE Entry	(3) it FE Entry	(4) pt FE Entry	(5) ct FE Entry
FYLYFM	0.0371***	0.0366***	0.0420***	0.0376***	0.0369***
	(0.00125)	(0.00123)	(0.00132)	(0.00125)	(0.00126)
FYLYFP	0.00419***	0.00452***	0.00377***	0.00388***	0.00412***
	(0.000181)	(0.000167)	(0.000208)	(0.000185)	(0.000183)
FYLYFMFP	0.0167***	0.0161***	0.0175***	0.0166***	0.0169***
	(0.00210)	(0.00203)	(0.00205)	(0.00210)	(0.00213)
LDROWt_distc_cpt	-4.87e-05	0.000164*	2.66e-05	-0.000424***	0.00110***
	(7.02e-05)	(9.73e-05)	(0.000105)	(0.000129)	(0.000119)
FYLYFMLDROWt_distc_cpt	0.00537	0.00583*	0.00725**	0.00435	0.00411
	(0.00346)	(0.00330)	(0.00347)	(0.00343)	(0.00348)
FYLYFPLDROWt_distc_cpt	-0.00260***	-0.00255***	-0.00300***	-0.00297***	-0.00301***
	(0.000538)	(0.000531)	(0.000675)	(0.000545)	(0.000547)
Observations	76,060,824	76,060,824	76,060,824	76,060,824	77,181,223
R-squared	0.013	0.020	0.030	0.015	0.014
N	7.610e+07	7.610e+07	7.610e+07	7.610e+07	7.720e+07
F	.	.	.	.	336.5
r2	0.0129	0.0199	0.0299	0.0154	0.0144

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(35). More precisely we estimate

$$\begin{aligned}\Delta \log X_{ijpt} &= \alpha_1 FY_{ijp,t-1} + \alpha_2 \left(FY_{ijp,t-1} \times FM_{ij}\right) + \alpha_3 FM_{ij} + \alpha_4 \left(FY_{ijp,t-1} \times FP_{ip}\right) \\ &+ \alpha_5 FP_{ip} + \alpha_6 \left(FM_{ij} \times FP_{ip}\right) + \alpha_7 \left(FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) \\ &+ \alpha_8 \Delta \ln t_{-jpt-1} + \alpha_9 \left(\Delta \ln t_{-jpt-1} \times FY_{ijp,t-1} \times FM_{ij} \times FP_{ip}\right) \\ &+ G_{jt} + \{FE\} + u_{ijpt}, \end{aligned} \tag{43}$$

Growth between $t-1$ and t is regressed on tariff changes between $t-2$ and $t-1$, as any firm's reaction to new tariffs would occur at $t-1$ or later.

According to our model changes in ROW tariffs affect the pool of firms who enter j with product p at time t, but does affects neither their probability of survival nor their optimal quantity choices (and therefore their growth rates) in their first destination. As a result we predict $\alpha_9 = 0$.

Table 13: Export Growth and Changes in Unweighted ROW Tariff Averages

	(1)	(2)	(3)	(4)	(5)	(6)
		i				
	OLS	t FE	it FE	pt FE	ct FE	ct FE
VARIABLES	xg	xg	xg	xg	xg	xg
FYLYFM	0.0234	0.0167	0.0440	0.0208	0.00164	-0.00362
	(0.0272)	(0.0301)	(0.0295)	(0.0262)	(0.0273)	(0.0304)
FYLYFP	-0.0363	-0.0414	-0.00662	-0.0320	-0.0276	-0.0388
	(0.0248)	(0.0281)	(0.0249)	(0.0231)	(0.0242)	(0.0277)
FYLYFMFP	0.163***	0.240***	0.0123	0.150***	0.169***	0.241***
	(0.0337)	(0.0374)	(0.0423)	(0.0330)	(0.0340)	(0.0377)
LDROWt_cpt	0.0159	-0.000540	0.0208	-2.034	-0.00328	-0.00370
	(0.0245)	(0.0267)	(0.0636)	(1.331)	(0.0255)	(0.0268)
FYLYFMFPLDROWt_cpt	0.0554	0.0333	-0.117	0.0445	0.0415	0.0248
	(0.0785)	(0.0955)	(0.122)	(0.0896)	(0.0811)	(0.0945)
Observations	501,369	501,369	501,369	501,369	502,732	502,732
R-squared	0.016	0.094	0.305	0.100	0.018	0.103
N	501369	501369	501369	501369	502732	502732
F	91.14	76.94	41.26	82.86	154.3	.
r2	0.0159	0.0937	0.305	0.0995	0.0179	0.103

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results are shown in Tables 13-14. We use the same battery of fixed effects as with exit and conditional entry regressions. As previously we find $\alpha_7 > 0$, meaning exports are systematically higher in the first year of exporting the first product to the first market, relative to the first years of exporting subsequent products to subsequent markets. However, that additional growth is systematically unaffected by ROW tariff changes, i.e. we cannot reject $\alpha_9 = 0$. In addition, we cannot reject $\alpha_8 = 0$: trade policy spillovers do not appear to affect the growth rate of exports to third countries.

3.5 Discussion

We have found that a reduction in tariffs in a country has a statistically significant impact on the export dynamics of a non-trading partner country, through the product and destination extensive

Table 14: Export Growth and Changes in ROW Tariff Averages Weighted by Distance to Destination

	(1)	(2)	(3)	(4)	(5)	(6)
		i				
	OLS	t FE	it FE	pt FE	ct FE	ct FE
VARIABLES	xg	xg	xg	xg	xg	xg
FYLYFM	0.0230	0.0169	0.0440	0.0210	0.00177	-0.00347
	(0.0272)	(0.0300)	(0.0295)	(0.0262)	(0.0273)	(0.0304)
FYLYFP	-0.0362	-0.0413	-0.00667	-0.0319	-0.0275	-0.0388
	(0.0248)	(0.0281)	(0.0249)	(0.0231)	(0.0242)	(0.0277)
FYLYFMFP	0.161***	0.236***	0.0154	0.147***	0.166***	0.238***
	(0.0333)	(0.0373)	(0.0419)	(0.0322)	(0.0335)	(0.0376)
LDROWt_distc_cpt	0.0262**	0.0340*	0.0545	0.0721*	0.00212	0.00226
	(0.0124)	(0.0204)	(0.0353)	(0.0370)	(0.0212)	(0.0224)
FYLYFMFPLDROWt_distc_cpt	0.0146	0.0288	-0.00373	0.0292	0.0135	0.0296
	(0.0406)	(0.0520)	(0.0681)	(0.0496)	(0.0491)	(0.0519)
Observations	501,369	501,369	501,369	501,369	502,732	502,732
R-squared	0.016	0.094	0.305	0.100	0.018	0.103
N	501369	501369	501369	501369	502732	502732
F	92.64	76.90	41.30	83.90	156.8	.
r2	0.0159	0.0937	0.305	0.0995	0.0179	0.103

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

margins. Where neoclassical trade models would predict trade diversion, we have found instead increased product and market entry in third countries that is more pronounced among first-time exporters and new exporters immediately after a first successful entry. New exporters appear also more likely to exit from non-trading partner countries right after entry, following a reduction in tariffs elsewhere, although the evidence is less robust. The effect seems driven by firms with a single product-country-year spell and in destinations near the liberalizing country. Finally, we have found no evidence of any change in the growth rate of exports to third countries that would be specific to new exporters. Taken together, these findings paint a picture that is consistent with learning and self-discovery among new exporters. Firms are more likely to enter and exit their first market (product-country) immediately upon a tariff cut in a third country, relative to other firms or other spells by the same firm.

The results in Tables 13-14 go against explanations that would involve both intensive and extensive margins of export growth. One may think of Global Value Chains (GVCs) and intermediate trade more generally. French exporters involved in GVCs are likely to increase exports at both margins in reaction to tariff changes in third countries, whether upstream in the GVC (passing through cheaper input prices) or downstream (adjusting supply to increased downstream demand). To the extent that such GVC linkages operate within the same HS6 product category, they would imply positive trade spillovers on export growth, which we do not find. Another mechanism would be economies of scale in R&D. Evidence suggests that exporters upgrade their products and process prior to exporting Tariff cuts in yet unentered third countries may spur innovation in preparation to future exports, which would also increase entry and growth in non-liberalizing countries. Again, the findings in 13-14 go against this type of explanation.

Results in Tables 9-10 go against alternative explanations going through the extensive margin that do not rely on learning. This includes any trade model where unilateral trade liberalization in a foreign country makes the domestic country a relatively better export base, because the resulting entry implies greater export entry in third markets.[27] However, such models generally do not explain exit and in particular do not predict exit rates that decrease with export tenure in third countries. Because exit results are less clear-cut we cannot rule out such general entry effects, but believe we have uncovered a complementary mechanism to explain positive trade policy spillovers.

4 Conclusions

In this paper we developed a model of export dynamics under uncertainty with multiproduct firms. Exporters learn from their initial export experiences and gradually adjust their sales, number of products and destination countries. The model captured potential learning about the profitability of currently exported products in new markets as well as the profitability of new products in current export destinations. Such a model rationalizes observed sequential patterns of exporting, whereby firms gradually expand in the product or country dimension, or both. More precisely, we predict that export growth, entry rates and exit rates are highest right after a first export experience.

Using disaggregated data on French exporters we find empirical support for most of our predictions of gradual expansion. We find that expansion of a firm's export product range in existing destinations is more likely than expansion of existing products in new countries. within a destination country across different products.

Our model also implies positive trade policy spillovers that go against traditional trade diversion effects. Bilateral trade liberalization will lead to entry in 3rd markets either right before or right after entry in the liberalizing country. We show that tariff reductions after the Uruguay Round led to entry in unaffected countries or products. This finding has important implications for our understanding of trade agreements and their design.

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[27] This is seen most clearly in trade models with an outside sector, such as the Melitz and Ottaviano (2008) model. In trade models with endogenous factor prices such as Melitz (2003) rising domestic factor prices dampen the incentive to enter, but the third country result remains if that dampening effect is not too strong.

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A Appendices

A.1 Proof of Proposition 1

We refer to Figure 1 and start from the south-west corner:

(a) Starting for low fixed entry costs F and for a sufficiently small fixed cost to expand product scope f: simultaneous multiproduct entry is optimal if $\Pi^{(ii)}_{(1,1,1,1)} > \Pi^{(iii)}_{(1,1,1,0)}$ and $\Pi^{(ii)}_{(1,1,1,1)} \geq 0$. Conversely, partially sequential multiproduct entry is optimal if $\Pi^{(iii)}_{(1,1,1,0)} \geq \Pi^{(ii)}_{(1,1,1,1)}$ and $\Pi^{(iii)}_{(1,1,1,0)} \geq 0$. Using (21) and (22), we can rewrite these conditions as

$$\Pi^{(ii)}_{(1,1,1,1)} = \Pi^{(iii)}_{(1,1,1,0)} + \Psi_b(\tau^B) - W_b(\tau^B; f) - f.$$

Simultaneous multiproduct entry is optimal if $\Psi_b(\tau^B) - W_b(\tau^B; f) - f > 0$, i.e. if the net profit to expand product scope in market B at $t = 1$ is larger than the option to wait and uncover the firm's profitability and expand product scope in $t = 2$. Rewriting the inequality as $\Psi_b(\tau^B) > W_b(\tau^B; f)+f$ and noting that the left-hand side does not depend on f while the right-hand side is increasing in f,([28]) it follows that there must be a unique fixed cost f^{Mu} that equates the net profits of the two entry strategies:

$$\Psi_b(\tau^B) = W_b(\tau^B; f^{Mu}) + f^{Mu}. \tag{44}$$

Thus, simultaneous multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1$) is optimal for a sufficiently small fixed cost to expand product scope in market B at $t = 1$ if

$$e^j_{v1}(\tau^B) = 1, \forall(j, v) \Leftrightarrow f < f^{Mu}(\tau^B), \tag{45}$$

Therefore, partially sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0$) is optimal if

$$e^j_{a1}(\tau^B) = 1, j = A, B; e^A_{b1}(\tau^B) = 1 \Leftrightarrow f^{Mu}(\tau^B) \leq f \leq \Psi_a(\tau^A)+\Psi_a(\tau^B)+\Psi_b(\tau^A)+W_b(\tau^B; f)-2F. \tag{46}$$

where the second inequality is the condition for the net profit of the simultaneous market and sequential product entry strategy to be non-negative, i.e. $\Pi^{(\text{iii})}_{(1,1,1,0)} \geq 0$.

(b) For low fixed entry costs F, as the fixed cost to expand product scope f increases, we move towards the north-west corner of Figure 1. There, the firm compares the net profit of Partially sequential multiproduct entry, $\Pi^{(\text{iii})}_{(1,1,1,0)}$, to the net profit of simultaneous monoproduct entry ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0$), $\Pi^{(\text{iv})}_{(1,0,1,0)}$, given by (23). Partially sequential multiproduct entry is then optimal if $\Pi^{(\text{iii})}_{(1,1,1,0)} > \Pi^{(\text{iv})}_{(1,0,1,0)}$ and $\Pi^{(\text{iii})}_{(1,1,1,0)} \geq 0$. Conversely, simultaneous multiproduct entry is optimal if $\Pi^{(\text{iv})}_{(1,0,1,0)} \geq \Pi^{(\text{iii})}_{(1,1,1,0)}$ and $\Pi^{(\text{iv})}_{(1,0,1,0)} \geq 0$.

Using (22) and (23), we can rewrite these conditions as

$$\Pi^{(\text{iii})}_{(1,1,1,0)} = \Pi^{(\text{iv})}_{(1,0,1,0)} + \Psi_b(\tau^A) - W_b(\tau^A; f) - f.$$

Partially sequential multiproduct entry is optimal if $\Psi_b(\tau^A) - W_b(\tau^A; f) - f > 0$, i.e. if the net profit to expand product scope in market A at $t = 1$ is larger than the option to wait and uncover the firm's profitability and expand product scope in $t = 2$. Rewriting the inequality as $\Psi_b(\tau^A) > W_b(\tau^A; f) + f$ and noting that the left-hand side does not depend on f while the right-hand side is increasing in f, it follows that there must be a unique fixed cost f^{Mo} that equates the net profits of the two entry strategies:

$$\Psi_b(\tau^A) = W_b(\tau^A; f^{Mo}) + f^{Mo}. \tag{47}$$

Thus, Partially sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0$) is optimal for a sufficiently small fixed cost to expand product scope in market A in $t = 1$ if

$$e^j_{a1}(\tau^B) = 1, j = A, B; e^A_{b1}(\tau^B) = 1 \Leftrightarrow f < f^{Mo}(\tau^A). \tag{48}$$

Therefore, Simultaneous monoproduct entry ($e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0$) is optimal if

$$e^j_{a1}(\tau^A) = 1, j = A, B \Leftrightarrow f^{Mo}(\tau^A) \leq f \leq \Psi_a(\tau^A) + \Psi_a(\tau^B) + \Psi_b(\tau^A) + W_b(\tau^B; f) - 2F. \tag{49}$$

[28]Defining the right-hand side of the inequality $W_b(\tau^B; f) + f \equiv H_b(\tau^B; f)$, it trivially follows from Leibinz's rule that $\frac{\partial}{\partial f} H_b(\tau^B; f) = G(2f^{1/2} + \tau^B + c) > 0$, where $G(.)$ is the profitability probability distribution expressed in terms of the core product a.

where the second inequality is the condition for the net profit of the Simultaneous monoproduct entry strategy to be non-negative, i.e. $\Pi^{(\text{iv})}_{(1,0,1,0)} \geq 0$.

Comparing conditions (44) and (47), we can further establish that

$$f^{Mu}(\tau^B) \leq f^{Mo}(\tau^A), \forall \tau \tag{50}$$

from noting that $W_b(\tau^B; f^{Mu}) + f^{Mu} = \Psi_b(\tau^B) \leq \Psi_b(\tau^A) = W_b(\tau^A; f^{Mo}) + f^{Mo}$ since $\tau^A \leq \tau^B$, and that $W_b(\tau; f) + f \equiv H_b(\tau, f)$ is increasing in f. Condition (50) effectively means that only for a sufficiently high fixed cost of expanding the product scope within destinations, $f \in (f^{Mo}(\tau^A), +\infty)$, the firm will prefer to enter both markets with its core-product only ('monoproduct') rather than entering both destinations with both products (multiproduct). For lower fixed costs to expand product scope, the firm will enter market A with both products and market B only with its core product a if $f \in (f^{Mu}(\tau^B), f^{Mo}(\tau^A)]$, while entering both markets with both products when $f \in [0, f^{Mu}(\tau^B)]$.

(c) For high fixed costs to expand product scope $f \in (f^{Mo}(\tau^A), +\infty)$, as the fixed entry cost F increases, we move from the north-west and towards the north-east corner of Figure 1. Due to the high fixed cost to expand product scope, the firm only considers entry with the core product, and effectively we are back to ACCO. There, the firm compares the net profit of Simultaneous monoproduct entry, $\Pi^{(\text{iv})}_{(1,0,1,0)}$, to the net profit of Sequential monoproduct entry $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0)$, $\Pi^{(\text{vi})}_{(1,0,0,0)}$, given by (20). Simultaneous monoproduct entry is optimal if $\Pi^{(\text{iv})}_{(1,0,1,0)} > \Pi^{(\text{vi})}_{(1,0,0,0)}$ and $\Pi^{(\text{iv})}_{(1,0,1,0)} \geq 0 = \Pi^{(\text{i})}_{(0,0,0,0)}$. Conversely, Sequential monoproduct entry is optimal if $\Pi^{(\text{vi})}_{(1,0,0,0)} \geq \Pi^{(\text{iv})}_{(1,0,1,0)}$ and $\Pi^{(\text{vi})}_{(1,1,0,0)} \geq 0 = \Pi^{(\text{i})}_{(0,0,0,0)}$. If neither set of conditions is satisfied, the firm does not enter any market making zero profits, $\Pi^{(\text{i})}_{(0,0,0,0)} = 0$. Using (23) and (25), we can rewrite these conditions as

$$\Pi^{(\text{iv})}_{(1,0,1,0)} = \Pi^{(\text{vi})}_{(1,0,0,0)} + \Psi_a(\tau^B) - W_a(\tau^B; F) - F.$$

Simultaneous monoproduct entry is optimal if $\Psi_a(\tau^B) - W_a(\tau^B; F) - F > 0$, i.e. if the net profit to enter market B at $t = 1$ with the core product a is larger than waiting to uncover the firm's profitability in A first. Rewriting the inequality as $\Psi_a(\tau^B) > W_a(\tau^B; F) - F$ and noting that the left-hand side does not depend on F while the right-hand side is increasing in F, it follows that there must be a unique fixed cost F^{Sm} that equates the net profits of the two entry strategies:

$$\Psi_a(\tau^B) = W_a(\tau^B; F^{Sm}) + F^{Sm}. \tag{51}$$

Thus, Simultaneous monoproduct entry $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0)$ is optimal for a sufficiently low fixed cost to enter market A at $t = 1$, i.e. if

$$e^j_{a1}(\tau^B) = 1, j = A, B \Leftrightarrow F < F^{Sm}(\tau^B). \tag{52}$$

In turn, Sequential monoproduct entry $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0)$ is optimal when $\Pi^{(\text{vi})}_{(1,0,0,0)} \geq \Pi^{(\text{iv})}_{(1,0,1,0)}$ and $\Pi^{(\text{vi})}_{(1,0,0,0)} \geq 0 = \Pi^{(\text{i})}_{(0,0,0,0)}$. Using (25), we can rewrite these conditions as

$$\Psi_a(\tau^A) + W_b(\tau^A; f) + W_b(\tau^B; f) \geq F - W_a(\tau^B; F).$$

Noting that the left-hand side of the inequality does not depend on F while the right-hand side is increasing in F, ([29]) it follows that there must be a unique fixed cost F^{Sq} that equates the net

[29]From applying Leibniz's rule, it follows that $\frac{\partial}{\partial F}[F - W_a(\tau^B; F)] = 2 - G(2F^{1/2} + \tau^B) > 0$.

profits of Sequential monoproduct entry to those of no entry:

$$\Psi_a(\tau^A) + W_b(\tau^A; f) + W_b(\tau^B; f) = F^{Sq} - W_a(\tau^B; F^{Sq}). \tag{53}$$

Therefore, Sequential monoproduct entry is optimal when

$$e^A_{a1}(\tau^A, \tau^B; f) = 1 \Leftrightarrow F^{Sq}(\tau^A, \tau^B; f) \geq F > F^{Sm}(\tau^B). \tag{54}$$

Comparing conditions (51) and (53), we can show that

$$F^{Sq}(\tau^A, \tau^B; f) > F^{Sm}(\tau^B), \forall f \tag{55}$$

from noting that $F^{Sq} > F^{Sq} - W_a(\tau^B; F^{Sq}) = \Psi_a(\tau^A) + W_b(\tau^A; f) + W_b(\tau^B; f) \geq \Psi_a(\tau^A) \geq \Psi_a(\tau^B) = F^{Sm} + W_a(\tau^B; F^{Sm}) \geq F^{Sm}$ for all values of f, since $W_b(\tau^j; f) \geq 0, \forall (j, f)$ and $\tau^A \leq \tau^B$ implies that $\Psi_a(\tau^A) \geq \Psi_a(\tau^B)$. Notice that the 'sequential' entry fixed cost threshold depends on f while the 'simultaneous' market entry one does not:

$$F^{Sq}(\tau^A, \tau^B; f) > F^{Sm}(\tau^B) \text{ when } f \in (f^{Mo}(\tau^A), +\infty) \tag{56}$$

which explains the vertical threshold line for the latter but not for the former in Figure 1 when the firm considers entry with only one product. [30]

[30] To see why $F^{Sq}(\tau^A, \tau^B; f)$ depends on f when $f \in (f^{Mo}(\tau^A), +\infty)$ evaluate the net profit of strategy (vi) at the point $f = f^{Mo}$ and $F = F^{Sq}$, i.e. where the firm is indifferent between entering sequentially in market A with the core product a and not entering any market,

$$\begin{aligned} \Pi^{(\text{vi})}_{(1,0,0,0)}\Big|_{(f=f^{Mo}, F=F^{Sq})} &= \Psi_a(\tau^A) + W_b(\tau^A; f^{Mo}) + W_a(\tau^A; F^{Sq}) - F^{Sq} + W_b(\tau^B; f^{Mo}) \\ &= \Psi_a(\tau^A) + [\Psi_b(\tau^A) - f^{Mo}] + [-\Psi_a(\tau^A) - W_b(\tau^A; f^{Mo}) - W_b(\tau^B; f^{Mo})] + W_b(\tau^B; f^{Mo}) \\ &= 0 = \Pi^{(\text{i})}_{(0,0,0,0)} \end{aligned}$$

where the second equality follows from imposing conditions (47) and (53). At that point, the net profits of sequential monoproduct entry, (vi), is equal to the net profit of no entry, (i). The effect on the net profit of increasing the fixed cost to expand the product scope at this point is given by:

$$\frac{\partial}{\partial f}\ \Pi^{(\text{vi})}_{(1,0,0,0)}\Big|_{(f=f^{Mo}, F=F^{Sq})} = \frac{\partial}{\partial f} W_b(\tau^A; f^{Mo}) + \frac{\partial}{\partial f} W_b(\tau^B; f^{Mo}) + [\frac{\partial}{\partial F} W_a(\tau^A; F^{Sq}) - 1]\frac{\partial F^{Sq}}{\partial f}$$

where the first two terms are negative, while the third captures the effect on the sequential fixed cost entry threshold F^{Sq} of an increase in f. If the sequential fixed cost entry threshold did not depend on f, the third term would be zero, and increasing the fixed cost of expanding the product scope would reduce profits below zero, i.e. $\Pi^{(\text{vi})}_{(1,0,0,0)}\Big|_{(f>f^{Mo}, F=F^{Sq})} < 0 = \Pi^{(\text{i})}_{(0,0,0,0)}\Big|_{(f>f^{Mo}, F=F^{Sq})}$. Therefore, increases in f need to be compensated by reductions in F^{Sq},

$$\frac{\partial F^{Sq}}{\partial f} = \frac{\frac{\partial}{\partial f} W_b(\tau^A; f) + \frac{\partial}{\partial f} W_b(\tau^B; f)}{1 - \frac{\partial}{\partial F} W_a(\tau^A; F^{Sq})} < 0$$

to restore the indifference between the two profit strategies so that:

$$\begin{aligned} \frac{\partial}{\partial f}\ \Pi^{(\text{vi})}_{(1,0,0,0)}\Big|_{(f=f^{Mo}, F=F^{Sq})} &= \frac{\partial}{\partial f} W_b(\tau^A; f^{Mo}) + \frac{\partial}{\partial f} W_b(\tau^B; f^{Mo}) + [\frac{\partial}{\partial F} W_a(\tau^A; F^{Sq}) - 1]\frac{\partial F^{Sq}}{\partial f} \\ &= \frac{\partial}{\partial f} W_b(\tau^A; f^{Mo}) + \frac{\partial}{\partial f} W_b(\tau^B; f^{Mo}) - [1 - \frac{\partial}{\partial F} W_a(\tau^A; F^{Sq})]\frac{\frac{\partial}{\partial f} W_b(\tau^A; f^{Mo}) + \frac{\partial}{\partial f} W_b(\tau^B; f^{Mo})}{1 - \frac{\partial}{\partial F} W_a(\tau^A; F^{Sq})} \\ &= 0 \end{aligned}$$

Intuitively, increases in the fixed cost to expand the product scope within a market, f, reduces the expected profits of entering that market, F, reducing the break-even entry threshold that leaves the firm indifferent between entering market A at $t = 1$ and not entering at all.

Finally notice that the above inequality is strict, i.e. $\lim_{f\to+\infty} W_b(\tau^j; f) = 0$ because the option value of expanding the product scope is decreasing in the fixed cost, implying that

$$\lim_{f\to+\infty} F^{Sq}(\tau^A, \tau^B; f) = \Psi_a(\tau^A) \geq \Psi_a(\tau^B) > \Psi_a(\tau^B) - W_a(\tau^B; F^{Sm}(\tau^B)) = F^{Sm}(\tau^B)$$

which is why in Figure 1, $F^{Sq}(\tau^A, \tau^B; f)$ never crosses the vertical fixed cost entry threshold $F^{Sm}(\tau^B)$.

(d) Considering now the case where $f \in (f^{Mu}(\tau^B), f^{Mo}(\tau^A)]$ in Figure 1, we need to compare the net profit of Partially sequential multiproduct entry, $\Pi^{(\text{iii})}_{(1,1,1,0)}$, to the net profit of Sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$), $\Pi^{(\text{v})}_{(1,1,0,0)}$, given by (24).

Partially sequential multiproduct entry is then optimal if $\Pi^{(\text{iii})}_{(1,1,1,0)} > \Pi^{(\text{v})}_{(1,1,0,0)}$ and $\Pi^{(\text{iii})}_{(1,1,1,0)} \geq 0$. Conversely, Sequential multiproduct entry is optimal if $\Pi^{(\text{v})}_{(1,1,0,0)} \geq \Pi^{(\text{iii})}_{(1,1,1,0)}$ and $\Pi^{(\text{v})}_{(1,1,0,0)} \geq 0$. Using (22) and (24), we can rewrite these conditions as

$$\Pi^{(\text{iii})}_{(1,1,1,0)} = \Pi^{(\text{v})}_{(1,1,0,0)} + \Psi_a(\tau^B) - W_a(\tau^B; F) - F.$$

Partially sequential multiproduct entry is optimal if $\Psi_a(\tau^B) - W_a(\tau^B; F) - F$, i.e. if the net profit to enter market B at $t = 1$ is larger than the option to wait and uncover the firm's profitability first. But noticing that this condition is identical to (51) above, Partially sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0$) is optimal for a sufficiently low fixed cost to enter market A at $t = 1$, i.e. if

$$e^j_{a1}(\tau^B) = 1, j = A, B; e^A_{b1}(\tau^B) = 1 \Leftrightarrow F < F^{Sm}(\tau^B). \tag{57}$$

In turn, Sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$) is optimal when $\Pi^{(\text{v})}_{(1,1,0,0)} \geq \Pi^{(\text{iii})}_{(1,1,1,0)}$ and $\Pi^{(\text{v})}_{(1,1,0,0)} \geq 0 = \Pi^{(\text{i})}_{(0,0,0,0)}$. Using (24), we can rewrite these conditions as

$$\Psi_a(\tau^A) + \Psi_b(\tau^A) + W_b(\tau^B; f) - f \geq F - W_a(\tau^B; F).$$

Noting that the left-hand side of the inequality does not depend on F while the right-hand side is increasing in F, it follows that there must be a unique fixed cost F^{Sq} that equates the net profits of Sequential multiproduct entry to those of no entry:

$$\Psi_a(\tau^A) + \Psi_b(\tau^A) + W_b(\tau^B; f) - f = F^{Sq} - W_a(\tau^B; F^{Sq}). \tag{58}$$

Therefore, Sequential multiproduct entry is optimal when

$$e^A_{v1}(\tau^A, \tau^B; f) = 1, v = a, b \Leftrightarrow F^{Sq}(\tau^A, \tau^B; f) \geq F > F^{Sm}(\tau^B). \tag{59}$$

Notice that when $f = f^{Mo}$, condition (47), $\Psi_b(\tau^A) = W_b(\tau^A; f^{Mo}) + f^{Mo}$, makes conditions (53) and (58) equivalent.

(e) Finally, we need to consider the case where $f \in [0, f^{Mu}(\tau^B)]$ in Figure 1. There we need to compare the net profit of Simultaneous multiproduct entry, $\Pi^{(\text{ii})}_{(1,1,1,1)}$, to the net profit of Sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$), $\Pi^{(\text{v})}_{(1,1,0,0)}$, given by (24). Simultaneous multiproduct entry is then optimal if $\Pi^{(\text{ii})}_{(1,1,1,1)} > \Pi^{(\text{v})}_{(1,1,0,0)}$ and $\Pi^{(\text{ii})}_{(1,1,1,1)} \geq 0$.

Conversely, Sequential multiproduct entry is optimal if $\Pi^{(\text{v})}_{(1,1,0,0)} \geq \Pi^{(\text{ii})}_{(1,1,1,1)}$ and $\Pi^{(\text{v})}_{(1,1,0,0)} \geq 0$. Using (21) and (24), we can rewrite these conditions as

$$\Pi^{(\text{ii})}_{(1,1,1,1)} = \Pi^{(\text{v})}_{(1,1,0,0)} + \Psi_a(\tau^B) - W_a(\tau^B; F) - F + \Psi_b(\tau^B) - W_b(\tau^B; f) - f.$$

Simultaneous multiproduct entry is optimal if $\Psi_a(\tau^B) - W_a(\tau^B; F) - F + \Psi_b(\tau^B) - W_b(\tau^B; f) - f > 0$, i.e. if the net profit to enter market B at $t = 1$ is larger than the option to wait and uncover the firm's profitability first before entering B. Rewriting the inequality as $\Psi_a(\tau^B) + \Psi_b(\tau^B) - W_b(\tau^B; f) - f > W_a(\tau^B; F) + F$ and noting that the left-hand side does not depend on F while the right-hand side is increasing in F, it follows that there must be a unique fixed cost F^{Sm} that equates the net profits of the two entry strategies:

$$\Psi_a(\tau^B) + \Psi_b(\tau^B) - W_b(\tau^B; f) - f = W_a(\tau^B; F^{Sm}) + F^{Sm}. \tag{60}$$

Thus, simultaneous multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1$) is optimal for a sufficiently low fixed cost to enter market A at $t = 1$, i.e. if

$$e^j_{v1}(\tau^B; f) = 1, \forall (j, v) \Leftrightarrow F < F^{Sm}(\tau^B; f). \tag{61}$$

Note that when $f = f^{Mu}(\tau^B)$, $F^{Sm}(\tau^B; f^{Mu}) = F^{Sm}(\tau^B)$ since the left hand side of conditions (51) and (60) coincide whenever condition (44) holds. And, as apparent from Figure 1, since the threshold $F^{Sm}(\tau^B; f)$ is linearly decreasing in f ([31]), whenever $f = 0$ we have that condition (60) becomes $F^{Sm} + W_a(\tau^B; F^{Sm})\big|_{f=0} = \Psi_a(\tau^B) + \Psi_b(\tau^B) - W_b(\tau^B; 0) - 0 = \Psi_a(\tau^B) + \left(\frac{E\mu - \tau^B - c}{2}\right)^2 > \Psi_a(\tau^B) \geq F^{Sm}(\tau^B)$.

In turn, Sequential multiproduct entry ($e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 0, e^B_{b1} = 0$) is optimal when $\Pi^{(v)}_{(1,1,0,0)} \geq \Pi^{(ii)}_{(1,1,1,1)}$ and $\Pi^{(v)}_{(1,1,0,0)} \geq 0 = \Pi^{(i)}_{(0,0,0,0)}$. Using (24), we can rewrite these conditions as

$$\Psi_a(\tau^A) + \Psi_b(\tau^A) + W_b(\tau^B; f) - f \geq F - W_a(\tau^B; F).$$

Noting that this condition is equivalent to condition (58), we have that Sequential multiproduct entry is optimal when

$$e^A_{v1}(\tau^A, \tau^B; f) = 1, v = a, b \Leftrightarrow F^{Sq}(\tau^A, \tau^B; f) \geq F > F^{Sm}(\tau^B; f). \tag{62}$$

QED.■

A.2 Model Extension: Differences in Productivity

To allow for differences in productivity, define a firm's product v unit costs as $\frac{1}{\varphi} + c_v$, where $\varphi \in [0, \infty)$ denotes the firm's (known) efficiency in production (i.e. its measure of productivity) and c_v again reflects its (unknown) product v unit export cost. It is easy to see, for example, that more productive firms will sell larger quantities (and expect higher profits) in the destinations

[31] Totally differentiating condition (60) in f and F^{Sm} yields:

$$\frac{dF^{Sm}}{df} = -\frac{G(2f^{1/2} + \tau^B + c)}{G(2\left[F^{Sm}\right]^{1/2} + \tau^B)} < 0$$

The same holds true when totally differentiating condition (58). However, the slopes can but do not need to coincide, as it can be seen from totally differentiating the latter:

$$\frac{dF^{Sq}}{df} = \frac{G(2f^{1/2} + \tau^A + c) + G(2f^{1/2} + \tau^B + c) - 2}{2 - G(2\left[F^{Sq}\right]^{1/2} + \tau^B)} < 0$$

they serve. More important for our purposes is how differences in productivity affect entry product patterns in foreign markets. The following proposition shows that the more productive a firm is, the less stringent the start-up fixed entry thresholds F^{Sq} and F^{Sm} and product scope thresholds f^{Mo} and f^{Mu} become.

Proposition 3 *F^{Sq}, F^{Sm}, f^{Mo} and f^{Mu} are increasing in productivity φ.*

Proof of Proposition 3. For sufficiently small fixed market entry costs F, consider first a small fixed cost to expand product scope f. Rewrite condition (45) for $(e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 1)$ as

$$f < \Psi_b(\tau^B + \frac{1}{\varphi}) - W_b(\tau^B + \frac{1}{\varphi}; f). \tag{63}$$

Analogously to Proposition 1, $f^{Mu} = 0$ if $E\mu \leq \tau^B + c + \frac{1}{\varphi}$, in which case $\frac{df^{Mu}}{d\varphi} = 0$. Otherwise, the expression above rewritten as an equality defines f^{Mu} implicitly:

$$f^{Mu} = \left[\Psi_b(\tau^B + \frac{1}{\varphi}) - W_b(\tau^B + \frac{1}{\varphi}; f^{Mu})\right],$$

or equivalently,

$$f^{Mu} = \left(\frac{E\mu - \tau^B - c - \frac{1}{\varphi}}{2}\right)^2 + \int_{\tau^B + c + \frac{1}{\varphi}}^{\overline{\mu}} \left(\frac{\mu - \tau^B - c - \frac{1}{\varphi}}{2}\right)^2 dG(\mu)$$
$$- \int_{2(f^{Mu})^{1/2} + \tau^B + c + \frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu - \tau^B - c - \frac{1}{\varphi}}{2}\right)^2 - f^{Mu}\right] dG(\mu).$$

Totally differentiating this expression and manipulating it, we find

$$\begin{aligned}
\frac{df^{Mu}}{d\varphi} &= \frac{\partial\Psi_b(\tau^B + \frac{1}{\varphi})/\partial\varphi - \partial W_b(\tau^B + \frac{1}{\varphi}; f^{Mu})/\partial\varphi}{1 + \partial W_b(\tau^B + \frac{1}{\varphi}; f^{Mu})/\partial f} \\
&= \frac{(E\mu - \tau^B - c - \frac{1}{\varphi}) + \int_{\tau^B + c + \frac{1}{\varphi}}^{2[f^{Mu}]^{1/2} + \tau^B + c + \frac{1}{\varphi}} (\mu - \tau^B - c - \frac{1}{\varphi}) dG(\mu)}{2\varphi^2 G(2\left[f^{Mu}\right]^{1/2} + \tau^B + c + \frac{1}{\varphi})} > 0.
\end{aligned}$$

Next rewrite condition (48) for $(e^A_{a1} = 1, e^A_{b1} = 1; e^B_{a1} = 1, e^B_{b1} = 0)$ as

$$f \leq \Psi_b(\tau^A + \frac{1}{\varphi}) + W_b(\tau^A + \frac{1}{\varphi}; f). \tag{64}$$

This expression defines f^{Mo} implicitly when it holds with equality:

$$f^{Mo} = \Psi_b(\tau^A + \frac{1}{\varphi}) + W_b(\tau^A + \frac{1}{\varphi}; f^{Mo}),$$

or equivalently,

$$f^{Mo} = \mathbf{1}_{\{E\mu > \tau^A + c + \frac{1}{\varphi}\}} \left(\frac{E\mu - \tau^A - c - \frac{1}{\varphi}}{2}\right)^2 + \int_{\tau^A + c + \frac{1}{\varphi}}^{\overline{\mu}} \left(\frac{\mu - \tau^A - c - \frac{1}{\varphi}}{2}\right)^2 dG(\mu)$$
$$+ \int_{2(f^{Mo})^{1/2} + \tau^A + c + \frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu - \tau^A - c - \frac{1}{\varphi}}{2}\right)^2 - f^{Mo}\right] dG(\mu).$$

Totally differentiating this expression and manipulating it, we find

$$\frac{df^{Mo}}{d\varphi} = \frac{\partial \Psi_b(\tau^A + \frac{1}{\varphi})/\partial\varphi + \partial W_b(\tau^A + \frac{1}{\varphi}; f^{Mo})/\partial\varphi}{1 - \partial W_b(\tau^A + \frac{1}{\varphi}; f^{Mo})/\partial f}$$

$$= \frac{1}{2\varphi^2 \left[2 - G(2\left[f^{Mo}\right]^{1/2} + \tau^A + c + \frac{1}{\varphi})\right]} \times \left[\mathbf{1}_{\{E\mu > \tau^A + c + \frac{1}{\varphi}\}} \left(E\mu - \tau^A - c - \frac{1}{\varphi}\right) + \right.$$

$$\left. + \int_{\tau^A + c + \frac{1}{\varphi}}^{\overline{\mu}} (\mu - \tau^A - c - \frac{1}{\varphi}) dG(\mu) + \int_{2[f^{Mo}]^{1/2} + \tau^A + c + \frac{1}{\varphi}}^{\overline{\mu}} (\mu - \tau^A - c - \frac{1}{\varphi}) dG(\mu)\right] > 0.$$

Next, we move to the market entry thresholds F^{Sm} and F^{Sq}. Rewrite condition (52) for $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0)$ as

$$F < \Psi_a(\tau^B + \frac{1}{\varphi}) - W_a(\tau^B + \frac{1}{\varphi}; F). \tag{65}$$

Analogously to Proposition 1, $F^{Sm} = 0$ if $E\mu \leq \tau^B + \frac{1}{\varphi}$, in which case $\frac{dF^{Sm}}{d\varphi} = 0$. Otherwise, the expression above rewritten as an equality defines F^{Sm} implicitly:

$$F^{Sm} = \left[\Psi_a(\tau^B + \frac{1}{\varphi}) - W_a(\tau^B + \frac{1}{\varphi}; F^{Sm})\right],$$

or equivalently,

$$F^{Sm} = \left(\frac{E\mu - \tau^B - \frac{1}{\varphi}}{2}\right)^2 + \int_{\tau^B + \frac{1}{\varphi}}^{\overline{\mu}} \left(\frac{\mu - \tau^B - \frac{1}{\varphi}}{2}\right)^2 dG(\mu)$$
$$- \int_{2(F^{Sm})^{1/2} + \tau^B + \frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu - \tau^B - \frac{1}{\varphi}}{2}\right)^2 - F^{Sm}\right] dG(\mu).$$

Totally differentiating this expression and manipulating it, we find

$$\frac{dF^{Sm}}{d\varphi} = \frac{\partial \Psi_a(\tau^B + \frac{1}{\varphi})/\partial\varphi - \partial W_a(\tau^B + \frac{1}{\varphi}; F^{Sm})/\partial\varphi}{1 + \partial W_a(\tau^B + \frac{1}{\varphi}; F^{Sm})/\partial F}$$

$$= \frac{(E\mu - \tau^B - \frac{1}{\varphi}) + \int_{\tau^B + \frac{1}{\varphi}}^{2\left[F^{Sm}\right]^{1/2} + \tau^B + \frac{1}{\varphi}} (\mu - \tau^B - \frac{1}{\varphi}) dG(\mu)}{2\varphi^2 G(2\left[F^{Sm}\right]^{1/2} + \tau^B + \frac{1}{\varphi})} > 0.$$

Next rewrite condition (54) for $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0)$ as

$$F \leq \Psi_a(\tau^A + \frac{1}{\varphi}) + W_a(\tau^B + \frac{1}{\varphi}; F) + W_b(\tau^A + \frac{1}{\varphi}; f) + W_b(\tau^B + \frac{1}{\varphi}; f). \tag{66}$$

This expression defines F^{Sq} implicitly when it holds with equality:

$$F^{Sq} = \Psi_a(\tau^A + \frac{1}{\varphi}) + W_a(\tau^B + \frac{1}{\varphi}; F^{Sq}) + W_b(\tau^A + \frac{1}{\varphi}; f) + W_b(\tau^B + \frac{1}{\varphi}; f),$$

or equivalently,

$$
\begin{aligned}
F^{Sq} = \mathbf{1}_{\{E\mu>\tau^A+\frac{1}{\varphi}\}} \left(\frac{E\mu-\tau^A-\frac{1}{\varphi}}{2}\right)^2 + \int_{\tau^A+\frac{1}{\varphi}}^{\overline{\mu}} \left(\frac{\mu-\tau^A-\frac{1}{\varphi}}{2}\right)^2 dG(\mu) \\
+ \int_{2(F^{Sq})^{1/2}+\tau^B+\frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu-\tau^B-\frac{1}{\varphi}}{2}\right)^2 - F^{Sq}\right] dG(\mu) \\
+ \int_{2f^{1/2}+\tau^A+c+\frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu-\tau^A-c-\frac{1}{\varphi}}{2}\right)^2 - f\right] dG(\mu) \\
+ \int_{2f^{1/2}+\tau^B+c+\frac{1}{\varphi}}^{\overline{\mu}} \left[\left(\frac{\mu-\tau^B-c-\frac{1}{\varphi}}{2}\right)^2 - f\right] dG(\mu).
\end{aligned}
$$

Totally differentiating this expression and manipulating it, we find

$$
\begin{aligned}
\frac{dF^{Sq}}{d\varphi} &= \frac{\partial\Psi_a(\tau^A+\frac{1}{\varphi})/\partial\varphi + \partial W_a(\tau^B+\frac{1}{\varphi};F^{Sq})/\partial\varphi + \partial W_b(\tau^A+\frac{1}{\varphi};f)/\partial\varphi + \partial W_b(\tau^B+\frac{1}{\varphi};f)/\partial\varphi}{1-\partial W_a(\tau^B+\frac{1}{\varphi};F^{Sq})/\partial F} \\
&= \frac{1}{2\varphi^2\left[2-G(2\left[F^{Sq}\right]^{1/2}+\tau^B+\frac{1}{\varphi})\right]} \times \Bigg[\mathbf{1}_{\{E\mu>\tau^A+\frac{1}{\varphi}\}}\left(E\mu-\tau^A-\frac{1}{\varphi}\right) + \\
&\quad + \int_{\tau^A+\frac{1}{\varphi}}^{\overline{\mu}} (\mu-\tau^A-\frac{1}{\varphi})dG(\mu) + \int_{2[F^{Sq}]^{1/2}+\tau^B+\frac{1}{\varphi}}^{\overline{\mu}} (\mu-\tau^B-\frac{1}{\varphi})dG(\mu) + \\
&\quad + \int_{2f^{1/2}+\tau^A+c+\frac{1}{\varphi}}^{\overline{\mu}} (\mu-\tau^A-c-\frac{1}{\varphi})dG(\mu) + \int_{2f^{1/2}+\tau^B+c+\frac{1}{\varphi}}^{\overline{\mu}} (\mu-\tau^B-c-\frac{1}{\varphi})dG(\mu)\Bigg] > 0,
\end{aligned}
$$

Noting that expressions (60) and (58), which define $F^{Sm}(\tau^B;f)$ and $F^{Sq}(\tau^A,\tau^B;f)$ respectively, depend analogously on productivity completes the proof. ■

Figure 9 illustrates Proposition 3 for the case in which the fixed cost to expand the product scope is low relative to the market entry cost, $f=\underline{\gamma}F$, conveyed in Figure 2. In that scenario, recall that it is optimal for the firm that enters a new destination (say A) with its core product a to expand its product scope there before entering a new destination (say B), i.e. entry strategy (v) dominates entry strategy (iv). Therefore, for intermediate values of productivity ($\frac{1}{\overline{\mu}-\tau^A} \leq \varphi \leq \frac{1}{E\mu-c-\tau^B}$) the firm will never enter into a new destination with its core product a ('simultaneous monoproduct entry', entry strategy (iv)) before first expanding there its product scope (to product b) conditional on surviving. If productivity is too low ($\varphi < \frac{1}{\overline{\mu}-\tau^A}$), there is no hope of making profits through exporting, and therefore the firm does not enter any foreign market with any product even if $F=0$. Similarly, the firm would never enter simultaneously in both markets with the core and the non-core products if it did not expect to make positive operational profits in market B with the non-core product b (i.e. if $\varphi > \frac{1}{E\mu-c-\tau^B}$). By contrast, observe that as the unit production cost falls to zero (i.e. $\varphi\to\infty$), the thresholds approach those defined in Corollary 1. A similar figure conveying similar conclusions can be drawn when instead the fixed cost to expand the product scope is high relative to the market entry cost, $f=\overline{\gamma}F$, as captured by Figure 3.

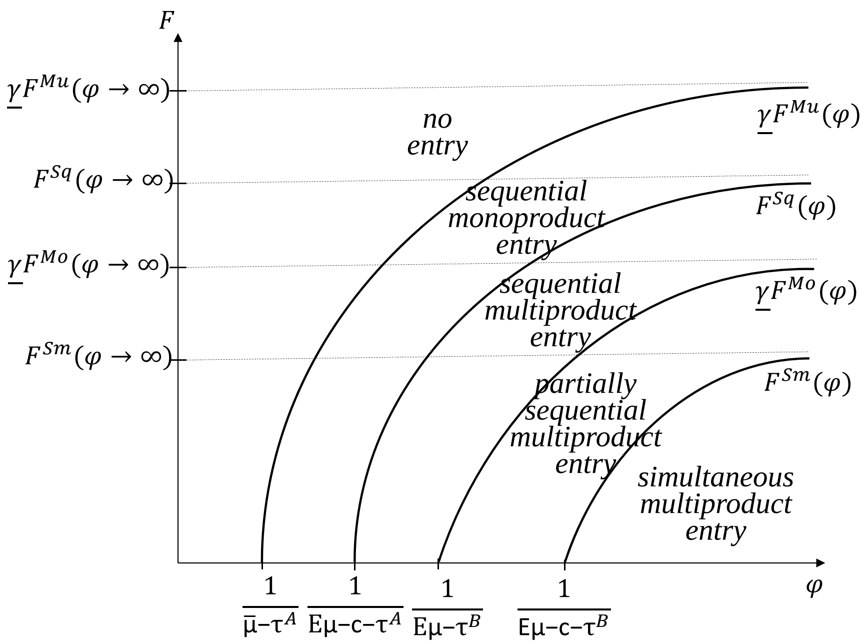

Figure 9: Optimal Entry strategies with Varying Productivity

A.3 Formalization of Empirical Predictions

We derive here the empirical predictions from the theoretical model in the main text. We extend it to $V > 2$ products, $T > 2$ periods and $N > 2$ foreign countries, so we can derive testable predictions for the intensive and the extensive (both entry and exit) margins of exporting. We assume throughout that F and $f < F$ are 'moderate,' so sequential monoproduct exporting is optimal. We keep the convention that $\tau^A = \min\{\tau^j\}$, $j = A, ..., N$, so that market A is the first the firm enters at $t = 1$.

Our model predicts, first, that conditional on survival the growth of a firm's exports is on average highest in the firm's core product, early in its first foreign market.

Prediction 1 *Conditional on survival, the growth rate of exports to a market is on average higher between the first and second periods for the first (core) product in the first foreign market served by the firm than in subsequent (non-core) products, markets or later in the firm's first market.*

Proof. Consider the first market, A, for the core product a. Conditional on entry, export volume at $t = 1$ is given by $q_{a1}^A = \mathbf{1}_{\{E\mu > \tau^A\}} \frac{E\mu - \tau^A}{2} + \mathbf{1}_{\{E\mu \leq \tau^A\}} \varepsilon$. At $t = 2$, the firm decides to stay active there if $\mu > \tau^A$, and in that case produces $q_{a2}^A = \frac{\mu - \tau^A}{2}$. Ex post quantities conditional on survival are distributed according to $G(\cdot | \mu > \tau^A)$. It follows that the average surviving firm will produce the ex ante expected quantity $E(q_{a2}^A | \mu > \tau^A) = \frac{\int_{\tau^A}^{\overline{\mu}} \left(\frac{\mu - \tau^A}{2}\right) dG(\mu)}{1 - G(\tau^A)} = \frac{E(\mu|\mu > \tau^A) - \tau^A}{2} > 0$. There are two cases. If $E\mu \leq \tau^A$, export growth from first to second year is $\sigma_a^A \equiv \frac{E(\mu|\mu > \tau^A) - \tau^A}{2} - \varepsilon > 0$. Otherwise, $\sigma_a^A = \frac{E(\mu|\mu > \tau^A) - \tau^A}{2} - \frac{E\mu - \tau^A}{2} = \frac{1}{2}[E(\mu| \mu > \tau^A) - E\mu]$. We now show that this difference is strictly positive:

$$
\begin{aligned}
E(\mu| \mu &> \tau^A) = \int_{\tau^A}^{\overline{\mu}} \mu dG(\mu| \mu > \tau^A) \\
&= \int_{\tau^A}^{\overline{\mu}} \mu \frac{dG(\mu)}{1 - G(\tau^A)} \\
&= \frac{1}{1 - G(\tau^A)} \left\{ \overline{\mu} - \int_{\tau^A}^{\overline{\mu}} G(\mu) d\mu \right\} \\
&= \frac{1}{1 - G(\tau^A)} \left\{ E\mu + \int_{\underline{\mu}}^{\tau^A} G(\mu) d\mu \right\} \\
&> \left\{ E\mu + \int_{\underline{\mu}}^{\tau^A} G(\mu) d\mu \right\} \\
&> E\mu
\end{aligned}
$$

Where the third equality follows from integration by parts and the fourth from rewriting $E\mu = \overline{\mu} - \int_{\underline{\mu}}^{\tau^A} G(\mu) d\mu - \int_{\tau^A}^{\overline{\mu}} G(\mu) d\mu$ as $\overline{\mu} - \int_{\tau^A}^{\overline{\mu}} G(\mu) d\mu = E\mu + \int_{\underline{\mu}}^{\tau^A} G(\mu) d\mu$. Now if $\tau^A \in (\underline{\mu}, \overline{\mu})$ we must have that $G(\tau^A) > 0$, which is equivalent to $1 - G(\tau^A) < 1 \Leftrightarrow \frac{1}{1 - G(\tau^A)} > 1$ so that the first inequality follows, and the second. Hence, conditional on survival, the firm expects to increase its export volume of product a to market A in the second period. In all subsequent periods expected growth in market A conditional on survival is nil, since $E(q_{at}^A | \mu > \tau^A) = \frac{E(\mu|\mu > \tau^A) - \tau^A}{2}$ for all $t > 1$.

Consider now foreign market j, $j \neq A$ for product a. Since the firm enters market j only if $\mu > 2F^{1/2} + \tau^j$, $E(q^j_{at+1}\Big| \mu > 2F^{1/2} + \tau^j) = E(q^j_{at}\Big| \mu > 2F^{1/2} + \tau^j) = \frac{E(\mu|\mu > 2F^{1/2}+\tau^j) - \tau^j}{2}$ for all $t \geq 1$. Thus, export growth of product a in market j is nil in all periods.

Consider now product b in market A. Conditional on entry, export volume at $t = 1$ is given by $q^A_{b1} = \mathbf{1}_{\{E\mu > \tau^A + c\}} \frac{E\mu - c - \tau^A}{2}$ because the firm will never optimally experiment with its non-core product, i.e. if $E\mu \leq \tau^A$. At $t = 2$, the firm decides to stay active there if $\mu > \tau^A + c$, and in that case produces $q^A_{b2} = \frac{\mu - c - \tau^A}{2}$. Ex post quantities conditional on survival are distributed according to $G(\cdot|\mu > c + \tau^A)$. It follows that the average surviving firm will produce the ex ante expected quantity $E(q^A_{b2}\big| \mu > \tau^A + c) = \frac{\int_{\tau^A + c}^{\overline{\mu}} \left(\frac{\mu - c - \tau^A}{2}\right) dG(\mu)}{1 - G(\tau^A + c)} = \frac{E(\mu|\mu > \tau^A + c) - c - \tau^A}{2} > 0$. Therefore, export growth from first to second year is $\sigma^A_b = \frac{E(\mu|\mu > \tau^A + c) - c - \tau^A}{2} - \frac{E\mu - c - \tau^A}{2} = \frac{1}{2}[E(\mu|\, \mu > \tau^A + c) - E\mu]$. Notice that for a sufficiently small ε,

$$\sigma^A_a \equiv \frac{E(\mu|\, \mu > \tau^A) - \tau^A}{2} - \varepsilon > \sigma^A_b \equiv \frac{1}{2}[E(\mu|\, \mu > \tau^A + c) - E\mu]$$

whereas, as long as $c > 0$,

$$\sigma^A_b \equiv \frac{1}{2}[E(\mu|\, \mu > \tau^A + c) - E\mu] \geq \sigma^A_a \equiv \frac{1}{2}[E(\mu|\, \mu > \tau^A) - E\mu]$$

which follows from subtracting both expressions and integrating by parts,

$$\begin{aligned} \sigma^A_b - \sigma^A_a &= E(\mu|\, \mu > \tau^A + c) - E(\mu|\, \mu > \tau^A) \\ &= \int_{\tau^A}^{\tau^A + c} G(\mu|\, \mu > \tau^A) d\mu + \frac{G(\tau^A + c) - G(\tau^A)}{[1 - G(\tau^A + c)][1 - G(\tau^A)]} \int_{\tau^A + c}^{\overline{\mu}} [1 - G(\mu)] d\mu \geq 0 \end{aligned}$$

because $G(\cdot)$ is a non-decreasing function.

Finally, consider foreign market j, $j \neq A$ for product b. Since the firm expands its product scope only if $\mu > 2f^{1/2} + c + \tau^j$, $E(q^j_{bt+1}\Big| \mu > 2f^{1/2} + c + \tau^j) = E(q^j_{bt}\Big| \mu > 2f^{1/2} + c + \tau^j) = \frac{E(\mu|\mu > 2f^{1/2} + c + \tau^j) - c - \tau^j}{2}$ for all $t \geq 1$. Thus, export growth of product b in market j is also nil in all periods. Hence, export growth of the firm's core product a is on average highest in market A between the first and second years of exporting, but not necessarily higher than in any of the firm's non-core product(s). ■

Second, our model predicts that new exporters are more likely to add new products into already entered destinations, enter new foreign destinations or both.

Prediction 2 *Conditional on survival, new exporters are more likely to either enter other foreign markets or to add new products (or both) than experienced ones.*

Proof. Denote the probability that a firm that has just started to export product v will enter a new foreign market j in the next period with that product by $\Pr(e^j_{v2} = 1|e^A_{v1} = 1 \;\&\; e^j_{v1} = 0)$, and the probability that a firm that has been an exporter of that same product v for a longer period will enter market j by $\Pr(e^j_{vt} = 1|\prod_{i=1}^{t-1} e^A_{vt-i} = 1 \;\&\; e^j_{vt-1} = 0)$, $t \geq 2$. The model implies that $\Pr(e^B_{v2} = 1|e^A_{v1} = 1 \;\&\; e^j_{v1} = 0) = 1 - G(2F^{1/2} + \tau^j) > 0 = \Pr(e^j_{vt} = 1|\prod_{i=1}^{t-1} e^A_{vt-i} = 1 \;\&\; e^j_{vt-1} = 0)$. Consider now the probability that a firm that has just started to export product v will expand its product scope there in the next period, $\Pr(e^A_{b2} = 1|e^A_{a1} = 1 \;\&\; e^A_{b1} = 0) = 1 - G(2f^{1/2} + c + \tau^A) > 0$.

But the probability that a firm that has been an exporter of that same product a for a longer period will expand its product scope there is nil according to the model, $\Pr(e^A_{bt} = 1 | \prod_{i=1}^{t-1} e^A_{at-i} = 1$ & $e^A_{bt-1} = 0) = 0$, concluding the proof. ■

Finally, our model predicts that the probability that firm i will exit a particular export market j with product p in period t ($Exit_{ijpt} = 1$) is higher if the firm exported for the first time in $t-1$.

Prediction 3 *New exporters and newly introduced (non-core) products are more likely to exit than experienced exporters and products, including those that are new in a market but have export experience elsewhere.*

Proof. Let the probability of exiting a foreign market right after entering there with product v be $\Pr(e^A_{v2} = 0|e^A_{v1} = 1)$ if the foreign market is the firm's first, and $\Pr(e^j_{vt+1} = 0|e^j_{vt} = 1 \text{ \& } e^j_{vt-1} = 1)$, $t \geq 2$, $j \neq A$, otherwise. The latter is also equal to the probability of exiting a market after being there for more than one period. The model implies that

$$\Pr(e^A_{v2} = 0|e^A_{v1} = 1) = G(\tau^A) > 0 = \Pr(e^j_{vt+1} = 0|e^j_{vt} = 1 \text{ \& } e^j_{vt-1} = 1).$$

Similarly, consider now the probability of dropping a non-core product $v = b$ right after entering there with it, relative to the probability of dropping a core-product $v = a$:

$$\Pr(e^A_{b2} = 0|e^A_{b1} = 1) = G(\tau^A + c) > G(\tau^A) = \Pr(e^A_{a2} = 0|e^A_{a1} = 1),$$

completing the proof. ■

A.4 Derivation of Trade Policy Implications

The following paragraphs before the proof of the Lemma should appear in the main text only

Consider a continuum of total mass one of firms with heterogeneous sunk costs of exporting, F, and of expanding the product scope, f. Let F follow a continuous c.d.f. $H(F)$ on the support $[0, \infty)$, and let f follow a continuous c.d.f. $U(f)$ on the same support. As before, for each firm ex ante profitability follows $G(\mu)$. Let $h(\cdot), u(\cdot)$ and $g(\cdot)$ denote the p.d.f.s of $H(\cdot), U(\cdot)$ and $G(\cdot)$, respectively. We assume that F, f and μ are independently distributed. Assuming independence is analytically very convenient. In particular, it implies an equivalence between having a single firm (as in the basic model) and a continuum of monopolists. In what follows we express all relevant outcomes in terms of the profitability of the core product a for simplicity.

Irrespective of the size of the fixed cost to expand the product scope, f, relative to the sunk cost to enter a destination, F, as long as $f < F$ we can characterize the masses of firms entering each destination $j = A, B$ with each product $v = a, b$ in $t = 1, 2$ more generally as:

- $m^A_{a1} = \int_0^{+\infty} H\left[F^{Sq}(\tau^A, \tau^B; f)\right] dU(f)$ firms export product a to market A at $t = 1$;
- $m^A_{b1} = \int_0^{f^{Mo}(\tau^A)} H\left[F^{Sq}(\tau^A, \tau^B; f)\right] dU(f)$ firms export product b to market A at $t = 1$;
- $m^B_{a1} = \int_0^{+\infty} H\left[F^{Sm}(\tau^B; f)\right] dU(f)$ of firms export product a to market B at $t = 1$;
- $m^B_{b1} = \int_0^{f^{Mu}(\tau^B)} H\left[F^{Sm}(\tau^B; f)\right] dU(f)$ of firms export product b to market B at $t = 1$;
- $m^A_{a2} = m^A_{a1}\left[1 - G(\tau^A)\right]$ firms export their core product a to market A at $t = 2$, all of which already exported it at $t = 1$;

- $m_{b2}^{A} = m_{b1}^{A}\left[1 - G(\tau^{A})\right] + \int_{f^{Mo}(\tau^{A})}^{+\infty} H\left[F^{Sq}(\tau^{A}, \tau^{B}; f)\right]\left[1 - G(2f^{\frac{1}{2}} + c + \tau^{A})\right] dU(f)$ firms export their non-core product b to market A at $t = 2$. The first term corresponds to continuing multiproduct exporters, whilst the second captures monoproduct firms that expand their product scope there at $t = 2$;
- $m_{a2}^{B} = m_{a1}^{B}\left[1 - G(\tau^{B})\right] + \int_{0}^{+\infty}\int_{F^{Sm}(\tau^{B};f)}^{F^{Sq}(\tau^{A},\tau^{B};f)}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)dU(f)$ firms export product a to market B at $t = 2$. The first term corresponds to continuing exporters; the second, to destination A exporters that expand geographically into B with either their core product a or with both products (multiproduct);
- $m_{b2}^{B} = m_{b1}^{B}\left[1 - G(\tau^{B})\right] + \int_{f^{Mu}(\tau^{B})}^{+\infty}\left[1 - G(2f^{\frac{1}{2}} + c + \tau^{A})\right]\int_{F^{Sm}(\tau^{B};f)}^{F^{Sq}(\tau^{A},\tau^{B};f)}\left[1 - G(2F^{\frac{1}{2}} + \tau^{B})\right] dH(F)dU(f)$ firms export product b to market B at $t = 2$. The first term corresponds to surviving multiproduct exporters, i.e. global firms. The second are destination A multiproduct firms that expand their product scope in destination B after uncovering there their core product a export profitability;
- $1 - \int_{0}^{+\infty} H\left[F^{Sq}(\tau^{A}, \tau^{B}; f)\right] dU(f)$ firms do not export.

Quantities of products $v = a, b$ sold in markets $j = A, B$ at $t = 1$ follow $\widehat{q}_{v1}^{j}$, and sold at $t = 2$ by new and old exporters, follow the corresponding expressions developed in the main text.

Let us then look at the effects of a $t = 1$ permanent decrease in trade cost τ^{j} on export levels. Consider first the intensive margin. Clearly, a fall in τ^{A} increases product sales of current exporters to A at $t = 1$ without affecting sales to B, while a fall in τ^{B} has symmetric immediate effects. At $t = 2$, export levels rise for surviving exporters. This is counterbalanced by a negative composition effect: the new entrants (and newly introduced products) benefiting from lower trade costs operate at a lower-than-average scale. The overall intensive margin effect is therefore generally ambiguous (see further below).

The most interesting and novel features of the model regard however the extensive margin effects of trade liberalization. As a first step, we determine how variable trade costs affect the market entry and product scope thresholds $f^{Mo}(\tau^{A})$, $f^{Mu}(\tau^{B})$, $F^{Sm}(\tau^{B}; f)$ and $F^{Sq}(\tau^{A}, \tau^{B}; f)$.

Lemma 2 *Variable trade costs for products a and b in markets A and B affect the fixed cost thresholds as follows:*

- $\frac{df^{Mu}}{d\tau^{A}} = 0;$
- $\frac{df^{Mu}}{d\tau^{B}} = -\frac{\left[1_{\{E\mu > \tau^{B}+c\}}(\frac{E\mu-\tau^{B}-c}{2}) + \int_{\tau^{B}+c}^{2\left[f^{Mu}\right]^{1/2}+\tau^{B}+c}(\frac{\mu-\tau^{B}-c}{2})dG(\mu)\right]}{G(2[f^{Mu}]^{1/2}+\tau^{B}+c)} < 0.$
- $\frac{df^{Mo}}{d\tau^{A}} = -\frac{1_{\{E\mu > \tau^{A}+c\}}\left(\frac{E\mu-\tau^{A}+c}{2}\right) + \int_{\tau^{A}+c}^{\overline{\mu}}(\frac{\mu-\tau^{A}-c}{2})dG(\mu) + \int_{2[f^{Mo}]^{1/2}+\tau^{A}+c}^{\overline{\mu}}(\frac{\mu-\tau^{A}-c}{2})dG(\mu)}{2-G(2[\gamma F^{Mo}]^{1/2}+\tau^{A}+c)} < 0;$
- $\frac{df^{Mo}}{d\tau^{B}} = 0;$
- $\frac{dF^{Sm}}{d\tau^{A}} = 0;$
- $\frac{dF^{Sm}}{d\tau^{B}} = -1_{\{E\mu > \tau^{B}\}}\frac{\left(\frac{E\mu-\tau^{B}}{2}\right) + \int_{\tau^{B}}^{2\left[F^{Sm}\right]^{1/2}+\tau^{B}}\left(\frac{\mu-\tau^{B}}{2}\right)dG(\mu)}{G(2[F^{Sm}]^{1/2}+\tau^{B})} \leq 0;$

- $\frac{dF^{Sq}}{d\tau^A} = -\frac{\left[\mathbf{1}_{\{E\mu>\tau^A\}}\left(\frac{E\mu-\tau^A}{2}\right)+\int_{\tau^A}^{\overline{\mu}}\left(\frac{\mu-\tau^A}{2}\right)dG(\mu)+\int_{2f^{1/2}+\tau^A+c}^{\overline{\mu}}(\frac{\mu-\tau^A-c}{2})dG(\mu)\right]}{2-G\left(2[F^{Sq}]^{1/2}+\tau^B\right)} < 0;$
- $\frac{dF^{Sq}}{d\tau^B} = -\frac{\left[\int_{2[F^{Sq}]^{1/2}+\tau^B}^{\overline{\mu}}\left(\frac{\mu-\tau^B}{2}\right)dG(\mu)+\int_{2f^{1/2}+\tau^B+c}^{\overline{\mu}}(\frac{\mu-\tau^B-c}{2})dG(\mu)\right]}{2-G\left(2[F^{Sq}]^{1/2}+\tau^B\right)} < 0.$

A.4.1 Proof of Lemma 2

Proof of Lemma 2. Recall from the main text that for sufficiently small fixed market entry costs F and a small fixed cost to expand product scope f, we can rewrite condition (45) for $(e_{a1}^A = 1, e_{b1}^A = 1; e_{a1}^B = 1, e_{b1}^B = 1)$ as

$$f < \Psi_b(\tau^B) - W_b(\tau^B; f). \tag{67}$$

Analogously to Proposition 1, $f^{Mu} = 0$ if $E\mu \le \tau^B + c$, in which case $\frac{df^{Mu}}{d\tau^B} = 0$. Otherwise, the expression above rewritten as an equality defines f^{Mu} implicitly:

$$f^{Mu} = \left[\Psi_b(\tau^B) - W_b(\tau^B; f^{Mu})\right],$$

from where it is straightforward to see that $\frac{df^{Mu}}{d\tau^A} = 0$. Fully developing the implicit equation, we find

$$f^{Mu} = \left(\frac{E\mu - \tau^B - c}{2}\right)^2 + \int_{\tau^B+c}^{\overline{\mu}} \left(\frac{\mu - \tau^B - c}{2}\right)^2 dG(\mu) - \int_{2(f^{Mu})^{1/2}+\tau^B+c}^{\overline{\mu}} \left[\left(\frac{\mu - \tau^B - c}{2}\right)^2 - f^{Mu}\right] dG(\mu).$$

Totally differentiating this expression and manipulating it, we find

$$\begin{aligned}\frac{df^{Mu}}{d\tau^B} &= \frac{\partial\Psi_b(\tau^B)/\partial\tau^B - \partial W_b(\tau^B; f^{Mu})/\partial\tau^B}{1 + \partial W_b(\tau^B; f^{Mu})/\partial f} \\ &= -\left[\frac{1_{\{E\mu>\tau^B+c\}}(\frac{E\mu-\tau^B-c}{2}) + \int_{\tau^B+c}^{2\left[f^{Mu}\right]^{1/2}+\tau^B+c}(\frac{\mu-\tau^B-c}{2})dG(\mu)}{G(2\left[f^{Mu}\right]^{1/2} + \tau^B + c)}\right] < 0.\end{aligned}$$

When imposing that $f = \gamma F, \gamma \in (0,1)$, the above conclusions also hold when applying the implicit function theorem to definition 26 in Corollary 1 as a special case.

Next rewrite condition (48) for $(e_{a1}^A = 1, e_{b1}^A = 1; e_{a1}^B = 1, e_{b1}^B = 0)$ as

$$f \le \Psi_b(\tau^A) + W_b(\tau^A; f). \tag{68}$$

This expression defines f^{Mo} implicitly when it holds with equality:

$$f^{Mo} = \Psi_b(\tau^A) + W_b(\tau^A; f^{Mo}),$$

from where it is straightforward to see that $\frac{df^{Mo}}{d\tau^B} = 0$. Fully developing the implicit equation, we find

$$f^{Mo} = \mathbf{1}_{\{E\mu>\tau^A+c\}} \left(\frac{E\mu - \tau^A - c}{2}\right)^2 + \int_{\tau^A+c}^{\overline{\mu}} \left(\frac{\mu - \tau^A - c}{2}\right)^2 dG(\mu) + \int_{2(f^{Mo})^{1/2}+\tau^A+c}^{\overline{\mu}} \left[\left(\frac{\mu - \tau^A - c}{2}\right)^2 - f^{Mo}\right] dG(\mu).$$

Totally differentiating this expression and manipulating it, we find

$$\frac{df^{Mo}}{d\tau^A} = \frac{\partial\Psi_b(\tau^A)/\partial\tau^A + \partial W_b(\tau^A; f^{Mo})/\partial\tau^A}{1 - \partial W_b(\tau^A; f^{Mo})/\partial f}$$
$$= \frac{-1}{\left[2 - G(2\left[f^{Mo}\right]^{1/2} + \tau^A + c)\right]} \times \left[\mathbf{1}_{\{E\mu>\tau^A+c\}}\left(\frac{E\mu - \tau^A - c}{2}\right) + \right.$$
$$\left. + \int_{\tau^A+c}^{\overline{\mu}} (\frac{\mu - \tau^A - c}{2})dG(\mu) + \int_{2\left[f^{Mo}\right]^{1/2}+\tau^A+c}^{\overline{\mu}} (\frac{\mu - \tau^A - c}{2})dG(\mu)\right] < 0.$$

Again, imposing that $f = \gamma F, \gamma \in (0,1)$, one can see that the above conclusions also hold when applying the implicit function theorem to definition 27 in Corollary 1 as a special case.

Next, we move to the market entry thresholds F^{Sm} and F^{Sq}. Rewrite condition (52) for $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 1, e^B_{b1} = 0)$ as

$$F < \Psi_a(\tau^B) - W_a(\tau^B; F). \tag{69}$$

Analogously to Proposition 1, $F^{Sm} = 0$ if $E\mu \leq \tau^B$, in which case $\frac{dF^{Sm}}{d\tau^B} = 0$. Otherwise, the expression above rewritten as an equality defines F^{Sm} implicitly:

$$F^{Sm} = 1_{\{E\mu>\tau^B\}}\left[\Psi_a(\tau^B) - W_a(\tau^B; F^{Sm})\right],$$

from where it is evident that $\frac{dF^{Sm}}{d\tau^A} = 0$. Applying the implicit function theorem to this expression, we find

$$\begin{aligned}\frac{dF^{Sm}}{d\tau^B} &= 1_{\{E\mu>\tau^B\}}\frac{\partial\Psi_a(\tau^B)/\partial\tau^B - \partial W_a(\tau^B; F^{Sm})/\partial\tau^B}{1 + \partial W_a(\tau^B; F^{Sm})/\partial F} \\ &= -1_{\{E\mu>\tau^B\}}\left[\frac{(\frac{E\mu-\tau^B}{2}) + \int_{\tau^B}^{2\left[F^{Sm}\right]^{1/2}+\tau^B}(\frac{\mu-\tau^B}{2})dG(\mu)}{G(2\left[F^{Sm}\right]^{1/2} + \tau^B)}\right] < 0.\end{aligned}$$

Next rewrite condition (54) for $(e^A_{a1} = 1, e^A_{b1} = 0; e^B_{a1} = 0, e^B_{b1} = 0)$ as

$$F \leq \Psi_a(\tau^A) + W_a(\tau^B; F) + W_b(\tau^A; f) + W_b(\tau^B; f). \tag{70}$$

This expression defines F^{Sq} implicitly when it holds with equality:

$$F^{Sq} = \Psi_a(\tau^A) + W_a(\tau^B; F^{Sq}) + W_b(\tau^A; f) + W_b(\tau^B; f),$$

or equivalently,

$$\begin{aligned}F^{Sq} = \mathbf{1}_{\{E\mu>\tau^A\}}\left(\frac{E\mu - \tau^A}{2}\right)^2 &+ \int_{\tau^A}^{\overline{\mu}}\left(\frac{\mu - \tau^A}{2}\right)^2 dG(\mu) \\ &+ \int_{2(F^{Sq})^{1/2}+\tau^B}^{\overline{\mu}}\left[\left(\frac{\mu - \tau^B}{2}\right)^2 - F^{Sq}\right] dG(\mu) \\ &+ \int_{2f^{1/2}+\tau^A+c}^{\overline{\mu}}\left[\left(\frac{\mu - \tau^A - c}{2}\right)^2 - f\right] dG(\mu) \\ &+ \int_{2f^{1/2}+\tau^B+c}^{\overline{\mu}}\left[\left(\frac{\mu - \tau^B - c}{2}\right)^2 - f\right] dG(\mu).\end{aligned}$$

Totally differentiating this expression and manipulating it, we find

$$\frac{dF^{Sq}}{d\tau^A} = \frac{\partial\Psi_a(\tau^A)/\partial\tau^A + \partial W_b(\tau^A; f)/\partial\tau^A}{1 - \partial W_a(\tau^B; F^{Sq})/\partial F}$$

$$= \frac{-1}{\left[2 - G(2\left[F^{Sq}\right]^{1/2} + \tau^B)\right]} \times \left[\mathbf{1}_{\{E\mu > \tau^A\}}\left(\frac{E\mu - \tau^A}{2}\right) + \right.$$

$$\left. + \int_{\tau^A}^{\overline{\mu}} (\frac{\mu - \tau^A}{2})dG(\mu) + \int_{2f^{1/2}+\tau^A+c}^{\overline{\mu}} (\frac{\mu - \tau^A - c}{2})dG(\mu)\right] < 0,$$

$$\frac{dF^{Sq}}{d\tau^B} = \frac{\partial W_a(\tau^B; F^{Sq})/\partial\tau^B + \partial W_b(\tau^B; f)/\partial\tau^B}{1 - \partial W_a(\tau^B; F^{Sq})/\partial F}$$

$$= \frac{-1}{\left[2 - G(2\left[F^{Sq}\right]^{1/2} + \tau^B)\right]} \times \left[\int_{2[F^{Sq}]^{1/2}+\tau^B}^{\overline{\mu}} (\frac{\mu - \tau^B}{2})dG(\mu) + \right.$$

$$\left. + \int_{2f^{1/2}+\tau^B+c}^{\overline{\mu}} (\frac{\mu - \tau^B - c}{2})dG(\mu)\right] < 0,$$

Noting that expressions (60) and (58), which define $F^{Sm}(\tau^B; f)$ and $F^{Sq}(\tau^A, \tau^B; f)$ respectively, depend analogously on variable trade costs $\tau^j, j = A, B$ completes the proof.[32] ■

A.4.2 Proof of Proposition 4

We can now establish the extensive margin effects of trade liberalization in countries A and B in both the short and the long runs, in the general case where $f < F$, and for the particular cases reported in the main text, .

Proposition 4 *Trade liberalization in a country has qualitatively different effects on (product and market) entry in the short and long runs, and encourages entry in other countries and/or with other products. Specifically, and from the ex-ante perspective of $t = 0$,*

a) A decrease in τ^A at $t = 1$, holding τ^B fixed:

1. *increases the number of both Home exporters and exported products to A at $t = 1$ and at $t = 2$;*

[32] Fully differentiating condition (58) with respect to $\tau^j, j = A, B$, yields:

$$\frac{dF^{Sq}}{d\tau^A} = \frac{\partial\Psi_a(\tau^A)/\partial\tau^A + \partial\Psi_b(\tau^A)/\partial\tau^A}{1 - \partial W_a(\tau^B; F^{Sq})/\partial F};$$

$$\frac{dF^{Sq}}{d\tau^B} = \frac{\partial W_a(\tau^B; F^{Sq})/\partial\tau^B + \partial W_b(\tau^B; f)/\partial\tau^B}{1 - \partial W_a(\tau^B; F^{Sq})/\partial F}$$

and similarly, from condition (60):

$$\frac{dF^{Sm}}{d\tau^A} = 0;$$

$$\frac{dF^{Sm}}{d\tau^B} = \frac{\sum_v \partial\Psi_v(\tau^B)/\partial\tau^B - \partial W_a(\tau^B; F^{Sm})/\partial\tau^B - \partial W_b(\tau^B; f)/\partial\tau^B}{1 + \partial W_a(\tau^B; F^{Sm})/\partial F}$$

2. has no effect on Home exports to B at $t = 1$, but increases the number of both Home exporters and exported products to B at $t = 2$.

b) A decrease in τ^B at $t = 1$, holding τ^A fixed and such that τ^B remains larger than τ^A:

1. increases the number of both Home exporters and exported products to A at $t = 1$ and $t = 2$;

2. increases the number of both Home exporters and exported products to B at $t = 1$ and $t = 2$.

Proof of Proposition 4. The proof follows from the definitions of m_{vt}^j, Lemma 2, and the facts that $H(\cdot)$ and $U(\cdot)$ are non-decreasing functions and that both $1 - G(2F^{\frac{1}{2}} + \tau^j)$ and $1 - G(\tau^j)$ are decreasing in $\tau^j, j = A, B$. In the general case, differentiating the m_{vt}^j's with respect to both variable trade costs, we obtain:

- $\frac{dm_{a1}^A}{d\tau^j} = u(H[F^{Sq}])h(F^{Sq})\frac{dF^{Sq}}{d\tau^j} < 0,\ j = A, B;$
- $\frac{dm_{b1}^A}{d\tau^A} = u[f^{Mo}]H[F^{Sq}(\tau^A, \tau^B; f^{Mo})]\frac{df^{Mo}}{d\tau^A} + \int_0^{f^{Mo}(\tau^A)} h(F^{Sq})\frac{dF^{Sq}}{d\tau^A}dU(f) < 0;$
- $\frac{dm_{b1}^A}{d\tau^B} = \int_0^{f^{Mo}(\tau^A)} h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f) < 0;$
- $\frac{dm_{a1}^B}{d\tau^A} = \int_0^{+\infty} h(F^{Sm})\frac{dF^{Sm}}{d\tau^A}dU(f) = 0;$
- $\frac{dm_{a1}^B}{d\tau^B} = \int_0^{+\infty} h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f) < 0;$
- $\frac{dm_{b1}^B}{d\tau^A} = u[f^{Mu}]H[F^{Sm}(\tau^B; f^{Mu})]\frac{df^{Mu}}{d\tau^A} + \int_0^{f^{Mu}(\tau^B)} h(F^{Sm})\frac{dF^{Sm}}{d\tau^A}dU(f) = 0;$
- $\frac{dm_{b1}^B}{d\tau^B} = u[f^{Mu}]H[F^{Sm}(\tau^B; f^{Mu})]\frac{df^{Mu}}{d\tau^B} + \int_0^{f^{Mu}(\tau^B)} h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f) < 0;$
- $\frac{dm_{a2}^A}{d\tau^A} = \frac{dm_{a1}^A}{d\tau^A}\left[1 - G(\tau^A)\right] - m_{a1}^A g(\tau^A) < 0;$
- $\frac{dm_{a2}^A}{d\tau^B} = \frac{dm_{a1}^A}{d\tau^B}\left[1 - G(\tau^A)\right] < 0;$
- $\frac{dm_{b2}^A}{d\tau^A} = \begin{bmatrix} u[f^{Mo}(\tau^A)]H(F^{Sq})\frac{df^{Mo}}{d\tau^A}\left[G(2\left[f^{Mo}(\tau^A)\right]^{1/2} + c + \tau^A) - G(\tau^A)\right] + \\ + \int_{f^{Mo}(\tau^A)}^{+\infty} h(F^{Sq})\frac{dF^{Sq}}{d\tau^A}[1 - G(2f^{1/2} + c + \tau^A)]dU(f) + \\ + \int_0^{f^{Mo}(\tau^A)} h(F^{Sq})\frac{dF^{Sq}}{d\tau^A}\left[1 - G(\tau^A)\right]dU(f) - \\ -g(\tau^A)\int_0^{f^{Mo}(\tau^A)} H(F^{Sq})dU(f) - g(2f^{1/2} + c + \tau^A)\int_{f^{Mo}(\tau^A)}^{+\infty} H(F^{Sq})dU(f) \end{bmatrix} < 0;$
- $\frac{dm_{b2}^A}{d\tau^B} = \frac{dm_{b1}^A}{d\tau^B}\left[1 - G(\tau^A)\right] + \int_{f^{Mo}(\tau^A)}^{+\infty} h\left[F^{Sq}\right]\frac{dF^{Sq}}{d\tau^B}\left[1 - G(2f^{\frac{1}{2}} + c + \tau^A)\right]dU(f) < 0;$
- $\frac{dm_{a2}^B}{d\tau^A} = \int_0^{+\infty}\left[1 - G(2\left[F^{Sq}\right]^{\frac{1}{2}} + \tau^B)\right]h(F^{Sq})\frac{dF^{Sq}}{d\tau^A}dU(f) < 0;$
- $\frac{dm_{a2}^B}{d\tau^B} = \begin{bmatrix} \int_0^{+\infty}\left[G(2\left[F^{Sm}\right]^{\frac{1}{2}} + \tau^B) - G(\tau^B)\right]h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f) - M_{b1}^B g(\tau^B) \\ + \int_0^{+\infty}\left[1 - G(2\left[F^{Sq}\right]^{\frac{1}{2}} + \tau^B)\right]h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f) - \\ - \int_0^{+\infty}\int_{F^{Sm}(\tau^B; f)}^{F^{Sq}(\tau^A, \tau^B; f)} g(2F^{1/2} + \tau^B)dH(F)dU(f) \end{bmatrix} < 0;$

- $\frac{dm_{b2}^B}{d\tau^A} = \int_{f^{Mu}(\tau^B)}^{+\infty} \left[1 - G(2f^{\frac{1}{2}} + c + \tau^B)\right] \left[1 - G(2\left[F^{Sq}\right]^{\frac{1}{2}} + \tau^B)\right] h(F^{Sq}) \frac{dF^{Sq}}{d\tau^B} dU(f) < 0;$
- $\frac{dm_{b2}^B}{d\tau^B} < 0.$

To find for example $\frac{dm_{b2}^B}{d\tau^B}$, notice that

$$\begin{aligned}
\frac{dm_{b2}^B}{d\tau^B} = & \underbrace{u(f^{Mu})H[F^{Sm}]\left[1 - G(\tau^B)\right]\frac{df^{Mu}}{d\tau^B}}_{(A)} + \left[1 - G(\tau^B)\right]\int_0^{f^{Mu}} h[F^{Sm}]\frac{dF^{Sm}}{d\tau^B}dU(f) - \\
& -g(\tau^B)\int_0^{f^{Mu}} H[F^{Sm}]dU(f) - \\
& \underbrace{-\left[1 - G(2\left[f^{Mu}\right]^{1/2} + c + \tau^B)\right] u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\int_{F^{Sm}}^{F^{Sq}} G(2F^{\frac{1}{2}} + \tau^B)dH(F) -}_{(B)} \\
& -\int_{f^{Mu}(\tau^B)}^{+\infty} g(2f^{1/2} + c + \tau^B)\int_{F^{Sm}}^{F^{Sq}} [1 - G(2F^{\frac{1}{2}} + \tau^B)]dH(F)dU(f) + \\
& +\int_{f^{Mu}(\tau^B)}^{+\infty} [1 - G(2f^{1/2} + c + \tau^B)]\left[1 - G(2\left[F^{Sq}\right]^{1/2} + \tau^B)\right] h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f) - \\
& \underbrace{-\int_{f^{Mu}(\tau^B)}^{+\infty} [1 - G(2f^{1/2} + c + \tau^B)]\left[1 - G(2\left[F^{Sm}\right]^{1/2} + \tau^B)\right] h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f) -}_{(C)} \\
& -\int_{f^{Mu}(\tau^B)}^{+\infty} [1 - G(2f^{1/2} + c + \tau^B)]\int_{F^{Sm}}^{F^{Sq}} g(2F^{\frac{1}{2}} + \tau^B)dH(F)dU(f),
\end{aligned}$$

which is negative since each of its terms is negative. To see it, add the 1st (A) and 4th (B) terms above to obtain,

$$(A) + (B) = \left[\begin{array}{c}
u(f^{Mu})H[F^{Sm}]\left[1 - G(\tau^B)\right]\frac{df^{Mu}}{d\tau^B} - u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\int_{F^{Sm}}^{F^{Sq}} dH(F) + \\
+G(2\left[f^{Mu}\right]^{1/2} + c + \tau^B)u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\int_{F^{Sm}}^{F^{Sq}} dH(F) + \\
+\left[1 - G(2\left[f^{Mu}\right]^{1/2} + c + \tau^B)\right] u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\int_{F^{Sm}}^{F^{Sq}} G(2F^{\frac{1}{2}} + \tau^B)dH(F)
\end{array}\right]$$

where

$$u(f^{Mu})H[F^{Sm}]\left[1 - G(\tau^B)\right]\frac{df^{Mu}}{d\tau^B} - u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\int_{F^{Sm}}^{F^{Sq}} dH(F) = u(f^{Mu})\frac{df^{Mu}}{d\tau^B}\{H[F^{Sm}]\left[2 - G(\tau^B)\right] - H[F^{Sq}]\} < 0$$

under the minor technical (but plausible) condition that $H[F^{Sm}]\left[2 - G(\tau^B)\right] - H[F^{Sq}] > 0$. Therefore, $(A) + (B)$ is decomposable into a sum of negative terms. proceeding similarly, the 7th term (C) can be decomposed as,

$$\begin{aligned}
(C) &= \left[\begin{array}{c}
-\int_{f^{Mu}(\tau^B)}^{+\infty}[1 - G(2f^{1/2} + c + \tau^B)]h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f) + \\
+\int_{f^{Mu}(\tau^B)}^{+\infty}[1 - G(2f^{1/2} + c + \tau^B)]G(2\left[F^{Sm}\right]^{1/2} + \tau^B)h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f)
\end{array}\right] \\
&= \left[\begin{array}{c}
h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}\int_0^{f^{Mu}(\tau^B)}[1 - G(2f^{1/2} + c + \tau^B)]dU(f) \\
+\int_{f^{Mu}(\tau^B)}^{+\infty}[1 - G(2f^{1/2} + c + \tau^B)]G(2\left[F^{Sm}\right]^{1/2} + \tau^B)h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f)
\end{array}\right]
\end{aligned}$$

so that each additive term is negative. Proceeding in a similar manner with the remaining expressions completes the proof for the general case where the fixed costs to expand product scope are arbitrarily sized relative to the fixed entry costs, i.e. as long as $f < F$.

When instead we consider the particular cases illustrated in Figures 2 and 3 in the main text, because there is a deterministic relationship between the fixed cost to expand the product scope f and the entry cost F, only one cumulative distribution function is needed to describe the masses of firms M_{vt}^{j} that export product v to destination j in each period t: that of the fixed entry costs $H(\cdot)$. Hence why $U(\cdot)$ does not appear in the definition of M_{vt}^{j}.

Consider first the case where the fixed cost to expand the product scope is relatively low, $f = \underline{\gamma} F, \underline{\gamma} \in (0,1)$. In that case, firms first expand their product scope within a new destination, and only then, they expand geographically across markets. Differentiating the M_{vt}^{j}'s with respect to both variable trade costs, we obtain:

- $\frac{dM_{a1}^{A}}{d\tau^{j}} = h(F^{Sq})\frac{dF^{Sq}}{d\tau^{j}} < 0$, $j = A, B$;
- $\frac{dM_{b1}^{A}}{d\tau^{A}} = h(\gamma F^{Mo})\frac{d(\gamma F^{Mo})}{d\tau^{A}} < 0$;
- $\frac{dM_{b1}^{A}}{d\tau^{B}} = h(\gamma F^{Mo})\frac{d(\gamma F^{Mo})}{d\tau^{B}} = 0$;
- $\frac{dM_{a1}^{B}}{d\tau^{A}} = h(F^{Sm})\frac{dF^{Sm}}{d\tau^{A}} = 0$;
- $\frac{dM_{a1}^{B}}{d\tau^{B}} = h(F^{Sm})\frac{dF^{Sm}}{d\tau^{B}} < 0$;
- $\frac{dM_{b1}^{B}}{d\tau^{A}} = h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^{A}} = 0$;
- $\frac{dM_{b1}^{B}}{d\tau^{B}} = h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^{B}} < 0$;
- $\frac{dM_{a2}^{A}}{d\tau^{A}} = h(F^{Sq})\frac{dF^{Sq}}{d\tau^{A}}\left[1 - G(\tau^{A})\right] - H(F^{Sq})g(\tau^{A}) < 0$;
- $\frac{dM_{a2}^{A}}{d\tau^{B}} = h(F^{Sq})\frac{dF^{Sq}}{d\tau^{B}}\left[1 - G(\tau^{A})\right] < 0$;
- $\frac{dM_{b2}^{A}}{d\tau^{A}} = \left[\begin{array}{c} h(\gamma F^{Mo})\frac{d(\gamma F^{Mo})}{d\tau^{A}}\left[G(2\left[\gamma F^{Mo}\right]^{1/2} + \tau^{A}) - G(\tau^{A})\right] - H(\gamma F^{Mo})g(\tau^{A}) + \\ + h(F^{Sq})\frac{dF^{Sq}}{d\tau^{A}}\left[1 - G(2\left[F^{Sq}\right]^{1/2} + \tau^{A})\right] - \int_{\gamma F^{Mo}}^{F^{Sq}} g(2F^{\frac{1}{2}} + \tau^{A})dH(F) \end{array}\right] < 0$;
- $\frac{dM_{b2}^{A}}{d\tau^{B}} = h(F^{Sq})\frac{dF^{Sq}}{d\tau^{B}}\left[1 - G(2\left[F^{Sq}\right]^{1/2} + \tau^{A})\right] < 0$;
- $\frac{dM_{a2}^{B}}{d\tau^{A}} = h(\gamma F^{Mo})\frac{d(\gamma F^{Mo})}{d\tau^{A}}\left[1 - G(2\left[\gamma F^{Mo}\right]^{1/2} + \tau^{B})\right] < 0$;
- $\frac{dM_{a2}^{B}}{d\tau^{B}} = \left[\begin{array}{c} h(F^{Sm})\frac{d(F^{Sm})}{d\tau^{B}}\left[G(2\left[F^{Sm}\right]^{1/2} + \tau^{B}) - G(\tau^{B})\right] \\ -H(F^{Sm})g(\tau^{B}) - \int_{F^{Sm}}^{\gamma F^{Mo}} g(2F^{\frac{1}{2}} + \tau^{A})dH(F) \end{array}\right] < 0$;
- $\frac{dM_{b2}^{B}}{d\tau^{A}} = 0$;
- $\frac{dM_{b2}^{B}}{d\tau^{B}} = \left[\begin{array}{c} h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^{B}}\left[G(2\left[\gamma F^{Mu}\right]^{1/2} + \tau^{B}) - G(\tau^{B})\right] - H(\gamma F^{Mu})g(\tau^{B}) + \\ + h(F^{Sm})\frac{dF^{Sm}}{d\tau^{B}}\left[1 - G(2\left[F^{Sm}\right]^{1/2} + \tau^{B})\right] - \int_{\gamma F^{Mu}}^{F^{Sm}} g(2F^{\frac{1}{2}} + \tau^{B})dH(F) \end{array}\right] < 0.$

To find for example $\frac{dM_{b2}^B}{d\tau^B}$, notice that

$$\begin{aligned}\frac{dM_{b2}^B}{d\tau^B}=&h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^B}\left[1-G(\tau^B)\right]-H(\gamma F^{Mu})g(\tau^B)\\&+h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}\left[1-G(2\left[F^{Sm}\right]^{1/2}+\tau^B)\right]-\int_{\gamma F^{Mu}}^{F^{Sm}}g(2F^{\frac{1}{2}}+\tau^B)dH(F)\\&-h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^B}\left[1-G(2\left[\gamma F^{Mu}\right]^{1/2}+\tau^B)\right]\\&=h(\gamma F^{Mu})\frac{d(\gamma F^{Mu})}{d\tau^B}\left[G(2\left[\gamma F^{Mu}\right]^{1/2}+\tau^B)-G(\tau^B)\right]-H(\gamma F^{Mu})g(\tau^B)+\\&+h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}\left[1-G(2\left[F^{Sm}\right]^{1/2}+\tau^B)\right]-\int_{\gamma F^{Mu}}^{F^{Sm}}g(2F^{\frac{1}{2}}+\tau^B)dH(F),\end{aligned}$$

which is negative since each of its terms is negative. Proceeding in a similar manner with the remaining expressions completes the proof for the case where the fixed costs to expand product scope are low relative to the fixed entry costs. When finally we consider the case illustrated in Figure 3 in the main text, and the fixed cost to expand the product scope are high $-f=\overline{\gamma}F, \overline{\gamma}\in(0,1)$–, similar conclusions follow from totally differentiating the expressions reported in F.N. 2.3 completing the proof. ■

A.4.3 Proofs of the Predictions on Trade Policy Spillovers

Proof of Prediction 4. According to our model, non-exporters are those firms the fixed costs of which are above the fixed cost threshold $F^{Sq}(\tau^A,\tau^B;f)$ depicted in Figure 2. Their mass is characterized by $\Pr(e_t^i=0)\equiv 1-\sum_v\sum_j m_{vt}^j = 1-\int_0^{+\infty}H[F^{Sq}(\tau^A,\tau^B;f)]dU(f), \forall(j,v)$, which is the unconditional probability that firm i does not enter any foreign destination j with any product v at time t. Its complement is the unconditional probability that firm i exports at least product v to market j in period t, $\Pr(e_t^i=1)=\sum_v\sum_j \Pr(e_{vt}^{ij}=1)\equiv\sum_v\sum_j m_{vt}^j=\int_0^{+\infty}H[F^{Sq}(\tau^A,\tau^B;f)]dU(f)$. The effect of a ('distant') country B tariff reduction $d\tau^B<0:0<\tau^A\leq\tau^B$ on the unconditional probability of exporting any product v by firm i at time t is then given by

$$\frac{d\Pr(e_t^i=1)}{d\tau^B}=\sum_v\sum_j\frac{dm_{vt}^j}{d\tau^B}=\left[\begin{array}{c}u(H[F^{Sq}])h[F^{Sq}]\frac{dF^{Sq}}{d\tau^B}+\\+\int_0^{f^{Mo}(\tau^A)}h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f)+\\+\int_0^{+\infty}h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f)+\\+u[f^{Mu}]H[F^{Sm}(\tau^B;f^{Mu})]\frac{df^{Mu}}{d\tau^B}+\\+\int_0^{f^{Mu}(\tau^B)}h(F^{Sm})\frac{dF^{Sm}}{d\tau^B}dU(f)\end{array}\right]<0$$

since each of the additive terms is negative, by Lemma 2 and Proposition 2. Since we are interested on the effects of a tariff reduction in a 'distant' country B on the probability of exporting to a 'close' destination $j=A$ product v in period t for firm i, only the first two additive terms in the previous expression are relevant,

$$\frac{d\Pr(e_t^{iA}=1)}{d\tau^B}=\sum_v\frac{dm_{vt}^A}{d\tau^B}=u(H[F^{Sq}])h[F^{Sq}]\frac{dF^{Sq}}{d\tau^B}+\int_0^{f^{Mo}(\tau^A)}h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f)<0$$

corresponding each to the increased probability of entry with the 'core' and 'non-core' products, respectively. The remaining three additive terms capture the 'own market effect' on entry in market

B of reductions in τ^B with products $v = a, b$. Notice that the effect of trade liberalization on the 'core' product a is larger than on the 'non-core' product b, $\left|\frac{dm_{at}^A}{d\tau^B}\right| = \left|\int_0^{+\infty} h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f)\right| > \left|\int_0^{f^{Mo}(\tau^A)} h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}dU(f)\right| = \left|\frac{dm_{bt}^A}{d\tau^B}\right|$. The effect on older exporters is captured by the effect on the mass of firms that entered in period $t-1$ (or earlier) in destination A, and survived there in period t, $\Pr(e_t^{iA} = 1|\sum_{s=1}^{t-1} e_{t-s}^{iA} > 0)$ $=[1 - G(\tau^A)]$, $t \geq 2$, which does not depend on τ^B: $\frac{d\Pr(e_t^{iA}=1|\sum_{s=1}^{t-1} e_{t-s}^{iA}>0)}{d\tau^B}= 0$. Hence $\frac{d\Pr(e_t^{iA}=1)}{d\tau^B} > \frac{d\Pr(e_t^{iA}=1|\sum_{s=1}^{t-1} e_{t-s}^{iA}>0)}{d\tau^B}$, concluding the proof. ■

Proof. The probability that a firm i that has just started to export product v will enter a new foreign market $j \neq A$ in the next period with that product is given by $\Pr(e_{v2}^{ij} = 1|e_{v1}^{iA} = 1$ & $e_{v1}^{ij} = 0)$ $=1 - G(2F^{1/2} + \tau^j)$, $\forall(v, j)$. As apparent from Figure 2, the mass of new exporters in t that will enter the 'distant' country B with (at least) product a in $t+1$ is given by $\Pr(e_{a2}^B = 1|e_{a1}^A = 1\&e_{a1}^B = 0) = \Pr(i \in m_{a2}^B - m_{a1}^B[1 - G(\tau^B)]) = \int_0^{+\infty}\int_{F^{Sm}(\tau^B;f)}^{F^{Sq}(\tau^A,\tau^B;f)} [1 - G(2F^{1/2} + \tau^B)]dH(F)dU(f)$, i.e. destination A exporters that expand geographically into B in $t+1$ with either their core or with both products, net of those exporters $i \in m_{a1}^B[1 - G(\tau^B)]$ which entered there in t with product a and *just* survived (continuing exporters). According to Proposition 2 and Lemma 2, a tariff reduction in the 'close' destination A, $d\tau^A < 0 : 0 < \tau^A \leq \tau^B$, will increase entry there in period t, and conditional on survival, will increase entry in the 'distant' destination B in $t+1$ since,

$$\frac{d\Pr(e_{a2}^B = 1|e_{a1}^A = 1\&e_{a1}^B = 0)}{d\tau^A} = \int_0^{+\infty} [1 - G(2[F^{Sq}]^{1/2} + \tau^B)]h(F^{Sq}(\tau^A, \tau^B; f))\frac{dF^{Sq}}{d\tau^A}dU(f) < 0,$$

where $\Pr(e_{vt}^B = 1|\prod_{i=1}^{t-1} e_{vt-i}^A = 1$ & $e_{vt-1}^B = 0)$, $t \geq 2$, is the probability that a firm that has been an exporter of that same product v for a longer period will enter market B. Since that probability is zero because experienced exporters have already learned their profitability, it does not depend on tariffs: $\frac{d\Pr(e_{vt}^B=1|\prod_{s=1}^{t-1} e_{vt-s}^A=1 \text{ \& } e_{vt-1}^B=0)}{d\tau^A} = 0$.

Consider now the probability that a firm i that starts to export product v in destination A in period t will enter destination B and expand its product scope there in the next period $t+1$, $\Pr(e_{b2}^{iB} = 1|e_{v1}^{iA} = 1$ & $e_{b1}^{iB} = 0) = [1 - G(2f^{1/2} + c + \tau^B)][1 - G(2F^{1/2} + \tau^j)]$, $v = a, b$. Again from Figure 2, the mass of new exporters in t that will enter the 'distant' country B with their non-core product b in $t+1$ is given by $\Pr(e_{b2}^B = 1|e_{v1}^A = 1$ & $e_{b1}^B = 0) = \Pr(i \in m_{b2}^B - m_{b1}^B[1 - G(\tau^B)]) = \int_{f^{Mu}(\tau^B)}^{+\infty} [1 - G(2f^{1/2} + c + \tau^B)]\int_{F^{Sm}(\tau^B;f)}^{F^{Sq}(\tau^A,\tau^B;f)} [1 - G(2F^{1/2} + \tau^B)]dH(F)dU(f)$, i.e. destination A exporters that expand geographically into B in $t+1$ with both products, becoming global firms, net of those exporters $i \in m_{b1}^B[1-G(\tau^B)]$ which entered there in t with product b and *just* survived (continuing exporters). According to Proposition 2 and Lemma 2, a tariff reduction in the 'close' destination A, $d\tau^A < 0 : 0 < \tau^A \leq \tau^B$, will increase entry there in period t, and conditional on survival, will also expand their product scope in the 'distant' destination B in $t+1$ since, $\frac{d\Pr(e_{b2}^B=1|e_{v1}^A=1\&e_{b1}^B=0)}{d\tau^A} = \int_{f^{Mu}(\tau^B)}^{+\infty} [1 - G(2f^{1/2} + c + \tau^B)][1 - G(2[F^{Sq}]^{1/2} + \tau^B)]h(F^{Sq}(\tau^A, \tau^B; f))\frac{dF^{Sq}}{d\tau^A}dU(f) < 0 = \frac{d\Pr(e_{vt}^B=1|\prod_{s=1}^{t-1} e_{vt-s}^A=1 \text{ \& } e_v^B}{d\tau^A}$, where $\Pr(e_{vt}^B = 1|\prod_{s=1}^{t-1} e_{vt-s}^A = 1$ & $e_{vt-1}^B = 0)$, $t \geq 2$, is the probability that a firm that has been an exporter of that same product v for a longer period will enter market B. Since that probability is again zero, because experienced exporters have already learned their profitability, it does not depend on tariffs, which concludes the proof. ■

Proof. Let the probability of exiting a foreign 'nearby' market A right after entering there with product v for firm i be $\Pr(e_{v2}^{iA} = 0|e_{v1}^{iA} = 1)$ $=G(\tau^A + c\mathbf{1}_{\{v=b\}}) > 0$ if market A is the firm's first, and

$\Pr(e_{vt+1}^{ij} = 0|e_{vt}^{ij} = 1 \,\&\, e_{vt-1}^{ij} = 1) = 0$, $t \geq 2$, $j \neq A$, otherwise. The latter is also equal to the probability of exiting a market after being there for more than one period. As apparent from Figure 2, the mass of new exporters in t that will exit the 'nearby' country A with their core product a in $t+1$ is then given by $\Pr(e_{a2}^{A} = 0|e_{a1}^{A} = 1) = \Pr(i \in G(\tau^A)m_{a1}^{A}) = G(\tau^A)[\int_0^{+\infty} \int_0^{F^{Sq}(\tau^A,\tau^B;f)} dH(F)dU(f)]$. According to Proposition 2 and Lemma 2, a tariff reduction in the 'distant' destination B will increase entry in the 'nearby' destination A in period t, and therefore exit from there in $t+1$ since $\frac{d\Pr(e_{a2}^{A}=0|e_{a1}^{A}=1)}{d\tau^B} = G(\tau^A)u[H(F^{Sq})]h(F^{Sq})\frac{dF^{Sq}}{d\tau^B} < 0 = \frac{d\Pr(e_{vt+1}^{j}=0|e_{vt}^{j}=1 \,\&\, e_{vt-1}^{j}=1)}{d\tau^B}$, $t \geq 2$, $j \neq A$ for $d\tau^B < 0 : 0 < \tau^A \leq \tau^B$. This is a short run third country effect of a tariff reduction in the 'distant' country B.

And new exporters are also more likely to drop 'non-core' product b from their first export destination A right after entry than old exporters: consider now the probability of dropping a non-core product $v = b$ right after entering in firm i's first export destination A with it, relative to the probability of dropping a non-core product $v = b$ for an experienced exporter, $\Pr(e_{bt+1}^{iA} = 0|e_{bt}^{iA} = 1 \,\&\, e_{bt-1}^{iA} = 1) = 0$, $t \geq 2$,

$$\Pr(e_{b2}^{iA} = 0|e_{b1}^{iA} = 1) = G(\tau^A + c) > 0 = \Pr(e_{b2}^{iA} = 0|e_{bt}^{iA} = 1 \,\&\, e_{bt-1}^{iA} = 1).$$

From Figure 2, the mass of new exporters in t that will exit the 'nearby' country A with their non-core product b in $t+1$ is given by $\Pr(e_{b2}^{A} = 0|e_{b1}^{A} = 1) = \Pr(i \in G(\tau^A + c)m_{b1}^{A}) = G(\tau^A + c)[\int_0^{f^{Mo}(\tau^A)} \int_0^{F^{Sq}(\tau^A,\tau^B;f)} dH(F)dU(f)]$. According to Proposition 2 and Lemma 2, a tariff reduction in the 'distant' destination B will increase entry with the 'non-core' product b in the 'nearby' destination A in period t, and therefore exit from there in $t+1$ since $\frac{d\Pr(e_{b2}^{A}=0|e_{b1}^{A}=1)}{d\tau^B} = G(\tau^A + c)\int_0^{f^{Mo}(\tau^A)} h(F^{Sq}(\tau^A,\tau^B;f))\frac{dF^{Sq}}{d\tau^B}dU(f) < 0 = \frac{d\Pr(e_{b2}^{A}=0|e_{bt}^{A}=1 \,\&\, e_{bt-1}^{A}=1)}{d\tau^B}$ for $d\tau^B < 0 : 0 < \tau^A \leq \tau^B$. This is again a short run third country effect of a tariff reduction in the 'distant' country B.

To understand the lack of symmetry in trade liberalization, let the probability of exiting a foreign 'distant' market B right after entering there with product v for firm i be $\Pr(e_{v2}^{iB} = 0|e_{v1}^{iB} = 1) = G(\tau^B + c\mathbf{1}_{\{v=b\}}) > 0$, and $\Pr(e_{vt+1}^{ij} = 0|e_{vt}^{ij} = 1 \,\&\, e_{vt-1}^{ij} = 1) = 0$, $t \geq 2$, $j \neq B$, otherwise. The latter is also equal to the probability of exiting a market after being there for more than one period. As apparent from Figure 2, the mass of new exporters in t that will exit the 'distant' country B with their core product a in $t+1$ is then given by $\Pr(e_{a2}^{B} = 0|e_{a1}^{B} = 1) = \Pr(i \in G(\tau^B)m_{a1}^{B}) = G(\tau^B)[\int_0^{+\infty} \int_0^{F^{Sm}(\tau^B;f)} dH(F)dU(f)]$ which is unaffected by a tariff liberalization in the 'nearby' country A according to Proposition 2 and Lemma 2, since $\frac{dm_{a1}^{B}}{d\tau^A} = 0$ for $d\tau^A < 0 : 0 < \tau^A \leq \tau^B$.

Similarly, consider now the probability of dropping a non-core product $v = b$ right after entering there with it, relative to the probability of dropping a non-core product $v = b$ for an experienced exporter:

$$\Pr(e_{b2}^{iB} = 0|e_{b1}^{iB} = 1) = G(\tau^B + c) > 0 = \Pr(e_{b2}^{iB} = 0|e_{bt}^{iB} = 1 \,\&\, e_{bt-1}^{iB} = 1).$$

From Figure 2, the mass of new exporters in t that will exit the 'distant' country B with their non-core product b in $t+1$ is given by $\Pr(e_{b2}^{B} = 0|e_{b1}^{B} = 1) = \Pr(i \in G(\tau^B + c)m_{b1}^{B}) = G(\tau^B + c)[\int_0^{f^{Mu}(\tau^B)} \int_0^{F^{Sm}(\tau^B;f)} dH(F)dU(f)]$ which is unaffected by a tariff liberalization in the 'nearby' country A according to Proposition 2 and Lemma 2, since $\frac{dm_{b1}^{B}}{d\tau^A} = 0$ for $d\tau^A < 0 : 0 < \tau^A \leq \tau^B$, completing the proof. [33] ■

[33] Eckel et al. (2016) show that multiproduct firms are more likely to drop non-core products than their core ones. We will now show that our model captures such a feature, but not as a result of trade liberalization by a non-trading

Proof. Consider the first market, A, for the core product a. From the proof of prediction 1 we know that the growth rate of exports of the firm's core-product in the firm's first market from first to second year is given by

$$\sigma_a^A \equiv \frac{E(\mu|\,\mu > \tau^A) - \tau^A}{2} - \mathbf{1}_{\{E\mu \leq \tau^A\}}\varepsilon - \mathbf{1}_{\{E\mu > \tau^A\}}\frac{E\mu - \tau^A}{2}$$

noticing that it only depends on the trade policy tariff τ^A of the just entered market A. And similarly for the the growth rate of exports of the firm's non-core product b in the firm's first market from first to second year, $\sigma_b^A \equiv \frac{1}{2}[E(\mu|\,\mu > \tau^A + c) - E\mu]$. More generally, recall that since the firm learns about its product profitability in its first market entered, A, the growth rate of exports of the firm's product v from first to second year in market j, other than the firm's first, $j \neq A$, is nil in all periods: $E(q_{vt+1}^j \Big| \mu > (2f^{1/2} + c)\mathbf{1}_{\{v=b\}} + \tau^j) = E(q_{vt}^j \Big| \mu > (2f^{1/2} + c)\mathbf{1}_{\{v=b\}} + \tau^j) = \frac{E(\mu|\mu>(2f^{1/2}+c)\mathbf{1}_{\{v=b\}}+\tau^j)-c\mathbf{1}_{\{v=b\}}-\tau^j}{2}$ for all $t \geq 1$. Thus, export growth of product v in market j does only depend on the country-specific tariff levied there τ^j and as such, a trade liberalization tariff change in a third country $d\tau^{-j} < 0 : 0 < \tau^j \leq \tau^{-j}$ have no exffect on the growth rate of exports in country j: $\frac{d\sigma_v^j}{d\tau^{-j}} = 0, \forall(j, v)$. ■

A.5 Margin Decompositions

Denote by X_{ijt} the total value of exports from country i to country j in time t, and by X_{ijt}^f the total value of exports from country i to country j in time t by firm f. Lower case letters denote 'logs' of upper case equivalent values, ex. $x_{ijt} \equiv \ln X_{ijt}$, while a 'upper bar' denotes 'average', ex. firm average sales in destination j at time t is $\overline{X}_{ijt}^f{=}\frac{1}{N_{ij}^E}\sum_{f\in E} X_{ijt}^f.N_{ij}^E{\equiv}|f \in E|$ denotes the cardinality of the set $\{f \in E\}$, *i.e.* the number of firms f in set E.

Following Eaton, Eslava, Kugler and Tybout (2007), we can define the growth rate in exports as:

$$\frac{\Delta X_{ijt}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}$$

partner country. Consider the probability of dropping a non-core product $v = b$ right after entering in the nearby country A with it, relative to the probability of dropping a core-product $v = a$ for firm i :

$$\Pr(e_{b2}^{iA} = 0|e_{b1}^{iA} = 1) = G(\tau^A + c) > G(\tau^A) = \Pr(e_{a2}^{iA} = 0|e_{a1}^{iA} = 1).$$

From Figure 2, the mass of new exporters in t that will exit the 'nearby' country A with their non-core product b in $t+1$ is given by $\Pr(e_{b2}^A = 0|e_{b1}^A = 1) = \Pr(i \in G(\tau^A + c)m_{b1}^A) = G(\tau^A + c)][\int_0^{f^{Mo}(\tau^A)}\int_0^{F^{Sq}(\tau^A,\tau^B;f)} dH(F)dU(f)]$. According to Proposition 2 and Lemma 2, a tariff reduction in the 'distant' destination B will increase entry with the 'non-core' product b in the 'nearby' destination A in period t, and therefore exit from there in $t+1$ since $\frac{d\Pr(e_{b2}^A=0|e_{b1}^A=1)}{d\tau^B} = G(\tau^A + c)\int_0^{f^{Mo}(\tau^A)} h(F^{Sq}(\tau^A,\tau^B;f))\frac{dF^{Sq}}{d\tau^B}dU(f) < 0$ for $d\tau^B < 0 : 0 < \tau^A \leq \tau^B$. Comparing the two expressions, following a trade liberalization in the 'distant' country B, $d\tau^B < 0 : 0 < \tau^A \leq \tau^B$, the probability of dropping a non-core product b is ambiguous relative to that of dropping a core product a, i.e. $\frac{d\Pr(e_{a2}^A=0|e_{a1}^A=1)}{d\tau^B} \gtrless \frac{d\Pr(e_{b2}^A=0|e_{b1}^A=1)}{d\tau^B}$ since $c > 0$, $G(.)$ is non-decreasing in its argument but $\left|\int_0^{f^{Mo}(\tau^A)} h(F^{Sq}(\tau^A,\tau^B;f))\frac{dF^{Sq}}{d\tau^B}dU(f)\right| < \left|\int_0^{+\infty} h(F^{Sq}(\tau^A,\tau^B;f))\frac{dF^{Sq}}{d\tau^B}dU(f)\right| = \left|u[H(F^{Sq})]h(F^{Sq})\frac{dF^{Sq}}{d\tau^B}\right|$. The intuition behind this result is that although the failure rates of non-core products are higher than those of core products for a given firm, that is not necessarily the case on average because the mass of multiproduct firms is relatively small within the Home economy.

which makes results less sensible to small values ('0s' in flows) and a +x% followed by a -x% returns the level to the same level, as opposed to what would happen if dividing by the value of exports in $t-1$. We can then decompose the change in the value of exports (numerator) into the change in exports of continuers 'C' (those firms exporting in both t and $t-1$) and that of entrants, 'e' (firms exporting in t but not in $t-1$, including 'single year' exporters 's', which are firms exporting either in t or in $t-1$, but not in both) and exiters, 'd' (firms exporting in $t-1$ but not in t), where the set 'E' denotes the unin of subsets $E = \{e\} \cup \{f\} \cup \{s\}$:

$$\begin{aligned}
\Delta X_{ijt} &= \sum_{f\in E} \Delta X^f_{ijt} + \sum_{f\in C} \Delta X^f_{ijt} \\
&= \sum_{f\in e} \Delta X^f_{ijt} + \sum_{f\in d} \Delta X^f_{ijt} + \sum_{f\in C} \Delta X^f_{ijt} \\
&= \sum_{f\in e} (X^f_{ijt} - \overline{X}^f_{ijt-1} + \overline{X}^f_{ijt-1}) + \sum_{f\in d} (-X^f_{ijt-1} + \overline{X}^f_{ijt-1} - \overline{X}^f_{ijt-1}) + \sum_{f\in C} \Delta X^f_{ijt} \\
&= N^e_{ij}\overline{X}^f_{ijt-1} + \sum_{f\in e} (X^f_{ijt} - \overline{X}^f_{ijt-1}) - N^d_{ij}\overline{X}^f_{ijt-1} - \sum_{f\in d} (X^f_{ijt-1} - \overline{X}^f_{ijt-1}) + \sum_{f\in C} \Delta X^f_{ijt}
\end{aligned}$$

where the third equality follows from (i) noting that for firms in the set of entrants, $\{f \in e\}, \Delta X^f_{ijt} = X^f_{ijt} - 0$ while for firms in the set of exiters, $\{f \in d\}, \Delta X^f_{ijt} = 0 - X^f_{ijt-1}$;and from (ii) adding and subtracting the average exports per firm in $t-1$, $\overline{X}^f_{ijt-1}$, within the subsets of 'entrants', N^e_{ij}, and 'exiters', N^d_{ij}. Then, the growth rate in exports can be decomposed into the relative contribution of continuers, entrants and exiters as follows:

$$\begin{aligned}
\frac{\Delta X_{ijt}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})} &= \frac{\sum_{f\in C} \Delta X^f_{ijt}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})} + \frac{\sum_{f\in e} \Delta X^f_{ijt}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})} + \frac{\sum_{f\in d} \Delta X^f_{ijt}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})} \\
&= \underbrace{\underbrace{\frac{\sum_{f\in C} \frac{1}{2}(\overline{X}^f_{ijt} + \overline{X}^f_{ijt-1})}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}}_{\text{Share of continuers' exports}} \underbrace{\frac{\sum_{f\in C} \Delta X^f_{ijt}}{\sum_{f\in C} \frac{1}{2}(\overline{X}_{ijt} + \overline{X}_{ijt-1})}}_{\text{Growth in continuers' sales}}}_{\text{Contribution to growth of continuers}} + \\
&\quad + \underbrace{\underbrace{\frac{N^e_{ij}\overline{X}^f_{ijt-1}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}}_{\text{Increase in the number of exporters}} + \underbrace{\frac{\sum_{f\in e} (X^f_{ijt} - \overline{X}^f_{ijt-1})}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}}_{\text{Difference between entrants' sales and those of the average firm in } t-1}}_{\text{Contribution to growth of entrants (includes single year exporters in } t\text{)}} \\
&\quad \underbrace{- \underbrace{\frac{N^d_{ij}\overline{X}^f_{ijt-1}}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}}_{\text{Drop in the number of exporters}} - \underbrace{\frac{\sum_{f\in d} (X^f_{ijt-1} - \overline{X}^f_{ijt-1})}{\frac{1}{2}(X_{ijt} + X_{ijt-1})}}_{\text{Drop in sales from exiters}}}_{\text{Contribution to growth of exiters (includes single year exporters in } t-1\text{)}}
\end{aligned}$$

Then following Goldberg et al. (2010) and Bernard et al. (2009), we can further decompose the growth rate in the (log) value of exports of continuer firms into the product 'p' extensive and intensive margins, as:

$$\sum_{f\in C}\Delta X_{ijt}^{f} = \underbrace{\sum_{p\in A} X_{ijt}^{fp}}_{\text{New products Added}} - \underbrace{\sum_{p\in D} X_{ijt}^{fp}}_{\text{Old products Dropped}} + \underbrace{\sum_{p\in G} \Delta X_{ijt}^{fp}}_{\text{Existing products Growing}} + \underbrace{\sum_{p\in S} \Delta X_{ijt}^{fp}}_{\text{Existing products Shrinking}}$$

which can be inserted into the first additive term above, and each weighted by the share of continuers' exports in total export flows.

Finally, following Meyer and Ottaviano (2007), we can further decompose the average exports of product p by firm f into the average product price per firm f, $\overline{P}_{ijt}^{fp}$, and the average quantity per firm of product p, $\overline{Q}_{ijt}^{fp}$, as:

$$\overline{X}_{ijt}^{fp}=\frac{1}{N_{ij}^{f}}\frac{1}{N_{ij}^{p}}\sum_{f}\sum_{p}X_{ijt}^{fp}=\frac{1}{N_{ij}^{f}}\frac{1}{N_{ij}^{p}}\sum_{f}\sum_{p}P_{ijt}^{fp}Q_{ijt}^{fp}=\frac{\sum\limits_{p}P_{ijt}^{fp}}{N_{ij}^{p}}\frac{\sum\limits_{f}Q_{ijt}^{fp}}{N_{ij}^{f}}\equiv\overline{P}_{ijt}^{fp}\overline{Q}_{ijt}^{fp}$$

(TBC)

A.6 Trade Policy Spillovers and Proximity to France

We report robustness checks for the results in Section 3.4 where we use a different weighting scheme for ROW tariffs. More precisely we weigh countries by proximity to France:

$$ROWtDistF_{jpt}=\sum_{c\neq j}\frac{\frac{1}{dist_{cF}}}{\sum_{c\neq j}\frac{1}{dist_{cF}}}t_{cpt} \tag{71}$$

where $dist_{cF}$ is distance between countries c and France.

Table 15: (Unconditional) Entry and Changes in ROW Tariff Averages Weighted by Distance to France

	(1)	(2)	(3)	(4)	(5)
		i			
	OLS	t FE	it FE	pt FE	ct FE
VARIABLES	Entry	Entry	Entry	Entry	Entry
FYFM	-0.0180***	-0.0180***	0.00547**	-0.0182***	-0.0185***
	(0.000411)	(0.000449)	(0.00225)	(0.000413)	(0.000413)
FYFP	0.000807***	0.000643***	-0.00762***	0.000438***	0.000535***
	(3.39e-05)	(4.20e-05)	(0.000358)	(3.59e-05)	(3.45e-05)
FYFMFP	0.536***	0.535***	0.543***	0.537***	0.535***
	(0.00827)	(0.00831)	(0.00854)	(0.00816)	(0.00828)
DROWt_distF_cpt	-0.000459***	-9.42e-05	0.000218**	-0.00393***	0.000384***
	(4.64e-05)	(7.89e-05)	(0.000111)	(0.000612)	(7.90e-05)
FYFMDROWt_distF_cpt	0.000903***	0.000231	-0.00548	0.00136***	0.00209***
	(0.000163)	(0.000836)	(0.00581)	(0.000201)	(0.000200)
FYFPDROWt_distF_cpt	0.000421***	0.000501***	-0.000324	0.000477***	0.000423***
	(4.61e-05)	(6.89e-05)	(0.000886)	(5.01e-05)	(4.43e-05)
FYFMFPDROWt_distF_cpt	-0.0354	-0.0357	-0.0330	-0.0359*	-0.0352
	(0.0219)	(0.0220)	(0.0225)	(0.0217)	(0.0218)
Observations	165,091,585	165,091,585	165,091,585	165,091,585	166,830,091
R-squared	0.161	0.165	0.183	0.162	0.162
N	1.650e+08	1.650e+08	1.650e+08	1.650e+08	1.670e+08
F	.	.	.	.	922.4
r2	0.161	0.165	0.183	0.162	0.162

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 16: Exit and Changes in ROW Tariff Averages Weighted by Distance to France

VARIABLES	(1) OLS Exit	(2) i t FE Exit	(3) it FE Exit	(4) pt FE Exit	(5) ct FE Exit	(6) ct i p FE Exit
FYFM	0.00236	0.0303***	0.00707***	0.00329	-0.00395	0.0213***
	(0.00292)	(0.00262)	(0.00262)	(0.00276)	(0.00287)	(0.00252)
FYFP	-0.0639***	-0.0397***	-0.0540***	-0.0566***	-0.0528***	-0.0302***
	(0.00241)	(0.00213)	(0.00218)	(0.00233)	(0.00239)	(0.00210)
FYFMFP	0.0798***	-0.0523***	0.0526***	0.0666***	0.0668***	-0.0579***
	(0.00406)	(0.00423)	(0.00513)	(0.00378)	(0.00392)	(0.00395)
DROWt_distF_cpt	0.0209***	-0.0359***	-0.0413***	-0.0351***	-0.0307***	-0.0325***
	(0.00217)	(0.00244)	(0.00381)	(0.00693)	(0.00291)	(0.00234)
FYFMFPDROWt_distF_cpt	-0.0602***	-0.00492	-0.0282***	-0.0294***	-0.0313***	-0.00485
	(0.00943)	(0.00657)	(0.00719)	(0.00884)	(0.00912)	(0.00639)
Observations	4,002,873	4,002,873	4,002,873	4,002,873	4,014,606	4,014,606
R-squared	0.119	0.305	0.465	0.200	0.169	0.321
N	4.003e+06	4.003e+06	4.003e+06	4.003e+06	4.015e+06	4.015e+06
F	.	.	.	.	2273	.
r2	0.119	0.305	0.465	0.200	0.169	0.321

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Conditional Entry and Changes in ROW Tariff Averages Weighted by Distance to France

VARIABLES	(1) OLS Entry	(2) i t FE Entry	(3) it FE Entry	(4) pt FE Entry	(5) ct FE Entry
FYLYFM	0.0370***	0.0365***	0.0419***	0.0375***	0.0367***
	(0.00126)	(0.00123)	(0.00132)	(0.00126)	(0.00126)
FYLYFP	0.00411***	0.00445***	0.00367***	0.00380***	0.00404***
	(0.000179)	(0.000165)	(0.000207)	(0.000182)	(0.000181)
FYLYFMFP	0.0167***	0.0161***	0.0175***	0.0166***	0.0169***
	(0.00210)	(0.00203)	(0.00205)	(0.00210)	(0.00213)
LDROWt_distF_cpt	-8.22e-05	0.000502***	0.000651***	-0.00389***	0.00123***
	(6.55e-05)	(0.000126)	(0.000157)	(0.000942)	(0.000132)
FYLYFMLDROWt_distF_cpt	0.00798**	0.00831**	0.00939***	0.00695*	0.00689*
	(0.00358)	(0.00342)	(0.00359)	(0.00356)	(0.00361)
FYLYFPLDROWt_distF_cpt	-0.00173***	-0.00168***	-0.00175**	-0.00205***	-0.00221***
	(0.000525)	(0.000532)	(0.000761)	(0.000536)	(0.000538)
Observations	76,060,824	76,060,824	76,060,824	76,060,824	77,181,223
R-squared	0.013	0.020	0.030	0.015	0.014
N	7.610e+07	7.610e+07	7.610e+07	7.610e+07	7.720e+07
F	.	.	.	.	338.2
r2	0.0129	0.0199	0.0300	0.0154	0.0144

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 18: Export Growth and Changes in ROW Tariff Averages Weighted by Distance to France

	(1)	(2)	(3)	(4)	(5)	(6)
		i				
	OLS	t FE	it FE	pt FE	ct FE	ct FE
VARIABLES	xg	xg	xg	xg	xg	xg
FYLYFM	0.0230	0.0169	0.0441	0.0210	0.00184	-0.00340
	(0.0272)	(0.0301)	(0.0295)	(0.0262)	(0.0273)	(0.0304)
FYLYFP	-0.0362	-0.0414	-0.00663	-0.0320	-0.0275	-0.0388
	(0.0248)	(0.0282)	(0.0249)	(0.0231)	(0.0242)	(0.0277)
FYLYFMFP	0.161***	0.236***	0.0159	0.147***	0.166***	0.238***
	(0.0333)	(0.0374)	(0.0420)	(0.0322)	(0.0335)	(0.0377)
LDROWt_distF_cpt	0.0211*	0.00812	0.0286	-0.344	0.00766	0.00429
	(0.0124)	(0.0228)	(0.0546)	(0.584)	(0.0214)	(0.0228)
FYLYFMFPLDROWt_distF_cpt	0.0195	0.0393	-0.0122	0.0271	0.0169	0.0345
	(0.0406)	(0.0545)	(0.0794)	(0.0506)	(0.0497)	(0.0541)
Observations	501,369	501,369	501,369	501,369	502,732	502,732
R-squared	0.016	0.094	0.305	0.100	0.018	0.103
N	501369	501369	501369	501369	502732	502732
F	92.66	76.71	41.17	83.86	156.3	.
r2	0.0159	0.0937	0.305	0.0995	0.0179	0.103

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1