Experimentation Speed Across Products: Evidence from Peru in the USA Market

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Abstract

This paper develops a model to explain how quickly exporters sequentially export products to a particular destination in a setting where product demands follow a joint bivariate distribution. By exporting shipments of a first product A to market d and observing realised demand, the exporter gradually updates his perceived demand for product B. Expected profitability of product B, and thus the decision to export, is shown to be a function of the number of shipments of A, the correlation coefficient between the two demands, as well as the mean export value of A. Sequential exporting is predicted to take place faster (after fewer shipments of product A) if (i) trade costs of product B are lower, (ii) the mean value of A exports is larger, and (iii) the higher is the correlation between product demands in market d. This prediction is then tested by a survival analysis, using a rich dataset of Peruvian firms that exported to the United States between 2006 and 2013. The enactment of the USA-Peru Free Trade Agreement in 2009, which eliminated most tariffs on Peruvian products in USA, is associated with an acceleration of the introduction of new products into that market, expressed as either fewer shipments of previous products or a shorter time spell between the first shipment of the old and the new product. Such acceleration tends to be larger for products with higher pre-FTA tariffs, not included in pre-FTA unilateral trade preferences by USA. Additionally, trade liberalisation tends to facilitate the introduction of new products by $pre-FTA$ firms after having sent smaller values of previous products.

Keywords: Export dynamics, experimentation, trade liberalisation, number of shipments, survival analysis, USA-Peru Free Trade Agreement

JEL Classification: F14, D21, F15, D22

1 Introduction

Recent literature on firm export dynamics has found that firms surviving in the export activity tend to experiment sequentially in the foreign market; but how fast do they experiment in that activity? And what factors determine that *experimentation speed*?

Albornoz et al. (2012) is one of the first studies on export sequential strategy, finding that new Argentinean exporters, despite having a higher probability of exiting the export business,

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grow more at the intensive and extensive margin, conditional on survival, compared to more established exporters. That is, surviving new exporters undertake a *sequential exporting* process.

Those described dynamics occur across destinations, leaving as a pending concern how dynamics in export decisions by firms work within one destination, across products. Moreover, the way trade liberalisation may affect those decisions remains insufficiently addressed.

Works like Albornoz et al. (2012) obtain that, by realising their export profitability in one market, firms may sequentially decide to sell to further destinations in the next period. However, that is not a real time estimation, either across markets and products within one destination. How fast do firms introduce a new product to a particular market? What factors determine the acceleration or delay of that decision? Does trade liberalisation play a role in this process?

Other studies on firm export dynamics focus on firms' probability to survive and/or exit the export activity. Roberts and Tybout (1997) and Eaton et al. (2008) describe the export entry and exit decision processes for Colombian firms. In the Peruvian context, Freund and Pierola (2010) theoretically explains the export entry determinants in terms of costs; while Malca and Rubio (2012) addresses the role of tenure as a driver of firms' export survival.

In that same line, other researches measure the duration of firms' permanence in the export activity and its determinants, by applying conventional methods like the Kaplam-Meier survival estimator or the Cox proportional hazard model. Indeed, Besedeš and Prusa (2006b) use these approaches to explore the role of product differentiation in the duration of USA import relationships. Volpe Martincus and Carballo (2008), with the same techniques, analyse the effect of product and geographical diversification, along with firm size, on the survival likelihood of Peruvian firms in the export business.

Even in the literature on multi-product firms, the use of duration models is practically limited to examining the survival of products in a firm's export portfolio. To my knowledge, no previous works on firm export dynamics have applied those methods under a more positive focus. One in which the event of entering into the export activity, i.e. a success, is analysed. One example is the decision to introduce a new product into a particular destination.

There is also a growing literature on experimentation in different areas, whereby the decision to undertake one particular action may be delayed, by gradually updating agents' beliefs on the payoff from that action. The use of that approach to illustrate firms' export strategies is quite recent, either by the role of learning from neighbour firms, like Fernandes and Tang (2014), or firms' previous experience in other markets, like Akhmetova and Mitaritonna (2012) and Nguyen (2012). Hence, firms' decision to introduce a new product to a market of interest by updating their beliefs on the demand for that product, given their previous experiences with other goods in that destination, is a subject of potential research under that approach.

Given the described gaps, this paper contributes to the literature by developing a theoretical model, empirically tested afterwards, explaining how quickly firms sequentially export products to a particular destination, incorporating the role of trade liberalisation and the firms' experience with other products in the market of interest. That is, what is the *experimentation speed* of firms across products in a market? In my approach, such speed is measured by the number of shipments of product A to market d by firm i required before deciding to introduce product B to that market. Hence, the fewer shipments of A prior to introducing B, the quicker the experimentation will be. The role of trade liberalisation in this scheme is accounted for as the tariff elimination by the market of interest on products from the country of origin.

I test the prediction from my theoretical model by a survival analysis, using a very rich dataset of Peruvian firms that exported to the United States between 2006 and 2013. I exploit the nature of my dataset, at the transaction level with actual dates, by constructing observations representing the event in which a Peruvian firm introduces one or many new products to the USA market, henceforth called an *experimentation round*. The Peru-USA case is an appropriate one for this research, since the two countries signed a Free Trade Agreement in 2009, and long discussions arose on the new opportunities and potential threats to the Peruvian manufacturing industry. Yet, little is known on the effects of this trade liberalisation process on the performance of Peruvian firms in that market.

By this analysis, not only do I measure the *experimentation speed* of Peruvian firms across products in the USA market. I also investigate whether the tariff elimination by USA on Peruvian products under the USA-Peru FTA plays an accelerating role in firms' decision to introduce a new product to that destination. This role can be assessed by comparing (1) firms founded before and after the FTA enactment; (2) experimentation rounds occurred before and after such enactment; (3) the original tariffs levied on the products introduced; or (4) the treatment given to the products before the FTA (whether the products enjoyed a unilateral USA trade preference). Additionally, I examine whether a firm's prior experience with other products in USA, measured as the mean export shipments of "old" products, exerts an accelerating effect on the decision to experiment with a new product.

My empirical approach embraces a Kaplan-Meier survival estimator, as well as a Cox proportional hazard model, where my time variable is the number of days before the firm's experimentation round i in USA, counting from the day round $i-1$ occurred, or firm's foundation. I also run OLS and panel data regressions at the experimentation round level, where my dependent variable is the number of shipments of product A before the introduction of product B to USA by a firm. Overall, the results find that trade liberalisation is associated with an acceleration of the introduction of new products into that market. Such acceleration tends to be larger for products with higher pre-FTA tariffs that were not included in pre-FTA unilateral trade preferences by USA, such as the ATPDEA regime or the MFN zero tariff. Moreover, in the case of firms founded before the FTA enactment, trade liberalisation tends to facilitate the introduction of new products after having sent smaller values of previous products.

The remainder of the paper is organised as follows. Section 2 goes deeper into the related literature. Section 3 presents the theoretical model. Section 4 describes the data and offers a descriptive analysis of Peruvian firms exporting to the USA market, focusing on their experimentation rounds. Section 5 presents the Kaplan-Meier survival analysis. Section 6 shows the results from my econometric approach. Section 7 concludes.

2 Related Literature

Three large strands of the previous literature clearly nourish my research: (i) firm export dynamics, (ii) multi-product firms and (iii) experimentation.

2.1 Firm Export Dynamics

Within the growing literature on ***firm export dynamics***, I highlight the recent interest in the ***sequential exporting*** strategy undertaken by firms in the foreign market.

Albornoz et al. (2012), which inspires part of my theoretical approach, is one of the first researches on that issue, focusing on the Argentinean industry. In line with previous researches, these authors argue that many new exporters give up very shortly after entering, despite having incurred substantial entry costs; while others raise sales and expand to new destinations. They assume that a firm's export profitability is initially uncertain, only realised once it enters the export market, paying a fixed entry cost. Such export profitability is perfectly correlated over time and across destinations, and its discovery leads to a *sequential exporting* process, whereby firms use their initial export experience to infer information on their potential success in this and other markets.

This compelling analysis is undertaken across markets, leaving unattended how these dynamics operate within one destination, i.e. how firms develop their strategy across products. Furthermore, trade liberalisation is yet to be accounted for in that analysis.

Like Albornoz et al. (2012) most literature reviewed on *firm export dynamics* cover the firm's decision to enter and exit the export activity, and its progress across destinations. Roberts and Tybout (1997), for instance, quantified the effect of prior exporting experience on Colombian manufacturing plants' decision to enter into foreign markets, finding that after a two-year absence, re-entry costs are as similar as those of a new exporter, due to export experience depreciation. Moreover, larger and older plants are all more likely to export. Eaton et al. (2008), also for the Colombian case, observe that, while many firms start and stop exporting, export sales are dominated by a few very large and stable firms.

Some studies address the Peruvian case, such as Freund and Pierola (2010), which shows a considerable entry and exit flows of Peruvian exporters each year. However, contrary to Albornoz et al. (2012), they argue that smaller firms can discover their entry costs by a very cheap trial, while firm size is positively associated with large export sales. In contrast, developing new products requires a much larger entry cost. Focusing on Peruvian agriculture, Malca and Rubio (2012) analyse the relation between tenure in export markets and export performance, finding that for one additional year a firm exports, there is a considerable rise in the probability of remaining as an exporter (survival).

The latter observation leads to a growing tendency to the use of duration models to measure firms' probability to remain or exit from the export activity. Besedeš and Prusa (2006a), for instance, address the duration of USA imports from up to 180 countries, finding a short median duration of about 2 or 4 years. They also obtain a negative duration dependence; that is, if a country can survive exporting for the first few years, its failure probability falls, maintaining its trade relation.

Other studies like Besedeš and Prusa (2006b) use more conventional survival analysis methods like the Kaplan-Meier estimator and the Cox proportional hazard models. These authors find that USA import trade relationships involving differentiated products, starting with considerably smaller initial purchases, have over twice as long a median duration as other product types. The larger these initial purchases, the longer the duration, and the larger the differences across product types. For the Peruvian case, Volpe Martincus and Carballo (2008) use both methods considering only new exporters, finding that both product and, especially, geographical diversification raise the chances of remaining an exporter. Larger firms, measured by number of employees, are more likely to survive in foreign markets. [1]

Despite the valuable findings from these studies, there is a limited consideration of trade liberalisation in the analysis of firm export dynamics. [2] Moreover, the cited papers on the

[1] Many other studies analyse export survival by the aforementioned approaches, such as Besedes and Blyde (2010) for Latin America and Carrère and Strauss-Kahn (2014) for non-OECD countries. Others explore alternative methods like discrete-time models (Hess and Persson (2012)), or the Prentice and Gloeckler (1978) model (Brenton et al. (2010)).

[2] Brenton et al. (2010), for instance, only introduces a dummy for countries signing a Regional Trade

Peruvian case have not addressed the recent enactment of the USA-Peru Free Trade agreement and other treaties. Hence, there is a huge potential to explore these issues and, from the commented Besedeš and Prusa (2006b) findings, we can also ask how the relationship between export size and duration varies across products.

Additionally, all studies on duration listed herein took the conventional process of considering the event of firms leaving the export market as the "failure" of interest. What about, instead, addressing a positive event of interest, for instance, how long it takes for firms to decide to enter into the export activity?

2.2 Multi-Product Firms

Since my focus is firms' export strategy across products in one destination, the event of interest I am interested in is the introduction of a new product into a foreign market. Therefore, it is necessary to refer to the literature on ***multi-product firms***. Within this strand, works like Eckel and Neary (2010), Eckel et al. (2009) and Mayer et al. (2011), on the role of "core competence" products in a context of trade liberalisation, clearly stand out, but most of them are limited to a single-year analysis at a firm level, rather than at a wider firm-product level.

Other studies follow the performance of *multi-product firms* in a longer period, such as Javorcik and Iacovone (2008), which presents stylised facts of firm-product dynamics in Mexican industry during an export boom. The authors find, among other facts, that new exporters tend to "start small" in value and number of products, and the introduction of new products is preceded by a surge in investment. Equally important, the intensive and extensive margin across products are positively correlated.

A valuable theoretical contribution is provided by Bernard et al. (2010), on the frequency, pervasiveness and determinants of product switching. The authors predict that the duration of a product in a firm's product mix is longer the greater the sale volume and the longer the tenure of the product; that the exit probability of a firm-product combination is decreasing in productivity and quality; and that the product adding and dropping rates are positively correlated. Motivated by that framework, Görg et al. (2012) analyses the determinants of products' survival in Hungarian firms' export mixes. Departing from the idea that product choices are endogenous, they find that both firm and product characteristics matter in export dynamics. In fact, firm productivity, as well as product scale and tenure, is associated with higher export survival rates.

Another remarkable theoretical approach is found at Bernard et al. (2006), which incorporates the role of trade liberalisation. Here, firm productivity is a combination of firm-level "ability" and firm-product-level "expertise", both unknown until the firm pays a sunk cost of entry. The authors conclude that higher "ability" raises a firm's productivity across all products, inducing a positive correlation between intensive and extensive margins. Trade liberalisation fosters productivity growth within and across firms and in aggregate, because firms drop marginally productive products and the least productive firms exit. However, surviving firms increase their share of products sold abroad, as well as their exports per product. Arkolakis and Muendler (2010), makes an empirical test with cross sectional Brazilian data, obtaining results akin to the predictions from Bernard et al. (2006).

These works, more focused on the firm-product level, offer a valuable contribution on the determinants of products' survival in firms' export mix. However, I propose to evaluate a

Agreement–, leaving room for further research.

different phenomenon. What determines firms' decision to introduce a product or set of products into one particular destination, and how long does it take for this event to occur? In other words, I am interested in measuring firms' experimentation speed in a market. And one departure point to consider comes from a literature survey by Bernard et al. (2011), highlighting studies which find that firms update their priors about profitability in export markets, based upon sales, deciding to exit or expand their penetration of export markets over time.

2.3 Experimentation

The point raised earlier leads me to refer to the literature on ***experimentation***. This strand dates back to a first model by Wald (1945b), illustrating sequential tests of statistical hypotheses. In this process, we may decide either to accept a null hypothesis, reject it, or continue the experiment by making an additional observation. That process terminates when one of the first two decisions is made; but will continue if we opt for the third. Thus, a sequential test is undertaken, where the number of observations is a random variable, unlike other tests where that number is predetermined. The author argues this test is more efficient as the expected number of observations required is lower.[3] Extensions to this approach can be found at Moscarini et al. (1998), aiming to find an optimal experimentation level, assuming the decision maker is impatient, making variable-size experiments each period, at some increasing and strictly convex cost before making a final decision. That optimal level is increasing in the confidence about the project outcome and for more impatient agents.

These basic ideas were further deployed in contexts like the decision to adopt new agricultural technologies in Ghana (Conley and Udry (2001)) and India (Foster and Rosenzweig (1995)) or the modelling of entrepreneurial learning (Minniti and Bygrave (2001)). The first two focus on belief updates depending on neighbours' performance.[4] Other studies, like Kelly and Kolstad (1999) on growth and pollution, emphasise that decision makers do a Bayesian learning process. This theoretical approach addresses the relation between greenhouse gas levels and global mean temperature changes. Policy makers learn depending on stochastic shocks to the realised temperature, and the expected learning time is related to the variance of that shock and the emissions policy, implying a tradeoff between emissions control and learning speed.

Closer to my focus are Rauch and Watson (2003) and Watson (1999) on "starting small" in a trade partnership. The former, theoretically portraying the relation between a developed country buyer and a developing country supplier, states that matched firms "start small" to assess the supplier's ability to successfully fulfil a large order. That propensity rises with the cost of seeking a new supplier, and falls with the probability of fulfilling a large order after training. The latter incorporates renegotiation into the analysis, making both agents decide with incomplete information whether to cooperate or betray each other. They find an equilibrium where partners "start small", uniquely selected under a strong renegotiation condition.

More into the exports matter is Fernandes and Tang (2014) on how learning from neighbouring firms affects new exporters' performance, updating their prior belief on a foreign market demand, based on the number of exporting neighbours, export heterogeneity and the firm's own belief. A positive signal from neighbours increases the firm's probability to enter a market and its initial sales, and that effect is stronger the more exporting neighbours and the less familiar to the market the firm is.

[3] Wald (1945a) provides more practical examples of this test.

[4] Bolton and Harris (1999) provides a theoretical approach in which N decision makers learn from each other's experimentations, deciding between a "safe" and a "risky" action.

Another approach is in terms of number of destinations explored. Akhmetova and Mitaritonna (2012) propose an experimentation model whereby a firm can postpone full entry into a market and learn more about its products' demand by accessing a few consumers. The firm chooses an optimal experimentation intensity (number of consumers accessed) and an entry/exit policy. That intensity will be larger if the firm is more productive, even if its beliefs are low. Empirically, these predictions are proven in a context of testing destinations before fully entering into a region.

But the closest work to my interest, inspiring part of my theoretical model, is Nguyen (2012), explaining why firms wait to export and why many fail. Its key assumption is imperfect correlation of demand across destinations, so that firms can use previously realised demands from other markets to forecast demands from untested destinations. This gives firms the chance to delay exporting to a particular market, by gathering information from already explored markets. Thus, firms opt for entering markets sequentially, entering and exiting destinations after realising their demands. A similar rationale I propose to apply to explaining firms' experimentation strategy within one destination, by introducing new products sequentially. Thus, I can theoretically measure how long it takes for a firm, after selling one new product to the market of interest, to sell another one, expressed as the number of shipments of the previous new product prior to the first shipment of the next one. Thus, I aim to measure firms' experimentation speed in a market and its determinants, highlighting the role of trade liberalisation. Note that Nguyen (2012) does not consider the influence of other firms. I follow this feature in my approach, as I am more interested in the transition from the first to the second and subsequent new products, rather than the decision to export for the first time.

3 Theoretical Model

The basics of my theoretical model are inspired from a previous study by Albornoz et al. (2012) on sequential exporting across markets.

A producer from country o evaluates whether to export or not to country d, with a product portfolio consisting of products A and B. If the firm decides to enter d, it will have to pay a sunk entry cost F_d per product, assumed to the identical across products, meant to reflect distribution channels, marketing strategy and exporting procedures, which might be specific to each kind of product. I assume other common entry costs across products within a market, such as information on institutional and policy characteristics of the foreign country, to be minimal and/or easily accessible to firms.

When exporting products A and B to country d, firms must pay a product-specific unit trade cost (tariff levied by d) τ^A and τ^B.[5] Variable costs per product comprise a unit export cost c_x and a firm-specific unit production cost, c_p^A and c_p^B. While production costs are known to the firm, unit export costs are unknown.

The demand side, on the other hand, is represented by the following function:

$$q^j(p^j) = d^j - p^j \tag{1}$$

where q^j denotes the quantity of product A or B exported; p^j is the price of that product; and d^j is an unknown demand component. Hence, uncertainty can be found in both the supply and demand sides. The calculation of firms' export profitability for product $j = \{A, B\}$, denoted as

[5] I make the assumption that home firm pays the tariff, since I do not have information on importers.

μ^j, will then consider the unknown demand component and the unknown unit export cost, as well as the known unit production cost:

$$\mu^j \equiv d^j - c_x - c_p^j \tag{2}$$

The unknown components of that export profitability of product j in destination d, $d^j - c_x$, can be summarised by the term μ^{Nj}. Hence, to determine the optimal quantity of product j exported to d at any time, firms maximise their profits –revenues minus costs–, expressed by:

$$\pi^j = (\mu^{Nj} - c_p^j - \tau^j - q^j)q^j \tag{3}$$

Consider an initial scenario where $\tau^A + c_p^A \leq \tau^B + c_p^B$, meaning that it is cheaper for the firm to produce and export product A. As this model focuses on a sequential entry strategy in market d, I present the case in which the firm first introduces the cheapest product A, subsequently selling the more costly product B.

When deciding to introduce product A to d, the firm maximises profits from Equation 3, considering its expected export profitability from selling A, $E\mu^{NA}$. If such expected profitability is greater than the known costs $\tau^A + c_p^A$, then the optimal export value for product A is:

$$\hat{q}^A = \begin{cases} \dfrac{E\mu^{NA} - c_p^A - \tau^A}{2}, & \text{if } E\mu^{NA} > \tau^A + c_p^A \\ \varepsilon, & \text{otherwise} \end{cases} \tag{4}$$

It must be pointed out, however, that even if the firm's initial expectations on the export profitability from product A are pessimistic ($E\mu^{NA} \leq \tau^A + c_p^A$), it may be tempted to sell an arbitrarily small value ε of product A to d, so as to have a preliminary view of demand in that market. Returning to the optimistic case, $\hat{q}^A$ is plugged into Equation 3 to obtain the maximised profits from introducing A to d:

$$\hat{\pi}^A = \left(\frac{E\mu^{NA} - c_p^A - \tau^A}{2}\right)^2 \tag{5}$$

The process described from Equation 3 to 5 also applies for the introduction of product B; but the gross maximised profits must be greater than the sunk entry cost F_d, for the firm to decide to sell a first shipment of B to d. Hence, the firm introduces product B if:

$$\left(\frac{E\mu^{NB} - c_p^B - \tau^B}{2}\right)^2 \geq F_d \tag{6}$$

Then, Equation 6 can be rearranged to obtain a minimum value required for $E\mu^{NB}$ to decide to export B:

$$E\mu^{NB} \geq 2F_d^{1/2} + \tau^B + c_p^B \tag{7}$$

One important assumption in this scheme is that export profitabilities are imperfectly correlated across products. Then, assuming that those profitabilities per product followed a bivariate normal distribution, with parameters $(E\mu^{NA}, E\mu^{NB}, \sigma^A, \sigma^B, \rho)$, I obtain a function for the expected export profitability for B, given the realisation of A:

$$E(\mu^{NB} \mid \mu^{NA}) = E\mu^{NB} + (\mu^{NA} - E\mu^{NA})\rho\frac{\sigma^A}{\sigma^B} \tag{8}$$

This outcome implies that $E(\mu^{NB} \mid \mu^{NA}) \geq 2F_d^{1/2} + \tau^B + c_p^B$ for the firm to decide to export B. From Equation 8, I could find a cutoff value of μ^{NA} above which the *sequential exporting* strategy would be undertaken.

However, under the scheme outlined so far, the firm only needs to make one shipment of product A to automatically realise the export profitability of that product, and that single piece of information is sufficient to decide whether to export B or not in the next period.

It is pertinent then to consider the more realistic assumption that the firm requires further shipments to be more certain about the demand of product A in market d. That will not only provide a better view of the demand for A; but will also give a tool to update the firm's expected export profitability of product B, leading to a better backed export decision. Furthermore, to simplify the model, I propose to take the uncertain export profitability as solely a function of the unknown demand of product j from destination d, denoted as x^j.

The maths and notation presented hereafter are inspired from Nguyen (2012), on delays in the export decision across destinations. Every shipment of product A provides one piece of information on the demand of that good, meaning that the firm is gradually realising the actual demand of A in market d. However, with those shipments, the firm is also updating its expected demand of product B. I may propose that each shipment of A produces one perceived demand x_i^A. All these perceived demands may be gathered in one random vector $x^A \equiv [x_1^A, \ldots, x_j^A, \ldots, x_J^A]$, where J is an arbitrarily large number of possible shipments.

I assume that demands for A and B in market d (x^A and x^B) follow a joint bivariate distribution. If the firm has not entered d yet, the moments of those demands collapse to:

$$E[x^A] = E[x^B] = 0 \tag{9a}$$

$$Var[x^A] = Var[x^B] = \sigma_0^2 > 0 \tag{9b}$$

$$\frac{Cov(x^A, x^B)}{\sigma_0^2} = \rho \rightarrow 0 < \rho < 1 \tag{9c}$$

While the firm begins exporting the less costly product A, it will be gradually updating its realised demand by calculating the mean demand of that product, considering $I_A \subseteq J$, the number of shipments so far:

$$\overline{x^A} = \frac{\Sigma_{i \in I_A} x_i^A}{I_A} \tag{10}$$

However, when it comes to decide to export product B to market d, the expected value and variance of the demand on that product are updated in function of the number of shipments of

A and the correlation coefficient. These values are obtained from the following functions:[6]

$$E[x^B \mid I_A] = \mu^B_{I_A} = \left(\frac{\Sigma_{i \in I_A} x^A_i}{I_A}\right)\left(\frac{I_A \rho}{I_A \rho + (1-\rho)}\right) \tag{11a}$$

$$Var[x^B \mid I_A] = \sigma^2_{I_A} = \sigma^2_0 \left(1 - \frac{I_A \rho^2}{I_A \rho + (1-\rho)}\right) \tag{11b}$$

Equations 11a and 11b imply a role for the number of shipments I_A. The more the firm has experimented with product A, the more its expected demand for B approaches to the sample mean of perceived demand for A. In other words, the firm is trusting more its own experience in market d with product A. Furthermore, the larger I_A, the lower the variance of B's demand $\sigma^2_{I_A}$. Hence, the firm is able to predict the demand x^B more precisely.

Let me go through the implications from extreme cases. When $I_A = 0$, meaning that firm i has not experimented yet with product A in market d, the expected demand of both A and B converge to zero, as in Equation 9a. When, instead, I_A tends to its maximum value J, the second term in brackets in the right hand side of Equation 11a will converge to unity. Hence, as mentioned above, the firm will practically rely solely on its own experience in market d with product A to decide on B.

Similar implications can be inferred for the correlation coefficient of products A and B. When $\rho = 0$, then $\mu^B_{I_A}$ will converge to zero, since experimenting with A does not provide any information on the demand of B in destination d. Conversely, when $\rho = 1$, its maximum value, then the second term in brackets from Equation 11a will converge to unity, meaning that firm i's own experience with product A provides full information to decide on product B in market d. Moreover, $\rho = 1$ makes $\sigma^2_{I_A}$ converge to zero, confirming the earlier statement.

There is an interesting implication when ρ lies between zero and unity, accounting for imperfect correlation of export profitabilities across products A and B. The second term in brackets of Equation 11a becomes lower than unity, which in turn represents a sort of penalty against the sample mean of the perceived demand of A –the first term in brackets–. In other words, the expected demand of B given the experience with A gets diminished by that second term, implying that what firm i has perceived so far from A is not sufficient to opt to introduce B into market d, and more information from A is required, translated into more shipments of A.

With the criteria presented above, I can then continuously compare the expected value of the demand for product B, given the updated realisations of the demand for A, with the known costs of B. If that updated expected demand for B equalises or exceeds those costs, then the firm will be prompted to make a first shipment of B to market d. Thus, if I replace μ^{NB} in Equation 7 with the function for $\mu^B_{I_A}$ in Equation 11a, that yields the following:

$$\left(\frac{\Sigma_{i \in I_A} x^A_i}{I_A}\right)\left(\frac{I_A \rho}{I_A \rho + (1-\rho)}\right) \geq 2F_d^{1/2} + \tau^B + c^B_p \tag{12}$$

By rearranging Equation 12 and denoting the right hand side of that function as TC_B –total known costs of product B–, I can obtain a cutoff value for the number of shipments of product

[6] See Appendix A for the proof for these functions.

A. Taking the first term in brackets of Equation 12, the sample mean of the perceived demand of A, as $\overline{x^A}$, I obtain the following condition:

$$I_A^* \geq \frac{(1-\rho)TC_B}{\rho(\overline{x^A} - TC_B)} \tag{13}$$

Equation 13 then displays a minimum number of shipments of product A required by firm i to decide to send one first shipment of product B to market d. From this condition, I can infer that cutoff value of I_A becomes lower if any of the total known costs of B, such as the unit trade cost τ^B, falls or is eliminated. Namely, when tariffs are eliminated under a trade liberalisation process, the number of shipments of A required to make a decision on B is reduced; or, the length of the experimentation time with product A in market d prior to the first shipment of B becomes shorter. Similarly, a higher ρ, the more correlated the demands of A and B are, the lower the cutoff value of I_A will be, since now the firm will require less information from A, which will be sufficient to make a decision on B.

These findings can be summarised in one single proposition, empirically tested afterwards.

Proposition 1: *There is a cutoff value for I_A, inversely related with ρ, the correlation between the demands of products A and B, as well as $\overline{x^A}$, the sample mean of the perceived demand of product A. Such cutoff is also directly related with F_d, the sunk entry cost per product, τ^B, the unit trade cost of product B, and c_p^B, the firm-specific unit production cost of B.*

Let me explore this proposition more deeply by calculating the derivative of the cutoff number of shipments of product A with respect to the main variables of interest. That leads to the following results:

$$\frac{\partial I_A^*}{\partial \tau^B} = \frac{1}{[(1-\rho)(2F_d^{1/2} + \tau^B + c_p^B)][\rho(\overline{x^A} - 2F_d^{1/2} - \tau^B - c_p^B)]} > 0 \tag{14a}$$

$$\frac{\partial I_A^*}{\partial \overline{x^A}} = \frac{-1}{(1-\rho)(2F_d^{1/2} + \tau^B + c_p^B)(\overline{x^A} - 2F_d^{1/2} - \tau^B - c_p^B)} < 0 \tag{14b}$$

$$\frac{\partial I_A^*}{\partial \rho} = \frac{-\overline{x^A}}{[(1-\rho)(2F_d^{1/2} + \tau^B + c_p^B)][\rho(\overline{x^A} - 2F_d^{1/2} - \tau^B - c_p^B)]} < 0 \tag{14c}$$

It can be observed that the relation between the variables of interest and I_A^* clearly depends on the initial values of those variables, although the sign of that effect remains unchanged.[7] Let me first focus on $\overline{x^A}$, the sample mean of the perceived demand of A. From Equations 14a and 14b, the size of the slope of I_A^* is lower in absolute value for larger mean export values of A; whereas Equation 14c shows a more negative relation for larger shipments of A. For the correlation coefficient and known costs, such as τ^B, the analysis is more complicated. Indeed, the size of the three derivatives is larger for extreme high and low values of those variables, meaning that the slopes are not linear. These dynamics described should be taken into account when it comes to testing Proposition 1 and interpreting the results.

Given the data availability, I may test the effect of trade liberalisation, as a tariff elimination by country d on most products, on the firm's number of shipments of old products prior to the

[7] The signs of the effects on I_A^* are obtained under the assumption that $\overline{x^A} > 2F_d^{1/2} + \tau^B + c_p^B$. Otherwise, the signs change. However, in a case where $\overline{x^A} < 2F_d^{1/2} + \tau^B + c_p^B$, it makes no sense to export B.

first shipments of a new product to market d. The number of shipments may also be proxied by the length of the time spell between the first shipment of product A and the equivalent of product B. The data also allows me to measure the impact of the mean export value of product A before the first shipment of B, as a proxy for the perceived demand of A in market d.

4 Data and Summary Statistics

4.1 The Data

The export data was provided by the Peruvian Society of Foreign Trade (COMEXPERÚ in Spanish), which manages data on daily export and import transactions from diverse sectors. This information is collected from the Peruvian Tax and Tariff Agency (Superintendencia Nacional de Administración Tributaria - SUNAT in Spanish).

The original datasets range from 1998 to 2013, each compiling information on daily export transactions per firm, from eight sectors: Agriculture, Basic Metal Industries, Chemical, Jewellery, Metallic-Mechanics, Non-Metallic Mining, Textile and Apparel, and Timber and Paper.

Each transaction contains very detailed information, such as the transaction date, name and tax code of the firm, port of departure, description and 10-digit tariff line of the product, destination and port of arrival, export value in US dollars, weight and unit of measure. This paper focuses on manufacturing industries due to the large share of small firms comprised, unlike more traditional extractive industries dominated by medium and large firms, as well as the known previous controversy on a potential damage by an FTA with USA to Peruvian manufacturers, especially the smallest firms.

From the Peruvian Tax and Tariff Agency, I also collected firm-level information, such as the year each firm came into existence and, where relevant, the year they exited the business, as well as the region their main headquarters is located.

Aiming to account for trade liberalisation, I collected the tariff rates levied by the United States at the HS 8-digit level, from the World Integrated Trade Solutions (WITS) database of the World Bank. These tariff rates derive from the Most Favoured Nation (MFN) scheme, until 2008. From 2009 onwards, under the Free Trade Agreement (FTA) between Peru and USA, the vast majority of these tariff rates become zero. Since many products were unilaterally liberalised by USA before the enactment of the FTA under the ATPDEA scheme, I also obtained the list of 8-digit tariff lines eligible under that regime, with their respective tariff until 2008.

For this analysis, I converted the original exports dataset into one on a daily basis. Thus, I proceeded to construct observations at the firm/day level, each representing one day on which firm i exports one or a set of new products to USA. This process involved the generation of relevant information, such as the number of days elapsing between rounds of new exports; every exact date each round took place, as well as the number of new products introduced and the order in which these new products were exported to USA for the first time.

This resulting daily dataset of new exports, covering the 2006-2013 period, is restricted to firms that started their business since 2006, leading to a total of 2,426 firms that sold to USA. This final sample includes both firms starting to export to USA with one single products and those starting with more than one good. It also considers those firms that never exported to USA up to three years since founded, raising the number to 7,806 firms.

4.2 Summary Statistics

4.2.1 Firms and Rounds of New Exports

Table 1 displays the 7,806 firms considered, according to their year of foundation, regardless of whether they ever exported or not to USA. In some statistics, I distinguish between firms starting before ($pre - FTA$ firms) and from 2009 ($post - FTA$ firms), intending to identify a potential influence of the USA-Peru FTA on firms' experimentation decisions. Hence, I end up with approximately 60% of firms that are $post - FTA$.

Table 1: Peru-USA - Exporters per Starting Year 2006-2013

Year	Freq.	Percent	Cum.
2006	1009	12.93	12.93
2007	992	12.71	25.63
2008	1052	13.48	39.11
2009	1149	14.72	53.83
2010	1044	13.37	67.2
2011	1055	13.52	80.72
2012	973	12.46	93.18
2013	532	6.82	100
Total	7806	100	

Source: COMEXPERÚ - SUNAT

From the eight sectors mentioned above, clearly Agriculture and Textile and Apparel are those accounting for the largest amount of firm export transactions involving new products –*experimentation rounds*–. Hence, for further analyses I gather the six remaining sectors into the group "OTHERS". Table 2 groups the experimentation rounds according to the sector product j belongs to. The upper part considers only the first experimentation round by each firm that ever exported to USA; whereas the lower part includes all rounds registered, leading to a total of 7,532 experimentation rounds by those 2,426 firms. [8]

[8]Products sold in one round may belong to more than one sector. However, the raw daily data shows that products from secondary sectors are mostly sold at minimum unit and transaction values compared to firms' core sectors. Also, the grouping made, which considers exports from six sectors into one category, helps control for this issue, assuming that an experimentation round consists of products from only one of these three groups.

Table 2: Peru-USA - Exporters per Sector 2006-2013

Sector (first exports)	Freq.	Percent	Cum.
Agriculture	792	32.65	32.65
Textile-Apparel	789	32.52	65.17
Others	845	34.83	100
Total	2426	100	

Sector (all new exports)	Freq.	Percent	Cum.
Agriculture	1782	23.66	23.66
Textile-Apparel	3624	48.11	71.77
Others	2126	28.23	100
Total	7532	100	

Source: COMEXPERÚ - SUNAT

Although the focus is the USA market, it is also relevant to take into account firms' experience in other destinations. Nevertheless, the daily basis and the nature of my dataset make it more difficult to control for that experience. As an approximation, I constructed the dummy *elsewhere*, taking value 1 if, between the firm's experimentation round $i-1$ and i in USA, that firm exported to any other destination. In Table 3 I distinguish the new export rounds according to that criterion, and it is evident from first experimentation rounds in USA that most Peruvian firms have previous experience in other markets. However, as firms subsequently experiment with more products in USA, it seems they become more focused in that destination, as results for all new exports show.

Table 3: Peru-USA - Exporters to USA Only vs. Elsewhere 2006-2013

Elsewhere (first exports)	Freq.	Percent	Cum.
No	298	12.28	12.28
Yes	2128	87.72	100
Total	2426	100	

Elsewhere (all new exports)	Freq.	Percent	Cum.
No	3534	46.92	46.92
Yes	3998	53.08	100
Total	7532	100	

Source: COMEXPERÚ - SUNAT

4.2.2 Number of Products Exported

The following tables are concentrated on the number of products exported by a Peruvian firm to USA. Table 4 groups firms according to the maximum number of new products introduced by firms in one single experimentation round. The figures show that most firms in the sample (55.15%) experiment with only one new product, followed by a 14.88% of firms exporting up to two new products in a round.

Table 4: Peru-USA - Maximum Number of New Products Introduced by a Firm to USA on Day t 2006-2013

N°	Freq.	Percent	Cum.
1	1338	55.15	55.15
2	361	14.88	70.03
3	187	7.71	77.74
4	138	5.69	83.43
5	93	3.83	87.26
6	74	3.05	90.31
7	60	2.47	92.79
8	32	1.32	94.11
9	33	1.36	95.47
10	22	0.91	96.37
11 - 20	65	2.65	99.02
21 - 94	23	0.92	100
Total	2426	100	

Source: COMEXPERÚ - SUNAT

It is equally striking to find that, throughout the 2006-2013 period, slightly more than 40% of firms have only exported one product to USA in total, as Table 5 states. Indeed, more than a half of the 2,426 firms that exported to USA during that period, have only introduced up to two products into that market.

To have a clearer view of firms' performance in terms of product experimentation in USA, in Table 6 I take all the 7,532 experimentation rounds counted to see how many products these rounds comprise. As expected from the previous numbers, over 64% of these rounds are composed by only one new product.

Table 5: Peru-USA - Total Number of New Products Introduced per Firm to USA 2006-2013

N°	Freq.	Percent	Cum.
1	980	40.40	40.40
2	331	13.64	54.04
3	200	8.24	62.28
4	122	5.03	67.31
5	98	4.04	71.35
6	83	3.42	74.77
7	69	2.84	77.62
8	56	2.31	79.93
9	50	2.06	81.99
10	46	1.9	83.88
11 - 20	223	9.2	93.08
21 - 30	89	3.67	95.88
31 - 60	61	2.47	99.26
61 - 256	18	0.72	100
Total	2426	100	

Source: COMEXPERÚ - SUNAT

Table 6: Peru-USA - Number of New Products Introduced to USA per Experimentation Round 2006-2013

N°	Freq.	Percent	Cum.
1	4866	64.60	64.60
2	1210	16.06	80.67
3	548	7.28	87.94
4	313	4.16	92.1
5	168	2.23	94.33
6	126	1.67	96.00
7	82	1.09	97.09
8	45	0.60	97.69
9	44	0.58	98.27
10	25	0.33	98.61
11 - 20	80	1.06	99.67
21 - 94	25	0.31	100
Total	7532	100	

Source: COMEXPERÚ - SUNAT

4.2.3 Experimentation Rounds per Firm

In the next stage of my descriptive analysis, I am interested in knowing how many rounds of new exports each firm has done to USA in the time period of study. Additionally, how many firms no longer introduce any new products after a particular round of new exports. That exercise is done in Table 7, initially for all firms in the sample.

Table 7: Peru-USA - Number of Experimentation Rounds by Firm i to USA
All Firms 2006-2013

N° Rounds	Experimenting Firms	%	Non-Exp. Firms	%
1	2426	100.00%	0	0.00%
2	1118	46.08%	1308	53.92%
3	720	29.68%	1706	70.32%
4	533	21.97%	1893	78.03%
5	415	17.11%	2011	82.89%
6	335	13.81%	2091	86.19%
7	280	11.54%	2146	88.46%
8	223	9.19%	2203	90.81%
9	188	7.75%	2238	92.25%
10	160	6.60%	2266	93.40%
11	134	5.52%	2292	94.48%
12	112	4.62%	2314	95.38%
13	105	4.33%	2321	95.67%
14	85	3.50%	2341	96.50%
15	74	3.05%	2352	96.95%
16	65	2.68%	2361	97.32%
17	55	2.27%	2371	97.73%
18	50	2.06%	2376	97.94%
19	44	1.81%	2382	98.19%
20	37	1.53%	2389	98.47%
21	32	1.32%	2394	98.68%
22	28	1.15%	2398	98.85%
23	24	0.99%	2402	99.01%
24	22	0.91%	2404	99.09%
25 - 26	20	0.82%	2406	99.18%
27	19	0.78%	2407	99.22%
28	18	0.74%	2408	99.26%
29 - 30	16	0.66%	2410	99.34%
31 - 32	13	0.54%	2413	99.46%
33	11	0.45%	2415	99.55%
34 - 36	9	0.37%	2417	99.63%
37 - 38	7	0.29%	2419	99.71%
39	6	0.25%	2420	99.75%
40 - 43	4	0.16%	2422	99.84%
44 - 55	3	0.12%	2423	99.88%
56 - 65	2	0.08%	2424	99.92%
66 - 67	1	0.04%	2425	99.96%

Source: COMEXPERÚ - SUNAT

The way to read these results is as follows: from the 2,426 firms that exported one first set of new products to USA, 1,118 firms (46.08%) move one step forward, undertaking a second experimentation round; while the other 1,308 (53.92%) firms never experimented with another new product again. Hence, for the effects of the survival analysis made afterwards, those 1,308 firms are considered as right censored. In a similar way, the next rows can be interpreted, so that only one firm managed to have up to 67 experimentation rounds; leaving the other 2,425 firms as right censored.

For the sake of that survival analysis, it is also necessary to establish differences in performance between $pre-FTA$ and $post-FTA$ firms. Hence, under the same previous rationale, Table 8 presents the equivalent exercise separately for both types of firms. It can be seen that the level of experimentation and right censoring across the two groups is very similar. Indeed, 45.47% of $pre-FTA$ firms jumped from the first to the second experimentation round; while that was the case for 46.71% of $post-FTA$ firms. Figures remain similar across the subsequent rounds, with the exception that the most experimenting $post-FTA$ firm has come to 39 rounds of new products, compared to the 67 rounds of one $pre-FTA$ firm.

Table 8: Peru-USA - Number of Experimentation Rounds per Firm to USA

(a) Pre-FTA Firms 2006-2008

N° Rounds	Experimenting Firms	%	Non-Exp. Firms	%
1	1225	100.00%	0	0.00%
2	557	45.47%	668	54.53%
3	360	29.39%	865	70.61%
4	273	22.29%	952	77.71%
5	214	17.47%	1011	82.53%
6	174	14.20%	1051	85.80%
7	145	11.84%	1080	88.16%
8	112	9.14%	1113	90.86%
9	100	8.16%	1125	91.84%
10	88	7.18%	1137	92.82%
11	76	6.20%	1149	93.80%
12	65	5.31%	1160	94.69%
13	64	5.22%	1161	94.78%
14	54	4.41%	1171	95.59%
15	45	3.67%	1180	96.33%
16	39	3.18%	1186	96.82%
17	35	2.86%	1190	97.14%
18	31	2.53%	1194	97.47%
19	28	2.29%	1197	97.71%
20	25	2.04%	1200	97.96%
21	22	1.80%	1203	98.20%
22	20	1.63%	1205	98.37%
23	17	1.39%	1208	98.61%
24	16	1.31%	1209	98.69%
25 - 26	14	1.14%	1211	98.86%
27 - 28	12	0.98%	1213	99.02%
29 - 30	11	0.90%	1214	99.10%
31 - 33	10	0.82%	1215	99.18%
34 - 36	8	0.65%	1217	99.35%
37 - 39	5	0.41%	1220	99.59%
40 - 43	4	0.33%	1221	99.67%
44 - 55	3	0.24%	1222	99.76%
56 - 65	2	0.16%	1223	99.84%
66 - 67	1	0.08%	1224	99.92%

Source: COMEXPERÚ - SUNAT

(b) Post-FTA firms 2009-2013

N° Rounds	Experimenting Firms	%	Non-Exp. Firms	%
1	1201	100.00%	0	0.00%
2	561	45.80%	640	52.24%
3	360	29.39%	841	68.65%
4	260	21.22%	941	76.82%
5	201	16.41%	1000	81.63%
6	161	13.14%	1040	84.90%
7	135	11.02%	1066	87.02%
8	111	9.06%	1090	88.98%
9	88	7.18%	1113	90.86%
10	72	5.88%	1129	92.16%
11	58	4.73%	1143	93.31%
12	47	3.84%	1154	94.20%
13	41	3.35%	1160	94.69%
14	31	2.53%	1170	95.51%
15	29	2.37%	1172	95.67%
16	26	2.12%	1175	95.92%
17	20	1.63%	1181	96.41%
18	19	1.55%	1182	96.49%
19	16	1.31%	1185	96.73%
20	12	0.98%	1189	97.06%
21	10	0.82%	1191	97.22%
22	8	0.65%	1193	97.39%
23	7	0.57%	1194	97.47%
24 - 28	6	0.49%	1195	97.55%
29 - 30	5	0.41%	1196	97.63%
31 - 32	3	0.24%	1198	97.80%
33 - 39	1	0.08%	1200	97.96%

Source: COMEXPERÚ - SUNAT

4.2.4 Export Values and Preference Regimes

It is important to point out that, prior to the enactment of the USA-Peru Free Trade Agreement, several Peruvian products had a tariff-free access to the USA market by unilateral trade preferences from that country, under the ATPDEA and zero-MFN schemes. The next two tables group the rounds of new exports according to their inclusion or not of at least one product favoured by either of those regimes. Table 10 exclusively focuses on the first exports by each of the 2,426 firms; while Table 9 covers all the 7,532 experimentation rounds in the sample.

The figures in Table 9 reveal that 63.27% of firms in the sample have started their experience in the USA market with either an ATPDEA or zero-MFN product. However, the amount of experimentation rounds comprising only products with no pre-FTA unilateral trade preference is also remarkable. In my whole sample, as shown in Table 10, 51.35% of experimentation rounds by firms include at least one product affected by one of the aforementioned regimes before the FTA was effective.

Table 9: Peru-USA - Firms' First Experimentation Rounds per Preference Regime 2006-2013

New ATPDEA product to USA on day t	New MFN product to USA on day t		
	No	Yes	Total
No	891	534	1425
Yes	668	333	1001
Total	1559	867	2426

Source: WITS - World Bank

Table 10: Peru-USA - Experimentation Rounds per Preference Regime 2006-2013

At least one new ATPDEA product to USA on day t	At least one new MFN product to USA on day t		
	No	Yes	Total
No	3664	1206	4870
Yes	1622	1040	2662
Total	5286	2246	7532

Source: WITS - World Bank

Briefly looking at daily exports by Peruvian firms to USA during 2006-2013, I constructed some Kernel densities of the log of a firm's total exports to that market on day t, considering only those days in which firms undertook an experimentation round, also taking into account that in those days –except for the first exports– firms may have exported both new products and other goods the firm previously sold to USA. Figures 1 and 2 display those densities for all the 7,532 experimentation rounds in the sample, and only the 2,426 first new exports, respectively. This exercise shows that export values by $post - FTA$ firms tend to be larger than those by older firms. Furthermore, focusing on Figure 2, the initial value with which $post - FTA$ firms jump into the USA market is usually larger than for $pre - FTA$ firms. While the latter on average start with a US \$ 21,568.26 shipment, the former do it with a mean value of US \$ 28,530.08.

Figure 1

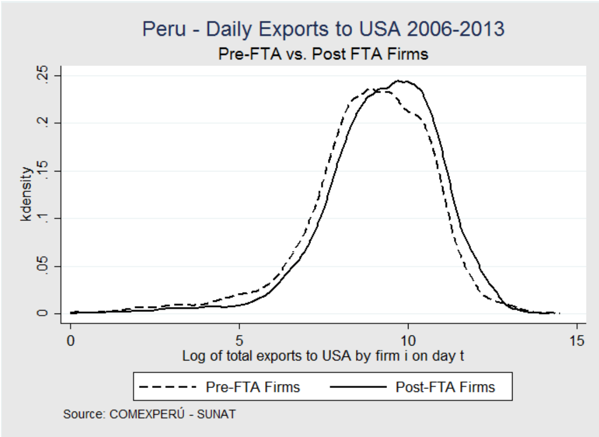
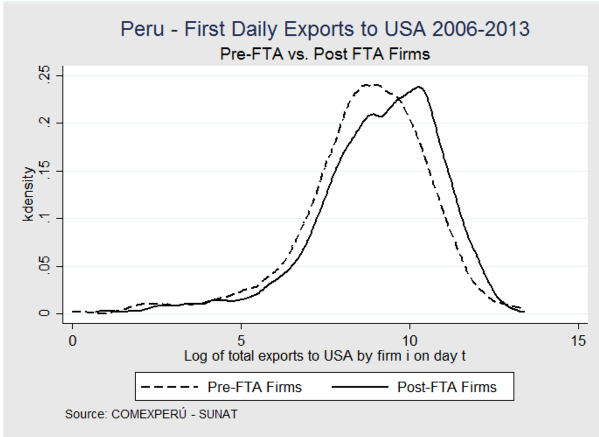


Figure 2



As a complement to the numbers in Tables 9 and 10, Figure 3 plots the Kernel densities of the pre-FTA weighted average tariff rate on a firm's exports to USA on day t, again only considering the days an experimentation round occurs on.[9] The histogram refers to the mean tariffs for all products sold by a firm on an experimentation round (both new and old products); whereas the black line takes the mean for only the new products sold on that day. Both weighted averages are very similar, with an overall mean between 7.9% and 8.6% per firm/day; but 14.04% of the experimentation rounds comprise only zero-tariff new products, under the zero-MFN scheme.

Figure 3

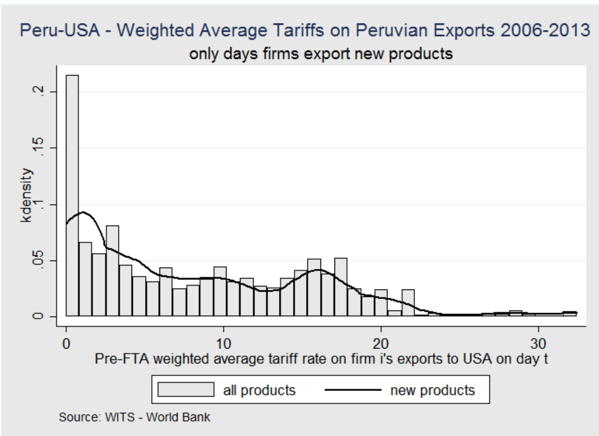
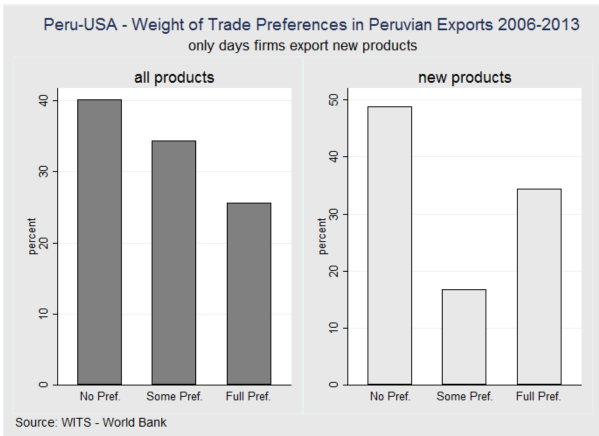


Figure 4



That last information makes it pertinent to analyse the share, in terms of export values, of products under a USA pre-FTA trade preference –be it ATPDEA or zero-MFN– on a day a firm experiments with new products. Figure 4 plots the densities of the weight of those preferences in firm i's exports to USA on day t, showing the vast majority of experimentation rounds comprise only new products with no preference at all (48.80%) or only fully liberalised products (34.39%). These preliminary findings must be taken into account for the survival analysis presented in the next section.

[9] Tariff rates are weighted by the export value of each product sold on day t.

5 Survival Analysis

My main interest is to test the main prediction from my theoretical model: whether trade liberalisation, in the shape of the tariff elimination on Peruvian goods exported to USA under the 2009 Free Trade Agreement, plays a facilitating role for experimentation. I am also interested in assessing a potential role of the size of export shipments prior to firms' experimentation rounds. One convenient approach is to characterise how long it takes for a Peruvian firm to introduce one or more new products into the USA market; namely, Peruvian firms' experimentation speed in that destination; and the main determinants of that speed.

To attain that outcome, I undertook a survival analysis which calculates the well-known Kaplan-Meier Survival Function. The innovation in this analysis, as opposed to most studies that consider as a failure the event of a firm leaving an export market or even dropping out of the export activity, is that the "failure" I assess is the event in which a Peruvian firm sells one or many new products to the USA market, i.e. the occurrence of an experimentation round. It should be kept in mind that a product is taken as "new" at the firm-destination level. That is, a product is new if The firm has never exported it to USA before.

Econometrics textbooks like Cleves et al. (2010) report that the Kaplan-Meier Estimator is a nonparametric estimate of the survival function, denoted as $S(t)$. That estimate, also known as the product limit estimate of $S(t)$ at any time t is defined as:

$$\hat{S}(t) = \Pi_{j|t_j \leq t}(\frac{n_j - d_j}{n_j}) \tag{15}$$

where n_j is the number of observations at risk at time t_j, and d_j is the number of failures at such t_j. This function is a product considering all j times there is a failure, both before and at time t. As a result, the estimate of the failure function is the complement of the estimated survival function: $1 - \hat{S}(t)$.

The basic way to interpret the Kaplan-Meier Estimator is: at day t, what is the probability for firms to introduce one or more new products into USA (failure)? Alternatively, at day t, what is the probability for firms not to experiment in USA with any other new product (survival)? The time span is measured in days, depending on the order of the experimentation round. For instance, for the first new exports by a firm to USA, I count the number of days since the firm was established. For the second experimentation round, in contrast, I count how many days have elapsed since the firm's first products sold to USA. That latter rationale is applied for the subsequent rounds. Note that the analysis considers the right censored firms lost in each round, as well as those that never exported to USA during the 2006-2013 period.

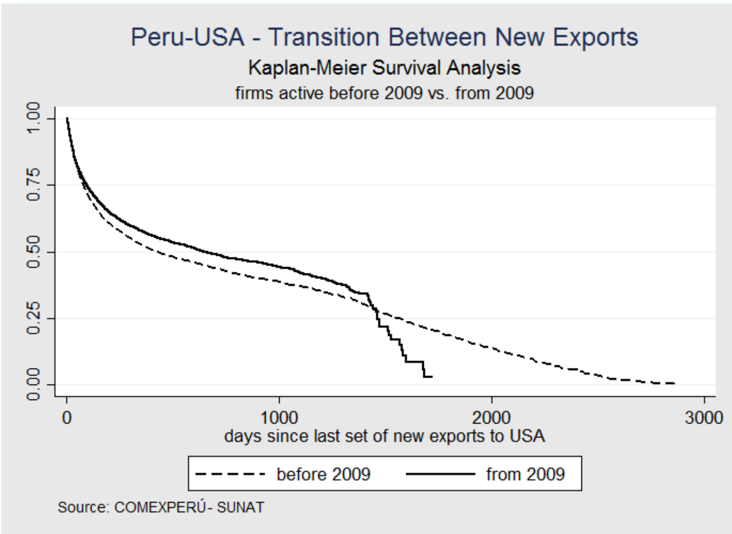
5.1 Pre-FTA vs. Post-FTA Firms

For the first Kaplan-Meier analysis, I split the sample of 7,806 firms according to their year of foundation, leading to 3,053 firms starting between 2006 and 2008 –$pre-FTA$ firms– and 4,753 founded between 2009 and 2013 –$post - FTA$ firms–. The outcomes are striking.

Figure 5 provides an overall comparison of the Kaplan-Meier Survival Function between both types of firms, considering the pool of experimentation rounds, regardless of the order and the firm. The observations "at risk" in this exercise are the number of days elapsed since the previous experimentation round of firm i. The dashed line shows the function for the experimentation rounds by $pre - FTA$ firms; whereas the solid line is the equivalent for $post - FTA$ firms.

This figure shows that, overall, experimentation rounds by $pre-FTA$ firms take shorter to effectively occur than by $post-FTA$ firms. More precisely, the probability for $pre-FTA$ firms of introducing one or more new products into the USA market rises to 50% 423 days after their previous experimentation round; while that probability is reached at 646 days for $post-FTA$ firms. Similarly, the "failure" probability becomes 25% at 79 days for $pre-FTA$ firms; while for $post-FTA$ firms, that likelihood is reached at 95 days. This might indicate that $pre-FTA$ firms tend to experiment faster than $post-FTA$ firms; however, after 1,500 days approximately, the survival probability for $post-FTA$ firms becomes lower.[10] The results also indicate that there is one $post-FTA$ firm which, 1,718 days after its last experimentation round, has not introduced any other products up to the end of the sample, leading to a final survival probability of 2.86%. As for $pre-FTA$ firms, the survival probability becomes zero after 2,862 days, meaning that all the time spells "at risk" concluded with the introduction of a new product into the USA market, with many other time spells became right-censored in between.[11]

Figure 5



However, I consider it much more informative to estimate the survival probability separately for each experimentation round, so that the interpretation can be done at the firm level. Thus, Figure 6 presents the results for each of the first four rounds of new exports. The pattern observed in Figure 5 is exhibited in Figure 6a) for first experimentation rounds. This time, both estimates of the survival function follow the same path; but the survival probability for $post-FTA$ firms drops at a faster pace from day 1,424. For $post-FTA$ firms, the probability of experimenting for the first time in USA becomes 50% at 1,419 days since the firm was founded; while that length was 1,391 days for $pre-FTA$ firms. For the reason exposed earlier, the survival probability becomes zero –the probability of exporting for the first time to USA becomes one– after 1,682 days for $post-FTA$ firms and 2,862 days for $pre-FTA$ firms.

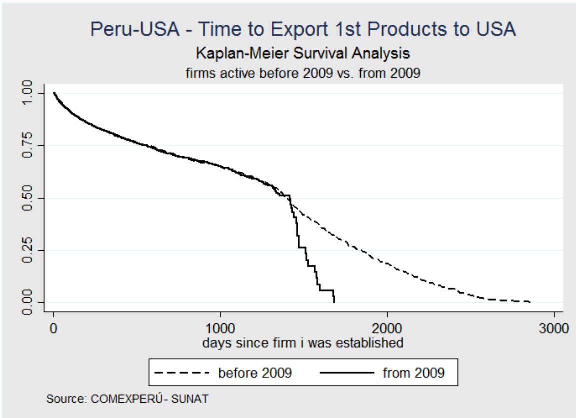
[10] This is likely to be explained by two factors: (1) the longer existence of $pre-FTA$ firms; and (2) the imposed 3-year threshold for firms that never exported to USA. The latter is more relevant for $post-FTA$ firms as we can only observe them between 2009 and 2013. Hence, fewer $post-FTA$ firms remain in the sample after removing those never selling to USA, affecting the probability function.

[11] A time spell becomes right-censored if a firm never exports to USA or no longer sells any other new product to USA. The date considered to close that time spell is either the day the firm closed down or the last date the firm sold any product to any other destination in my sample.

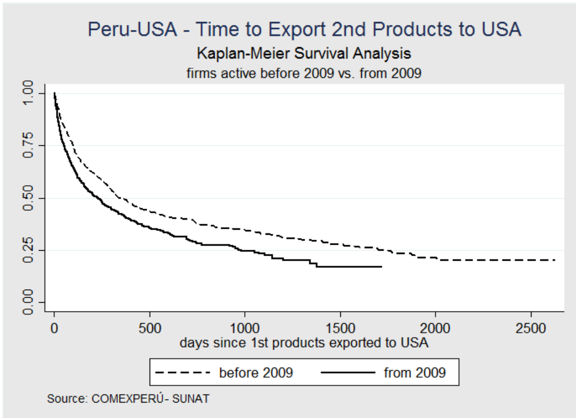
In the next three graphs, a trend in favour of $post-FTA$ firms becomes evident. Figure 6b), only considering firms that exported for a first time to USA, indicates that the probability of experimenting with a second consignment of new products in the USA market becomes 50% for $post-FTA$ firms 226 days since their first export; whereas that length for older firms is 339. Another way to interpret those results is: at day 500 since their first export to USA, the probability of having experimented for a second time there is about 57% for $pre-FTA$ firms; and almost 65% for newer firms. Moreover, there is a maximum 83.12% probability for $post-FTA$ firms to experiment for a second time, attained at 1,718 days; while that maximum likelihood is just 79.98% for incumbents, at 2,628 days. Even though both types of firms take less time to undertake a third or fourth experimentation rounds, Figures 6c) and 6d) confirm that $post-FTA$ firms are faster. The contrast with Figure 5 is arguably explained by the longer existence of $pre-FTA$ firms, which were able to make up to 67 experimentation rounds, compared to the maximum of 39 for new firms.

Figure 6: Kaplan-Meier Survival Analysis: Firms Active Before 2009 vs. From 2009

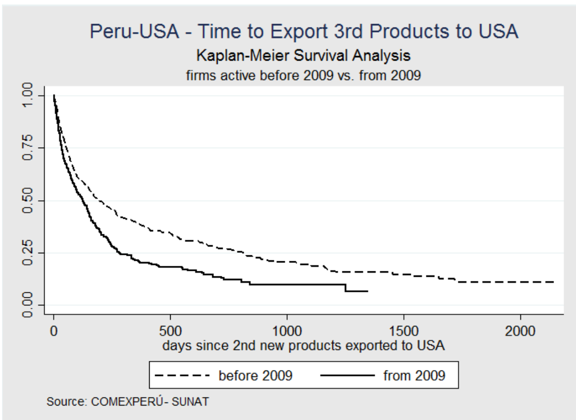
(a)



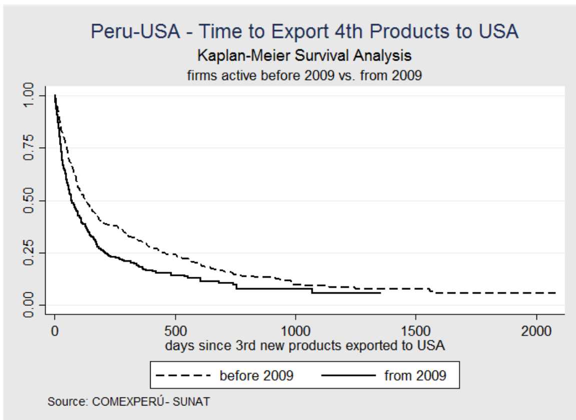
(b)



(c)



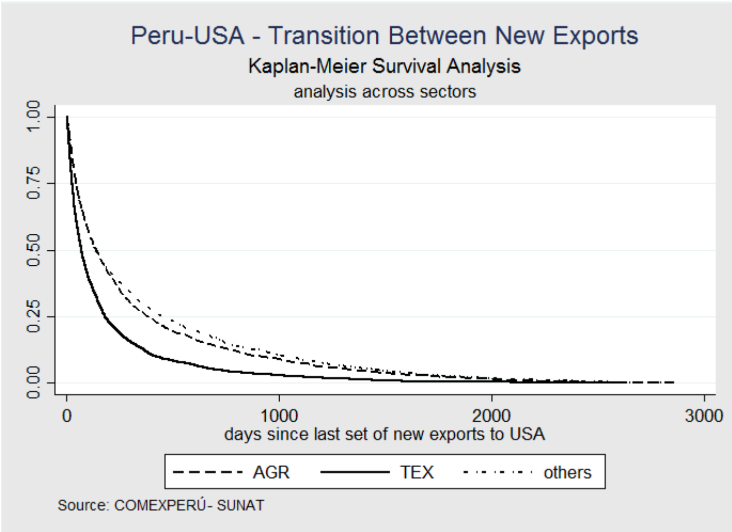
(d)



5.2 Analysis Across Sectors

Another survival analysis distinguishes between the sectors the products exported belong to. Figure 7 presents the Kaplan-Meier estimator for all experimentation rounds in the sample, according to the three sectoral groups constructed earlier. Overall, sets of new exports embracing textile and apparel products –solid line– take place faster than agricultural exports –dashed line–, and other manufacturing industries –dotted line–. Note that, since I compare the span lengths between sectors –how long it takes to introduce products from a particular sector–, it is impossible to control for right-censored firms in this estimation.

Figure 7



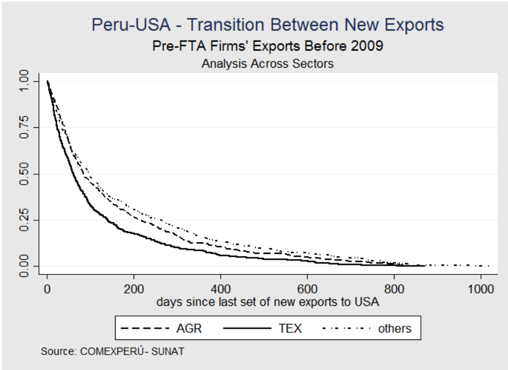
When looking at each round separately, Kaplan-Meier estimations –not reported in this paper– reveal that agricultural first exports tend to be faster than those from other sectors; but from the second round onwards, textile and apparel new exports take fewer days than the rest.

In order to better assess the findings from this exercise, I combined the analysis across sectors with the pre-FTA vs. post-FTA criterion. But I consider it more informative to split the experimentation rounds by $pre - FTA$ firms between rounds before and after 2009, so as to identify a clearer role of trade liberalisation. Figure 8 presents a set of nine graphs with the results from the criteria combination. The first row shows the overall analysis for all experimentation rounds; the second one, only the first exports; and the third one, the second round. The first column considers the new exports by $pre - FTA$ firms done before 2009; the second column takes those made by such firms since the FTA; and the third one works with all $post - FTA$ firms.

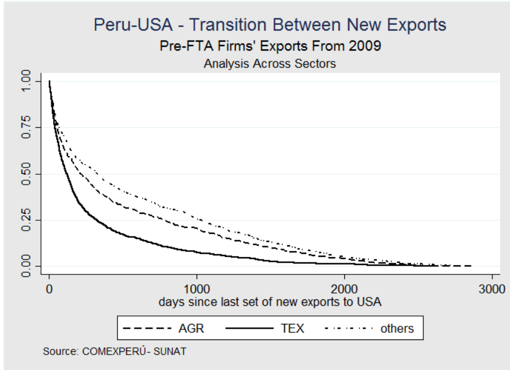
The dynamics previously described of experimentation across sectors are still evident in this estimation. What is most remarkable, looking at the second row of first exports, is that the argued faster experimentation speed by agricultural exports is mostly explained by pre-FTA transactions (Figure 8(d)) and, to a much lesser extent, transactions by $post - FTA$ firms (Figure 8(f)). In the case of post-FTA transactions by $pre - FTA$ firms (Figure 8(e)), it is textile exports that are effectively faster, just like in subsequent rounds. This outcome may imply a particular boost for textile exports by the Free Trade Agreement, especially for firms that, prior to the FTA, depended on the ATPDEA trade preferences given by USA to many textile exports, and were not certain about the renewal of those preferences. Also, some textile products were levied with very high tariffs, meaning that, with the elimination of those tariffs since 2009, it is much easier to export these products, in a shorter time span, which matches my theoretical approach.

Figure 8: Kaplan-Meier Survival Analysis Pre- vs. Post-FTA Firms: Analysis Across Sectors

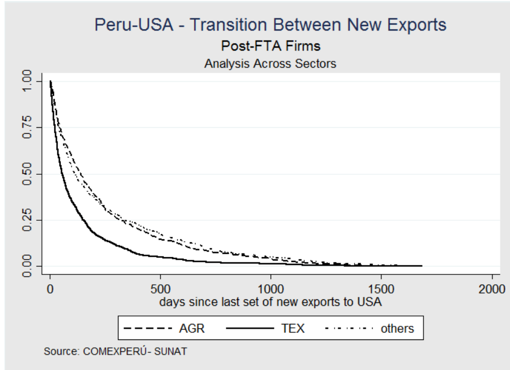
(a)



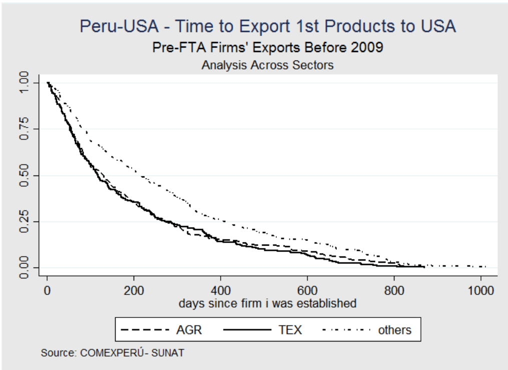
(b)



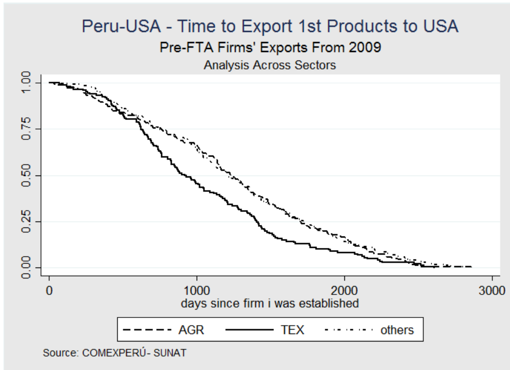
(c)



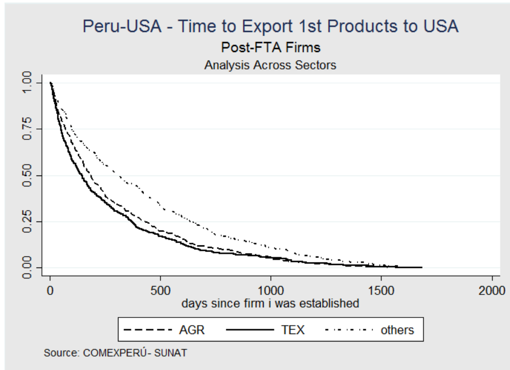
(d)



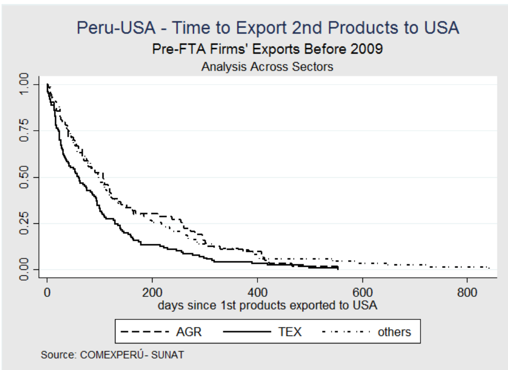
(e)



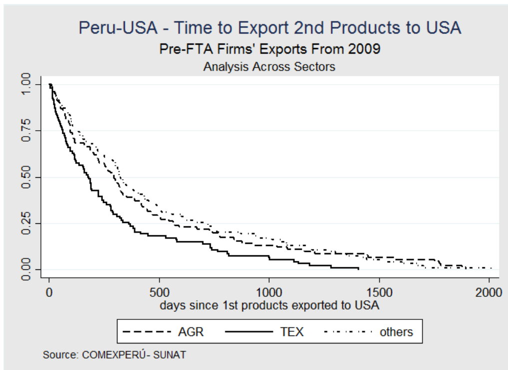
(f)



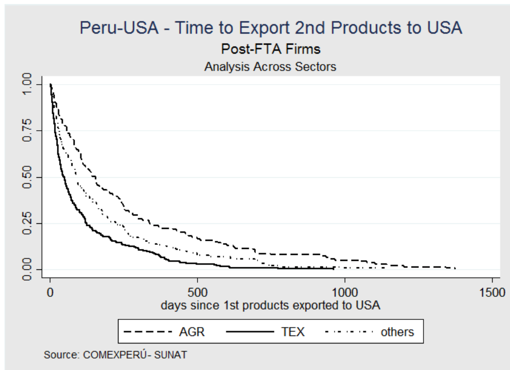
(g)



(h)



(i)



5.3 Exporting One or Many New Products

One approach to address the role of firm size and experience in the dynamics of experimentation by Peruvian firms in USA market is to compare the experimentation speed between one single new product and sets of many new products. Recall from the summary statistics that 64.6% of experimentation rounds comprise only one single product.[12]

Figure 9 portrays the overall results of this exercise, showing that the time lapsed to experiment with more than one new product to USA tends to be shorter. In fact, the survival probability for experimentation rounds involving many products becomes 50% at 82 days after the firm's previous experimentation; whereas that number is 107 for one-product rounds.

Figure 9

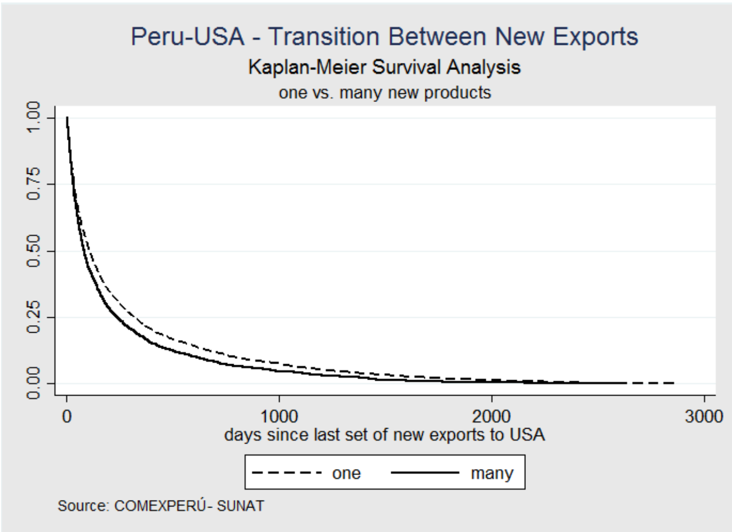


Figure 10, like in the analysis across sectors, distinguishes between $pre-FTA$ and $post-FTA$ transactions. The trend described earlier is almost omnipresent. However, two striking features can be identified. Firstly, for $post-FTA$ transactions by $pre-FTA$ firms –the second column– the speed difference in favour of many-product experimentation rounds gets much larger, compared to the first column, where speeds are fairly similar between both groups. Secondly, for $post-FTA$ firms, the speed difference tends to be smaller, and even gets reversed in the third experimentation round, in favour of one-product rounds. Further experimentation rounds by $post-FTA$ firms, not presented herein, have quite similar speeds across both categories. I can interpret these findings as follows: trade liberalisation plays a determinant role for both $pre-FTA$ and $post-FTA$ firms, which are encouraged to take more advantage of this condition by exporting more new products to USA more rapidly, presumably their core competence products; and the fact that such effect is stronger for $pre-FTA$ firms may be a sign of the role of size and experience in the USA market and, more importantly, an additional incentive for those firms to more easily experiment with more products, previously levied with a tariff.

[12]Like in the analysis across sectors, this exercise cannot control for right-censored firms: there is no chance for censoring across products.

Figure 10: Kaplan-Meier Survival Analysis Pre- vs. Post-FTA Firms: One vs. Many Products Exported

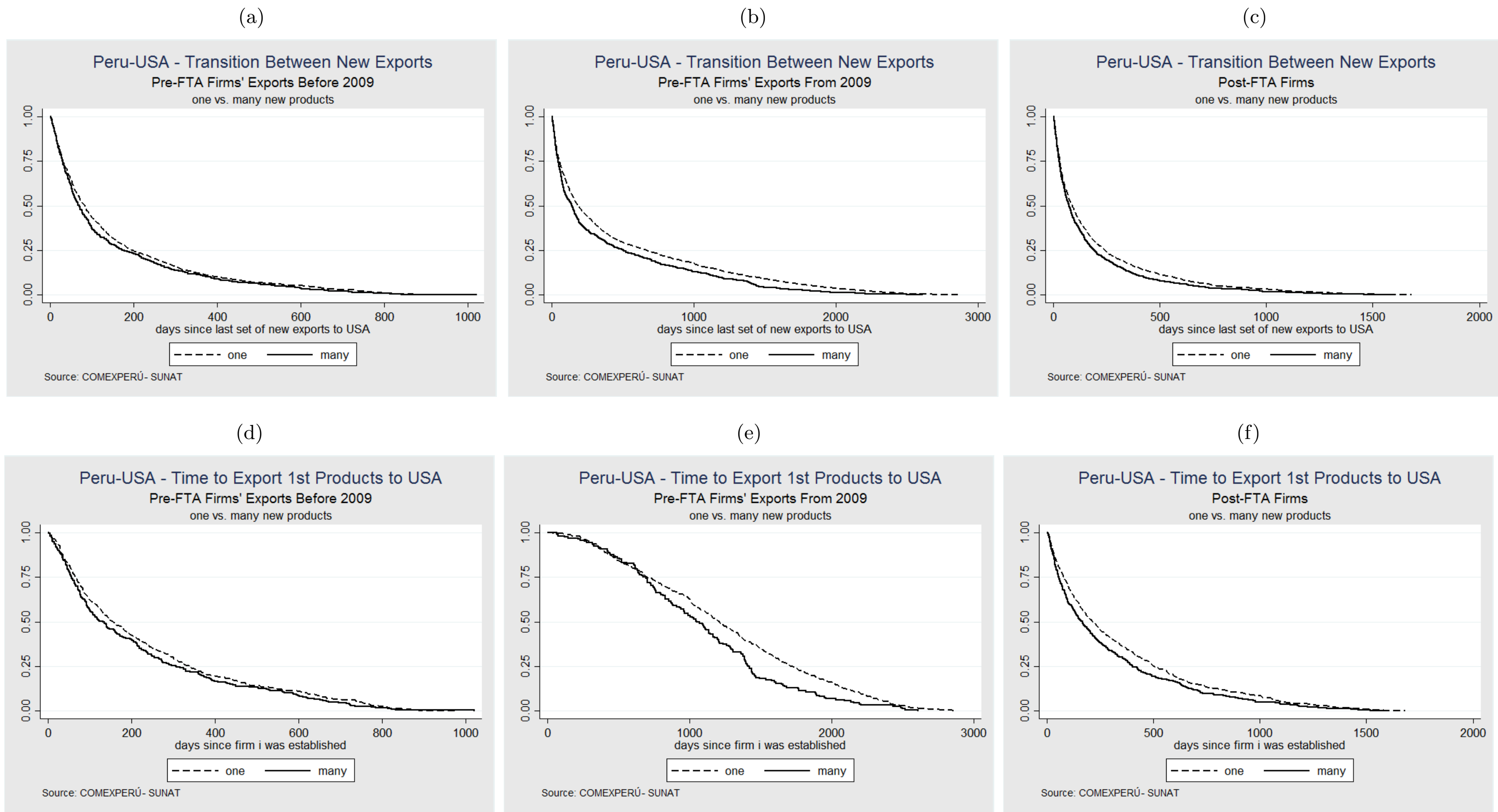
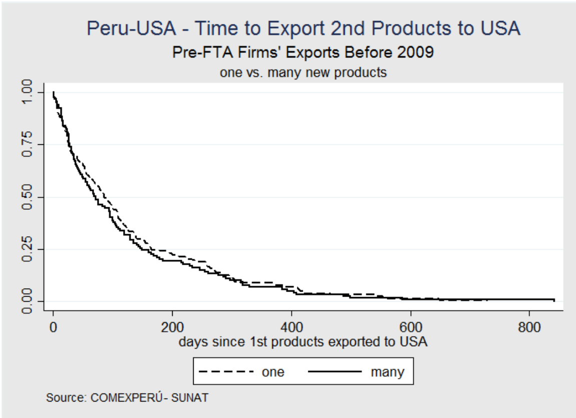
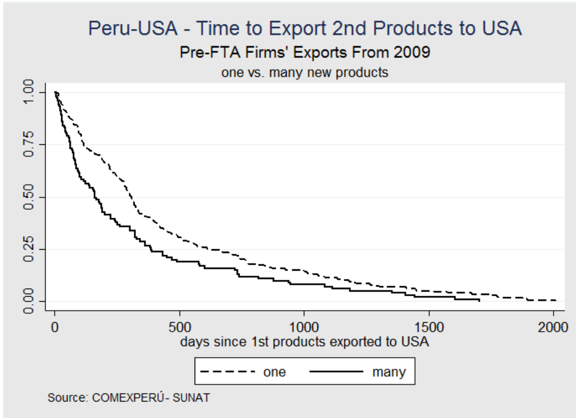


Figure 10 (Cont.): Kaplan-Meier Survival Analysis Pre- vs. Post-FTA Firms: One vs. Many Products Exported

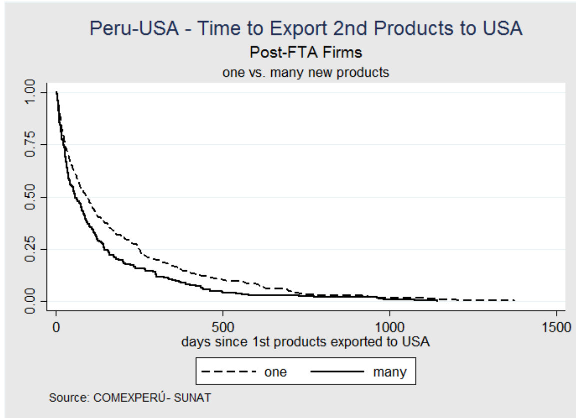
(g)



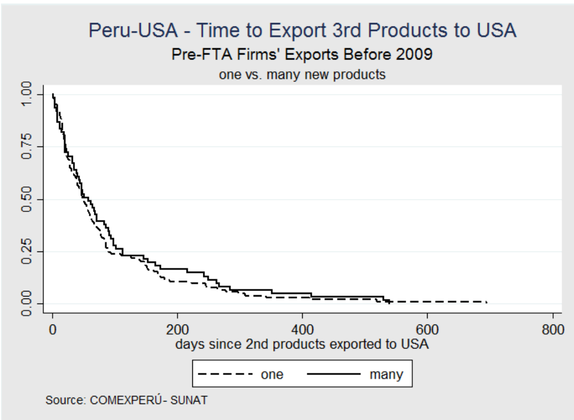
(h)



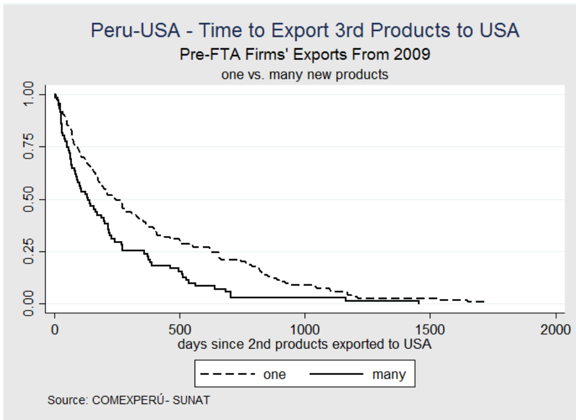
(i)



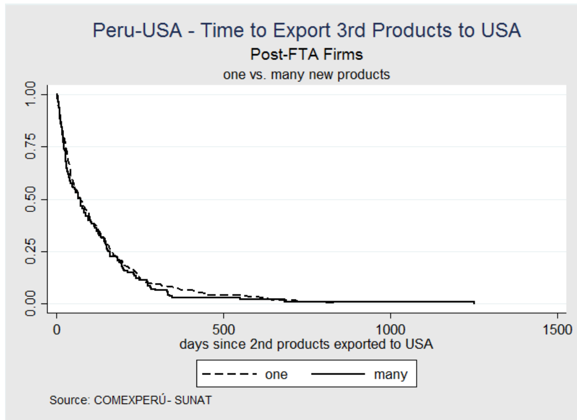
(j)



(k)



(l)



5.4 Analysis Across Mean Export Values

My theoretical model predicts that the number of shipments of product A by a firm to country d prior to the introduction of B is inversely related to the firm's mean export value of shipments of A. Thus, I test this prediction with a Kaplan-Meier survival analysis on the experimentation speed across quintiles of the mean export value of shipments by a Peruvian firm prior to a new experimentation round in the USA market. The exercise separately utilises shipments to USA only and to all destinations.

5.4.1 Mean Exports to USA

In this first estimation, I obtain quintiles of the mean values of shipments by a Peruvian firm to USA, from its first shipment of product A inclusively, to the last one before the introduction of product B. The same rule applies for all subsequent experimentation rounds. The mean export quintiles are as follows:

- First quintile: mean export value of up to US \$ 662.
- Second quintile: above US \$ 662 and up to US \$ 2,379.
- Third quintile: above US \$ 2,379 and up to US \$ 6,542.35.
- Fourth quintile: above US \$ 6,542.35 and up to US \$ 20,625.50.
- Fifth quintile: above US \$ 20,625.50.

Each graph elaborated in this analysis shows five step lines, each of them representing one of the mentioned quintiles.

Figure 11 compiles all experimentation rounds, regardless of the firm; while Figure 12 focuses on the second new products exported to USA per firm. Recall that, since I work with the previous shipments to USA, the first experimentation rounds are excluded from this exercise.

Figure 11 shows that introductions of new products to USA preceded by small mean shipment values tend to occur faster than experimentations following larger mean export values. Thus, for the first quintile function –the solid grey line– the experimentation probability becomes 50% at day 56 since last experimentation round. Conversely, for the last quintile function –the solid black line–, that probability is attained at day 254.

Figure 12 on the introduction of the second new products to USA portrays a common pattern that will be more clearly seen in the forthcoming graphs: there is a growing difference in survival/failure probabilities between experimentation rounds from the first three quintiles and the last two, embracing mean exports above US \$ 6,542.35. Introduction of second new exports preceded by average shipments up to US \$ 6,542.35 take a shorter span than experimentation rounds occurring after mean exports above that value.

These findings appear to go against the prediction from my theoretical approach. However, looking at differences between $pre - FTA$ and $post - FTA$ transactions may provide further information.

Figure 11

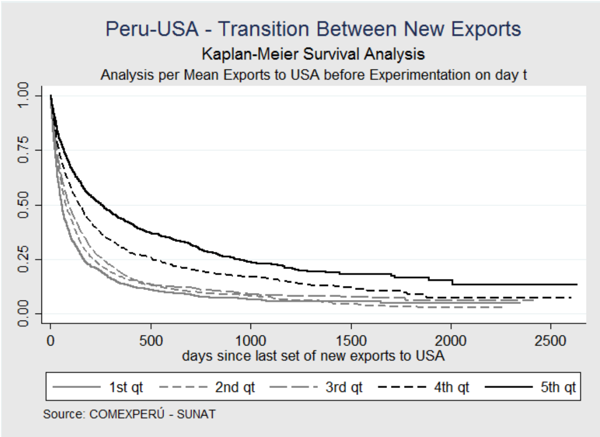
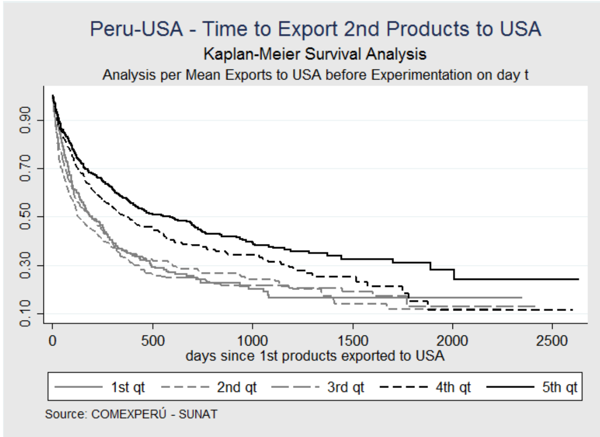


Figure 12



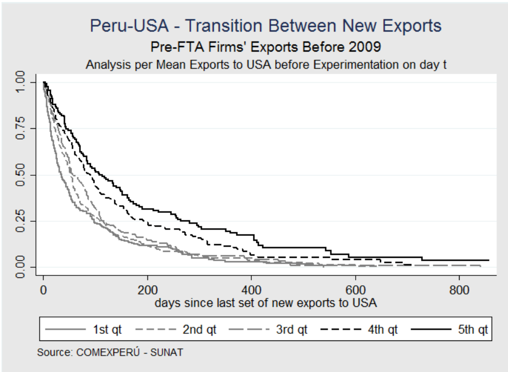
Indeed, when observing the Kaplan-Meier estimations in Figure 13 and comparing the trends of the functions between $pre - FTA$ transactions –the first column– versus $post - FTA$ experimentation rounds –the next two columns–, it is evident that the mentioned gap between the first three quintiles and the last two becomes much larger for $post - FTA$ transactions.

The first column for $pre-FTA$ experimentation rounds shows that the survival functions for all quintiles are closer to each other, at least at value 0.5 in the vertical axis, especially in Figure 13(g) for the third round of new exports. Conversely, when looking at $post-FTA$ transactions, principally Figures 13(h) and (i) for third new exports, the probability of experimentation for the first three quintiles becomes increasingly larger than for the last two.

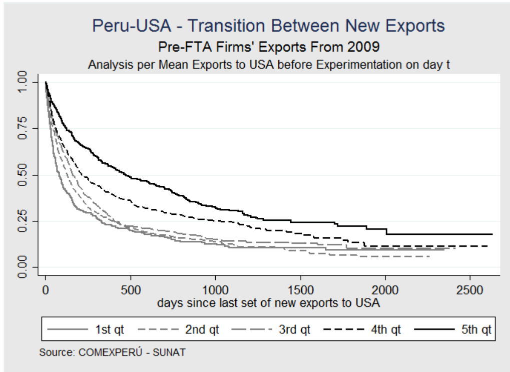
This finding may provide a valuable implication on the role of trade liberalisation. Since 2009, when most tariffs were eliminated, Peruvian firms, especially the smallest ones, may have a chance to realise the USA demand for their products more easily, by shipping smaller values of their products, i.e. starting small. I can also relate these estimation results with Equation 14b of my theoretical model, which indicates a lower –in absolute value– negative slope of the cutoff number of shipments for larger mean export values. This may be translated into relatively lower experimentation speed for larger sales, which is the general tendency of my estimates.

Figure 13: Kaplan-Meier Survival Analysis per Quintiles of Mean Exports to USA Before Experimentation on Day t

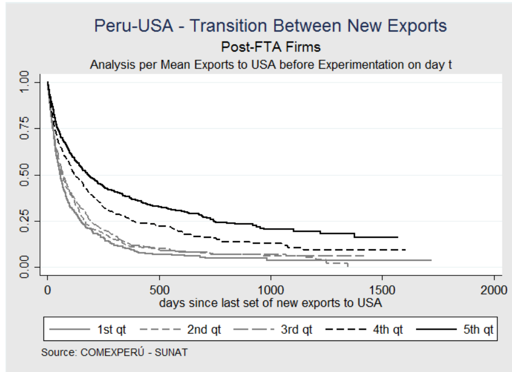
(a)



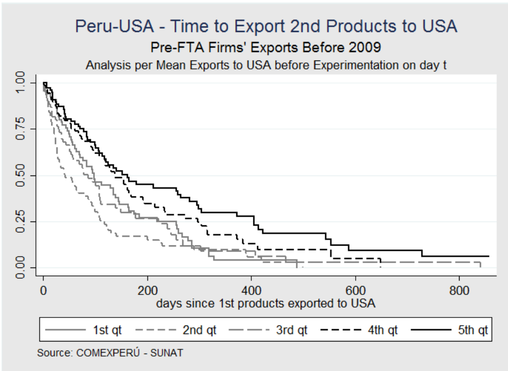
(b)



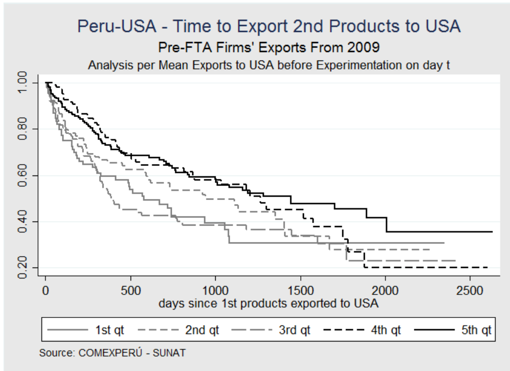
(c)



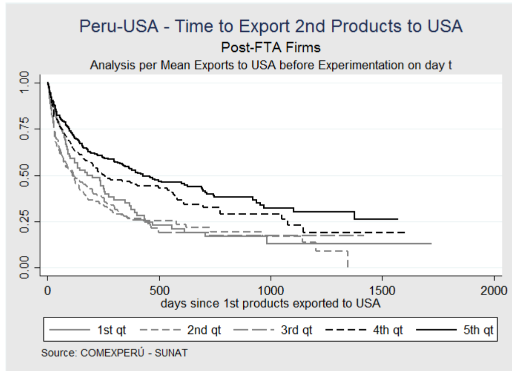
(d)



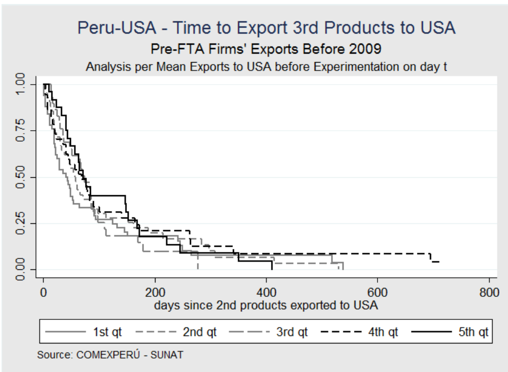
(e)



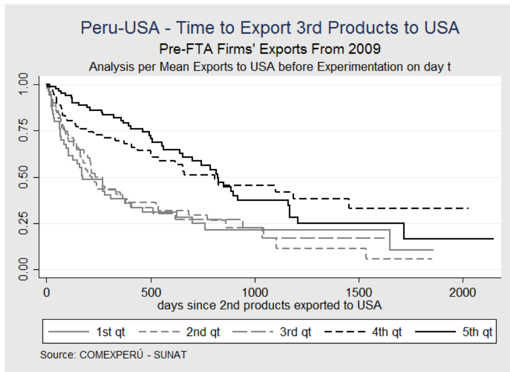
(f)



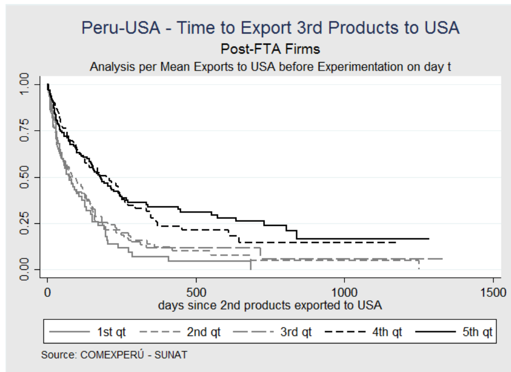
(g)



(h)



(i)



5.4.2 Mean Exports to All Destinations

I also prepared a similar exercise, but working with the firm's mean value of shipments to everywhere, including USA. This may provide valuable information on experimentation speed by Peruvian firms, especially for the introduction of their first new products to that market.

Similarly, I constructed quintile values for firms' mean shipments to any destination, obtaining the following numbers:

- First quintile: mean export value of up to US \$ 308.23. This group includes experimentation rounds in USA with no previous exports anywhere (zero mean export value).
- Second quintile: above US \$ 308.23 and up to US \$ 2,148.74.
- Third quintile: above US \$ 2,148.74 and up to US \$ 6,954.26.
- Fourth quintile: above US \$ 6,954.26 and up to US \$ 22,452.89.
- Fifth quintile: above US \$ 22,452.89.

This analysis gives as interesting results as the former. Figures 14 and 15 show the overall results for all experimentation rounds and the first new exports, respectively. I am particularly interested in the outcome from Figure 15. On the one hand, it is evident that the introduction of a first product to USA preceded by tiny or no shipments to any other destination –the solid grey line– takes place in a much shorter time span since the firm's foundation than the first experimentations from the other quintiles. This is a sign of the existence of Peruvian firms exclusively focused on the USA market. Indeed, most débuts in USA from the first quintile correspond to firms without any export experience elsewhere.

On the other hand, after the first quintile, the group with the highest experimentation speed is the fifth quintile –the solid black line–, embracing firms with the largest mean export values. This last pattern can be more clearly observed when distinguishing between $pre-FTA$ and $post-FTA$ transactions.

Figure 14

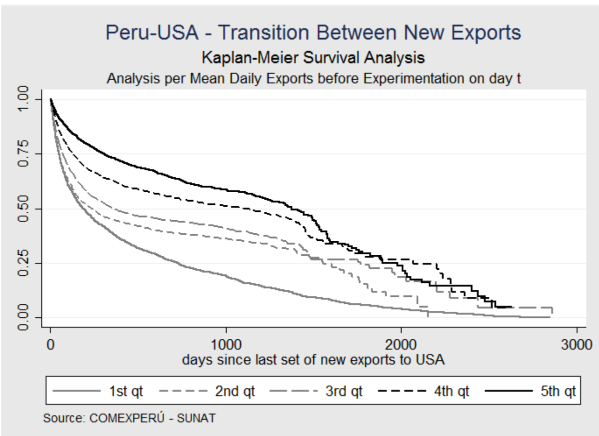
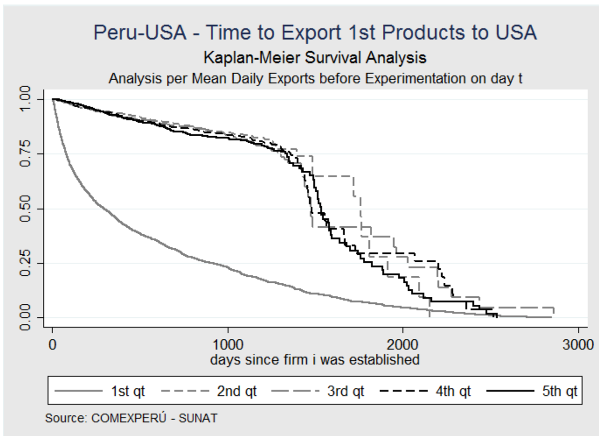


Figure 15



That exercise, performed in Figure 16, effectively confirms in the second row that the experimentation speed, measured in days since the firm was established, is highest for firms with almost exclusive focus on the USA market. That speed gap between the first quintile and the rest gets exacerbated for $post-FTA$ firms, as Figure 16(f) shows.

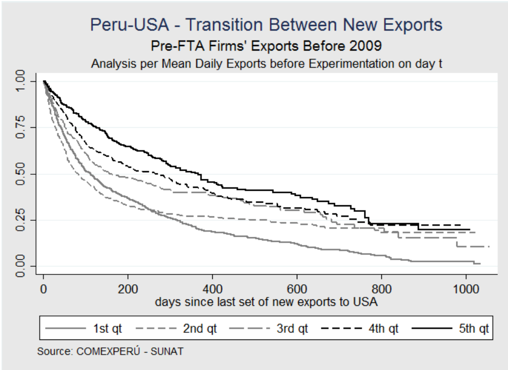
The second pattern identified, the particularly high probability of experimenting for the first time in USA by firms from the last quintile of mean exports everywhere, is more evident for $pre-FTA$ rounds in Figure 16(d). And that difference between the largest exporters and the 2nd-4th quintiles fades for $post-FTA$ transactions, shown in Figures (e) and (f). The gap in experimentation speed at $post-FTA$ transactions between quintiles 1-3 and quintiles 4-5, identified in the previous subsection, is evident for second experimentation rounds, exhibited in Figures (h) and (i).

With the results obtained from this survival analysis across mean export values prior to the introduction of new products to USA, I can extract some stylised facts on experimentation speed and the role of trade liberalisation.

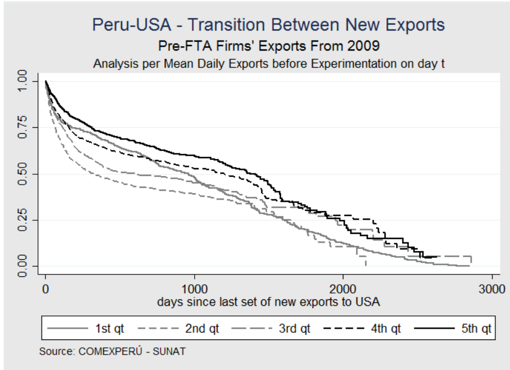
1. For the first experimentation rounds in USA, except for Peruvian exporters exclusively focused on the USA market, there is a negative relation between experimentation speed and the mean value of shipments everywhere, especially before the FTA enactment. That advantage in favour of larger exporters is diminished once the FTA comes into effect.
2. For subsequent experimentation rounds, Peruvian firms that previously sold smaller values of products either to USA only or everywhere, tend to introduce new products to USA at a faster speed than those exporting larger previous shipments. That difference gets much larger after the enactment of the USA-Peru Free Trade Agreement. This implies that trade liberalisation is associated with quicker experimentation by firms in the USA market after sending smaller shipments, which now provide information on the perceived demand for their products more effectively.

Figure 16: Kaplan-Meier Survival Analysis per Quintiles of Mean Exports to All Destinations Before Experimentation on Day t

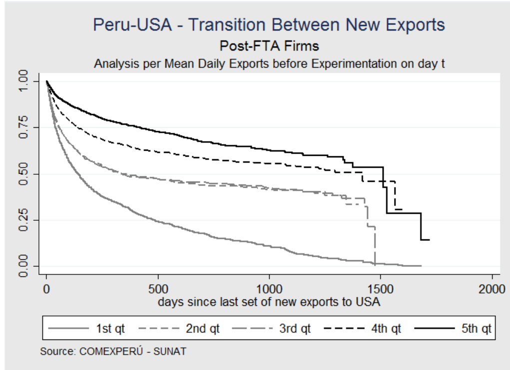
(a)



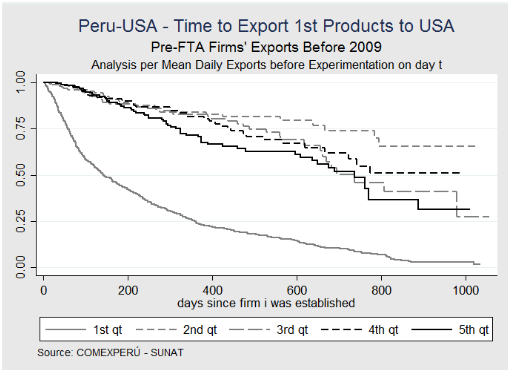
(b)



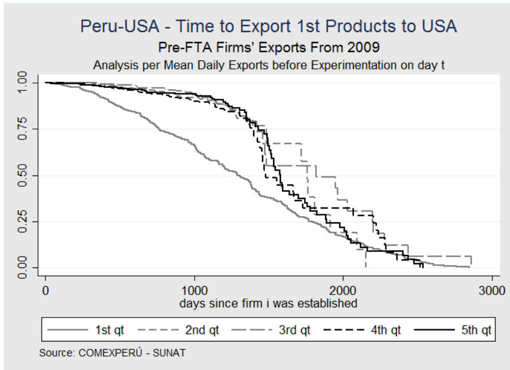
(c)



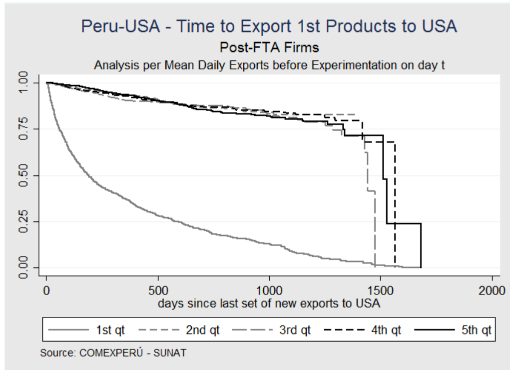
(d)



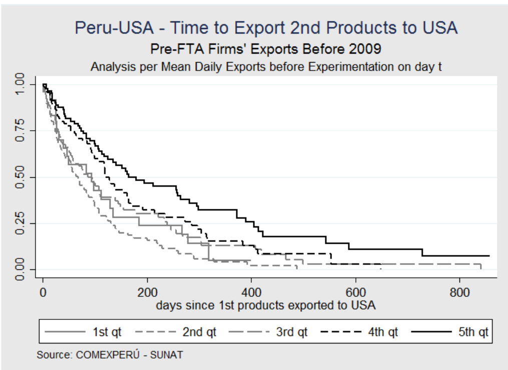
(e)



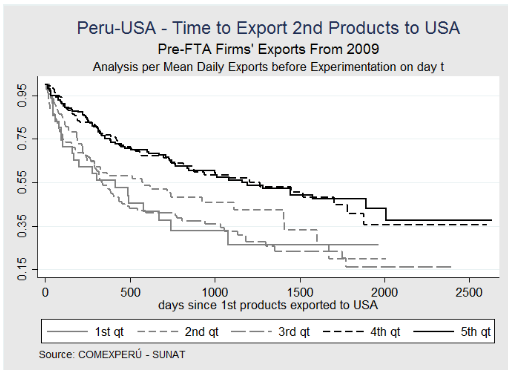
(f)



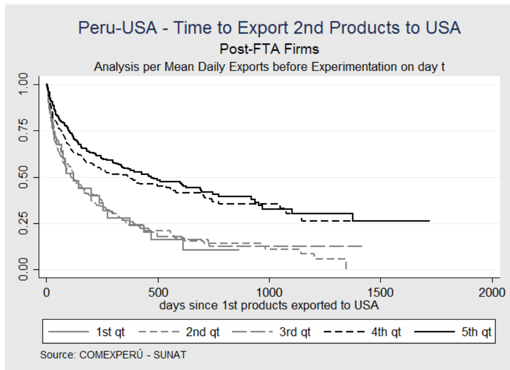
(g)



(h)



(i)



5.5 Analysis Across Tariff Rates and Preference Regimes

In this next stage of the survival analysis, I am interested in knowing the number of days taken by firms to experiment in the USA market, depending on the mean pre-FTA tariff rate levied by that country and whether these products enjoyed a USA trade preference regime prior to the enactment of the Free Trade Agreement. The trade preferences regimes addressed are the Andean Trade Preference and Drug Eradication Act (ATPDEA) and the zero tariff rates under the WTO Most Favoured Nation (MFN) regime.

5.5.1 Analysis Across Weighted Average Tariffs

As we know, since 2009 the vast majority of products were automatically liberalised (zero tariff). Hence, for the tariff-based analysis to be done, I decided to calculate for each experimentation round a pre-FTA weighted average tariff rate, which weight is the US $ export value of each product.

I constructed two types of weighted average tariffs: 1) one for all the products sold by a firm on day t; and 2) another one for only the new products introduced by the firm on day t. In this paper, I present the results from the second type, as my main focus is on the new exports.

For the effects of the calculation of the Kaplan-Meier survival estimator, I obtained the quintiles of the weighted average tariffs, which are as follows:

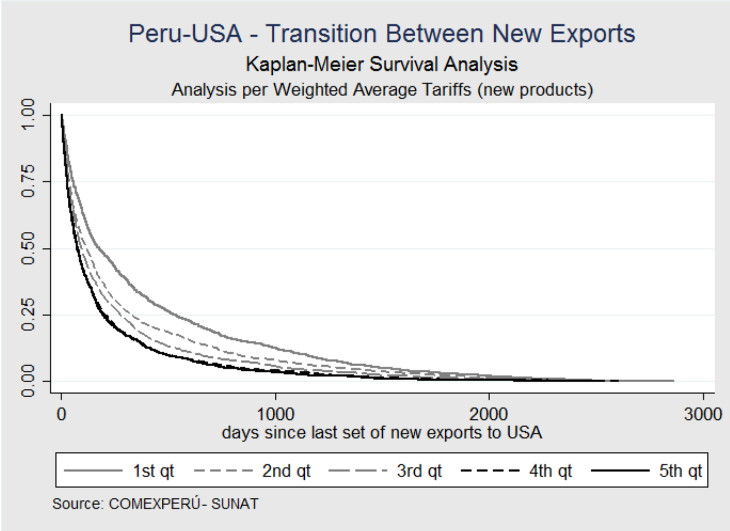
- First quintile: up to 0.279%, mostly accounting for new products with zero MFN tariff.
- Second quintile: above 0.279% and up to 3.07%.
- Third quintile: above 3.07% and up to 7.34%.
- Fourth quintile: above 7.34% and up to 14.9%.
- Fifth quintile: above 14.9%.

Similar to the mean export analysis, all graphs provided show five step lines, each representing one quintile.

Figure 17 displays the outcome from this exercise, including all experimentation rounds, regardless of the order and the firm. It is clear from this figure that it usually takes a shorter time spell for firms to experiment in USA with products which pre-FTA weighted average tariff belongs to the 4th –the dashed black line– and, especially, the 5th quintile –the solid black line–. In numbers, firms are faster to export new goods with an over 7.34% pre-FTA weighted average rate. On the contrary, firms take much longer to export new products from the 1st quintile, namely, those with zero MFN tariffs. It must be pointed out, nevertheless, that products from such 1st quintile are more quickly exported by firms in further rounds, even quicker than products from the top quintiles.

This first finding may imply an opposite result compared to the basics of my sequential exporting theory, which stated that, between two types of products, the firm would experiment with the one with the lowest trade cost. However, recall that some of the tariff lines exported before the 2009 FTA, from either the lowest or highest quintiles, enjoyed a zero tariff under the ATPDEA regime by USA.

Figure 17

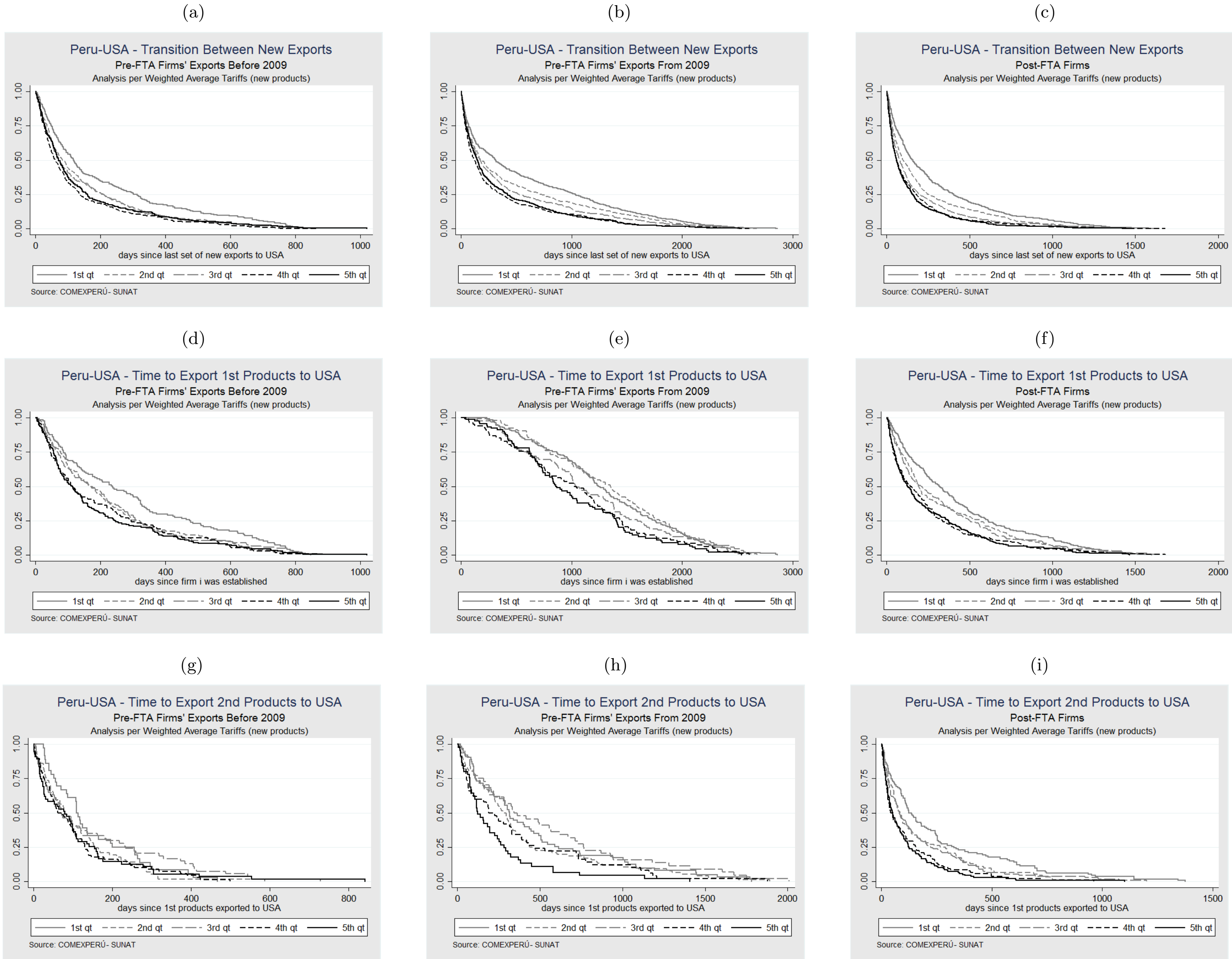


Additionally, the export behaviour by firms may vary between $pre-FTA$ and $post-FTA$ firms. Figure 18 compiles that analysis, across pre-FTA tariff quintiles and distinguishing between transactions done before and from 2009.

The first row confirms the findings from the previous figure, in that new products belonging to the 4th and 5th pre-FTA tariff rate quintiles tend to wait less to be introduced than products with lower trade costs. This tendency for $pre-FTA$ firms, however, is more evident for the post-FTA new exports (Figure 18(b)), in which nearly all tariffs become zero. Clearly, in that case new exports of the furthest quintiles are more dynamic than exports of the 2nd –the dashed grey line– and 3rd quintiles –the dashed and dotted grey line–, and even more dynamic than those of the 1st quintile –the solid grey line representing the zero MFN tariff group–. In Figure 18(b), the probability of introducing new products to USA becomes 50% at 123 days since the firm's last experimentation round for transactions from the 4th quintile by $pre-FTA$ firms done since 2009; while for the 5th quintile, that probability is achieved 22 days later. Relatively longer spells are taken by new exports of products with lower weighted average tariffs.

When looking at the first and second experimentation rounds, the finding described earlier also holds. Products with the highest pre-FTA tariffs tend to take less time to be exported after the FTA by more experienced firms. Particularly, the second experimentation round of products from the top quintile (Figure 18(h)) are by far more dynamic than the rest. Such tendency was also found for the second rounds by $post-FTA$ firms (Figure 18(i)). It must be pointed out though that for further rounds, the duration difference between low and high tariff products diminishes considerably. Hence, it can be argued that there is an experimentation peak for the most costly products at the second round of post-FTA transactions, followed by more experimentation with products with lower pre-FTA tariffs in further rounds. Relating these results with Equation 14a of my theoretical model, I highlight that for $post-FTA$ experimentation rounds by both types of firms, the gap between the top two tariff quintiles and the rest becomes larger, meaning that trade liberalisation's experimentation accelerating role is more relevant for products with highest $pre-FTA$ tariffs.

Figure 18: Kaplan-Meier Survival Analysis per Weighted Average Pre-FTA Tariffs (new exports)



5.5.2 Analysis Across Trade Preference Regimes

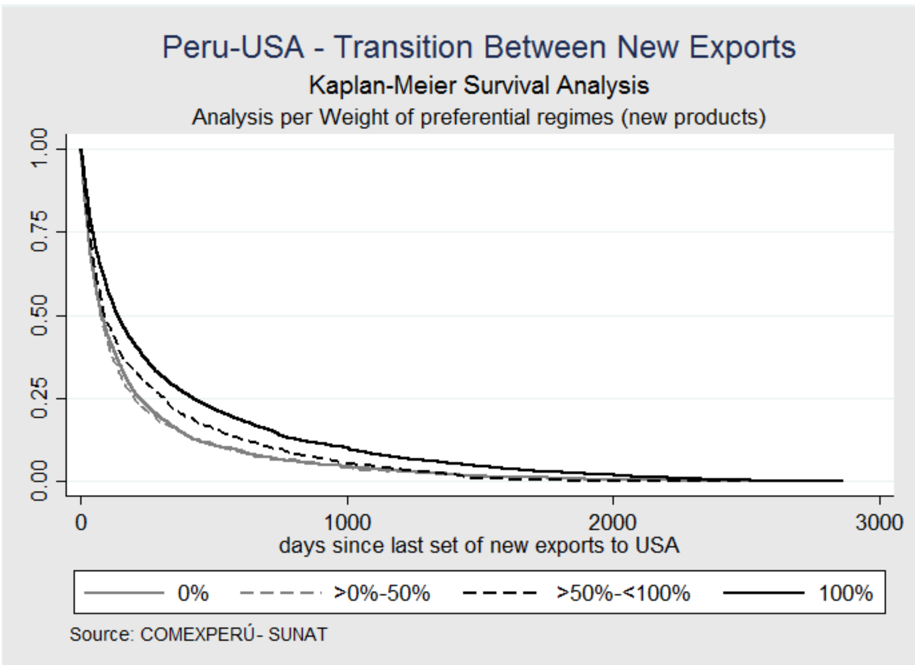
As pointed out earlier, prior to the FTA, many Peruvian products, regardless of the official USA tariff rate, enjoyed a special trade preference under the ATPDEA regime, which guaranteed a zero tariff entry into that market to several tariff lines, subject to a periodical unilateral renewal by the USA government.

In the following analysis, I construct survival functions for experimentation rounds, depending on how much of the total export value by a firm to USA on day t was accounted for by products benefited from a special trade preference, be either ATPDEA or the zero MFN tariff. I allocate experimentation rounds into four groups according to the share in the export value of new products that enjoyed a pre-FTA trade preference. The groups are as follows:

- Group 1: rounds not involving any new product with a pre-FTA trade preference (0%).
- Group 2: rounds in which up to 50% of the total value of new exports involve products with a pre-FTA trade preference (>0%-50%).
- Group 3: rounds in which over 50% but below 100% of the total value of new exports involve products with a pre-FTA trade preference (>50%-<100%).
- Group 4: rounds in which all new products enjoyed a pre-FTA trade preference (100%).

Figure 19 presents the outcome from this analysis, gathering all experimentation rounds from all firms in the sample. What this first graph implies is that the fastest rounds of new exports involve either no trade preference –the solid grey line– or at least a little share of products enjoying any pre-FTA zero tariff –the dashed grey line–. More days are taken for new exports from Group 3 –the dashed black line–, and even more days for new exports with full special treatment –the solid black line–.

Figure 19



In the last stage of this survival analysis, I present in Figure 20 the results distinguishing between $pre - FTA$ and $post - FTA$ experimentation rounds.

From another exercise, not reported in this paper, where I simply distinguished between $pre-FTA$ and $post-FTA$ firms, it was surprisingly obtained that, even for $pre-FTA$ firms, new exports with few or null trade preferences were quicker to occur than goods with large or full USA preference. One reason for this outcome may be that, since the USA trade preferences under ATPDEA date back to the early 1990s –formerly known as ATPA– that acceleration for liberalised products might have taken place before the start of my sample. However, one important issue to take into account in this analysis, apart from the spell length, is the number of firms/experimentation rounds per preference category.

In fact, when looking into the numbers behind Figure 20, in the overall results from the first row, we see that for $pre-FTA$ firms, rounds from the two extreme preference categories (0% and 100%) account for more than 80% of the total experimentation events analysed. That share is even greater for $post-FTA$ firms. Therefore, I should focus on those two extreme categories for further analyses.

Having that in mind, the results from the second row, on the first experimentation rounds, show that for $pre-FTA$ firms, both before and after the agreement, products with no trade preference tend to be sold at a faster rhythm than those fully liberalised. That gap between these two categories gets narrower for $post-FTA$ firms.

All this apparently contradicts the basics of my sequential exporting theory, which states that firms enter a market with the product with lowest trade costs. However, for $pre-FTA$ experimentation rounds, 334 (49.55%) firms begin their experience in the USA market by exporting only liberalised products; while only 221 (32.79%) sold only non-liberalised ones. As for $post-FTA$ experimentations by $pre-FTA$ firms, I obtain 276 vs. 187 firms (51.02% vs. 34.57%); and for the $post-FTA$ firms case, the difference clearly diminishes: 517 (43.23%) vs. 483 firms (40.38%). Hence, it can be seen that in general, more firms tend to experiment with a less costly product in terms of trade preferences; but since the enactment of the FTA, there is more incentive for firms to experiment with previously non-liberalised (more costly) products.

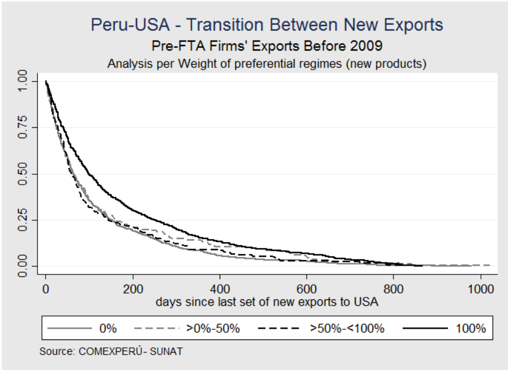
When moving further to the second round of new exports in the third row of Figure 20, it can be spotted that, in terms of spell length, non-pre-FTA-liberalised products get exported even more quickly, especially in $post-FTA$ experimentation rounds. In terms of number of firms, that higher frequency for experimenting with fully liberalised products observed in the first round is reversed, especially for $post-FTA$ firms. In other words, more firms tend to experiment with non-liberalised new products in the USA market at their second experimentation round. Moreover, for further rounds, the difference in favour of non-pre-FTA-liberalised products gets larger, again especially for $post-FTA$ firms.

In summary, three stylised facts can be extracted from this analysis across mean pre-FTA tariffs and trade preference regimes.

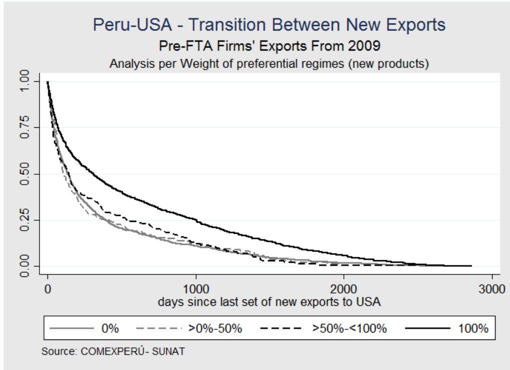
1. Products which used to enjoy no pre-FTA trade preference tend to be exported quicker than pre-FTA liberalised products.
2. Most firms, however, tend to start their experience in the USA market with pre-FTA liberalised products, obviously cheaper to export.
3. The USA-Peru FTA seems to play the role of encouraging firms to experiment more with products that did not enjoy any trade preference prior to it, usually with the highest pre-FTA tariffs. The latter can be seen both in terms of experimentation speed and number of firms.

Figure 20: Kaplan-Meier Survival Analysis per Weight of USA Pre-FTA Preferential Regimes (new exports)

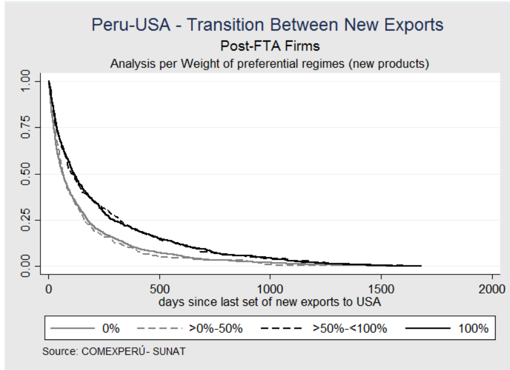
(a)



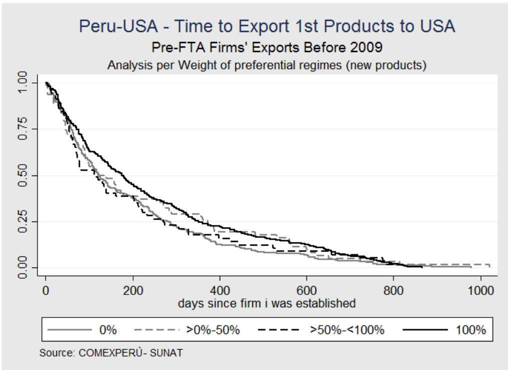
(b)



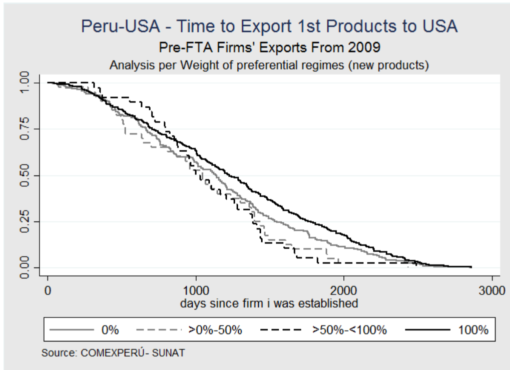
(c)



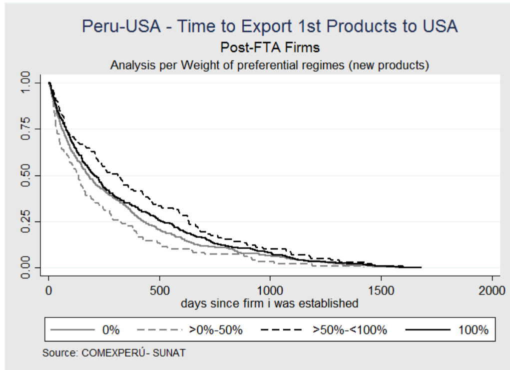
(d)



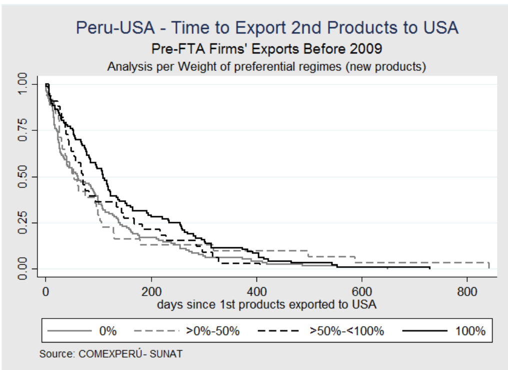
(e)



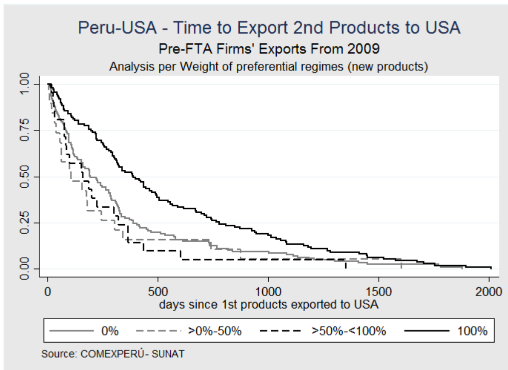
(f)



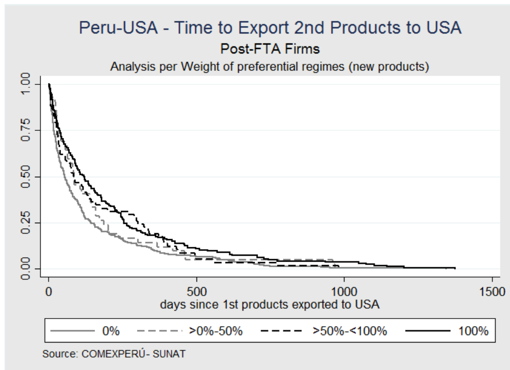
(g)



(h)



(i)



6 Econometric Approach

After the first testing attempt by a Kaplan-Meier survival analysis, in this section I present the main results from the econometric models, aiming to provide an alternative approach to test some of the main predictions from the theory.

6.1 Number of Shipments

I start by running an Ordinary Least Square (OLS) identification strategy, in which each observation represents the event of the introduction of one or many products by a Peruvian firm into the USA market, i.e. *experimentation round*. As in the previous analyses, these estimations consider Peruvian firms starting to export to USA between 2006 and 2013. Since my purpose is to assess the influence of trade liberalisation and the value of exports on the number of shipments prior to an experimentation round, I propose the following basic specification:

$$\begin{aligned} num\_shipments\_USA_i = \alpha_0 + \alpha_1 postfta_i + \alpha_2 mean\_export\_USA_i + \\ \alpha_3 postfta * export\_USA_i + \alpha_4 new\_wmean\_tariff_i + \\ \alpha_5 postfta * tariff_i + \mu_i \end{aligned} \tag{16}$$

This first approach takes every experimentation round independently, regardless of the firm, because a panel fixed effects model at the firm level, shown afterwards, omits some relevant variables I am interested in.

The dependent variable is the log of the number of shipments to USA by a Peruvian firm before experimentation round i, from experimentation round $i-1$ inclusively. That variable is regressed on $postfta$, a dummy variable taking value 1 if the firm making experimentation round i was founded between 2009 and 2013, when the USA-Peru Free Trade Agreement becomes effective. $mean\_export\_USA$ stands for the log of the firm's mean export value of shipments to USA from experimentation round $i-1$ to the last shipment before experimentation round i. These first two variables are interacted to see if there is a combined effect. Aiming to find a more specific effect of trade liberalisation at the product level, I include new_wmean_tariff, the log of one plus the average pre-FTA tariffs levied on the new products exported in experimentation round i, weighted by the export value per product. Thus, tariffs levied on products accounting for the largest shares of the full experimentation shipment are given more weight. That variable is also interacted with the $postfta$ dummy.

Further additions and modifications are made to that basic specification. Firstly, I incorporate the $pre\_postfta$ dummy, taking value 1 if experimentation round i was done by a $pre-FTA$ firm after the enactment of the FTA. By adding this dummy, and keeping the $postfta$ variable, $pre-FTA$ experimentation rounds by $pre-FTA$ firms become now the base category. $pre\_postfta$ is afterwards interacted with the export and tariff variables. Secondly, I replace the tariff regressor by new_wpref, standing for the proportion, in terms of export value, of new products exported in experimentation round i eligible for a $pre-FTA$ trade preferential regime, either ATPDEA or zero-MFN tariffs. I interact this variable with the $postfta$ and $pre\_postfta$ dummies.

This first approach and the subsequent ones all include year and sector fixed effects, as well as other controllers used in the survival analysis, such as dummies for many products per round, the elsewhere experience, and others for first and second experimentation rounds per firm. As for the sector fixed effects, they are also interacted with the mean export value variable, since the effect of the latter might be stronger for some sectors. It must be emphasised as well that, since the dependent variable is the previous number of shipments to USA, this initial estimation does not include as observations the firms' first experimentation rounds.

Table 11: N° Shipments by Peruvian Firms to USA Before Introduction of New Exports to That Market

Dependent Variable	num_shipments_USA							
Estimation	OLS							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	-0.271***	0.251*	-0.116***	-0.123	-0.273***	0.0616	-0.112***	-0.266
	(0.0325)	(0.132)	(0.0428)	(0.196)	(0.0325)	(0.132)	(0.0428)	(0.194)
mean_export_USA	0.0961***	0.133***	0.0923***	0.0632***	0.0950***	0.128***	0.0910***	0.0584***
	(0.0152)	(0.0166)	(0.0153)	(0.0208)	(0.0153)	(0.0166)	(0.0153)	(0.0207)
postfta*export_USA		-0.0644***		0.00915		-0.0587***		0.0144
		(0.0159)		(0.0209)		(0.0159)		(0.0209)
new_wmean_tariff		0.140		-0.158				
		(0.425)		(0.614)				
postfta*tariff		-0.975**		-0.685				
		(0.484)		(0.660)				
new_wpref					0.174***	0.0981*	0.182***	0.0912
					(0.0480)	(0.0584)	(0.0479)	(0.0836)
postfta*pref						0.190***		0.196**
						(0.0719)		(0.0924)
pre_postfta			0.232***	-0.631***			0.241***	-0.570***
			(0.0460)	(0.203)			(0.0462)	(0.200)
pre_postfta*export_USA				0.106***				0.105***
				(0.0222)				(0.0221)
pre_postfta*tariff				0.470				
				(0.734)				
pre_postfta*pref								0.00258
								(0.0994)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5036	5009	5036	5009	5028	5028	5028	5028
r2_o	0.0573	0.0919	0.0620	0.0966	0.0600	0.0945	0.0650	0.0992
F	36.63	24.19	34.58	21.70	33.62	25.12	32.10	22.55

Robust standard errors controlling for heteroskedasticity.
These estimations do not consider firms' first experimentation rounds in the USA market.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table 11 presents the results from this exercise.[13] From the theory and the survival analysis, I would expect a negative coefficient for $postfta$. This is the case for the odd columns of the table, meaning that Peruvian firms founded after the enactment of the USA-Peru Free Trade Agreement tend to have fewer shipments to USA with old products before introducing new exports into that market. However, the even columns show a change in the sign when adding further covariates. That issue is discussed later.

I would also expect from the theory a negative sign for the mean export value of shipments to USA prior to an experimentation round. Instead, all specifications give a positive coefficient for $mean\_export\_USA$, i.e. a slow-down effect, which rather matches the outcome from the survival analysis. However, this might give support to Equation 14b of my theory, which states that the accelerating effect of mean export values of previous shipments is lower for larger means.

[13]This and the next tables are divided in two sections of four specifications. The first section controls for the role of pre-FTA tariffs; whereas the last one addresses the effect of pre-FTA unilateral trade preferences. The even columns incorporate interactions of the $postfta$ dummy to more clearly distinguish effects between $pre - FTA$ and $post - FTA$ firms, as well as year fixed effects to assess how the main covariates change with their inclusion. The last two columns of each section control for post-FTA rounds by $pre - FTA$ firms.

Something interesting occurs when controlling for the $postfta * export\_USA$ interaction, though. Its negative and significant coefficient in Columns (2) and (6) indicates that the slow-down effect of mean export values is lower for $post-FTA$ firms. This also implies an increasingly accelerating $postfta$ effect for higher mean exports. Focusing on Column (2), let me explore the net effects. Assuming a zero $pre-FTA$ tariff, the net effect of a 1% increase in the mean export value on the number of shipments is 0.133% for a $pre-FTA$ firm, and 0.0683% for a $post-FTA$ firm. More interestingly, taking the median value of the $mean\_export\_USA$ variable for $post-FTA$ firms (US $ 4,077.33), the net effect of the $postfta$ dummy on the number of shipments is approximately -25%, being only US $ 49.28 the mean export value at which the $postfta$ effect cancels out. The pattern described remains consistent across most specifications and methods I present in this paper, and may be interpreted as follows: the effect of being a $post-FTA$ firm on experimentation speed is mostly positive, expressed in fewer shipments to USA prior to a new experimentation round compared to $pre-FTA$ firms, turning negative only for rounds preceded by very small consignments of products previously introduced.

As for the weighted mean $pre-FTA$ tariff, my theory's proposition make me expect a positive coefficient; but Columns (2) and (4) do not give significant numbers. These two columns also include the interaction with $postfta$, which obtains a negative and significant value in Column (2). Again, this sign is consistent across further estimations shown afterwards, and is reasonable to expect, as after the FTA enactment most tariffs are eliminated, facilitating the decision to experiment in USA, especially for products with higher $pre-FTA$ tariffs. Moreover, going back to the change in the sign of $postfta$ from Column (1) to (2), for instance, I can argue that the effect of being a $post-FTA$ firm on experimentation speed is an accelerating effect for most products, except for those with zero or a minimum $pre-FTA$ tariff.

But what is the effect on number of shipments for $pre-FTA$ firms experimenting after the FTA enactment? To address this concern, in Columns (3) and (4) I add the $pre\_postfta$ dummy. Column (3) shows a positive and significant coefficient for that dummy, meaning that experimentation rounds after the FTA by $pre-FTA$ firms are preceded by more shipments than rounds before the FTA by those firms. This outcome may reflect cases where, for instance, firms founded in 2006 try to experiment in 2013, long after the FTA enactment. Hence, such experimentation round may be preceded by more shipments than an equivalent event by another $pre-FTA$ firm before the agreement came into effect.

When adding the interactions in Column (4), the sign for $pre\_postfta$ becomes instead negative, with the previous positive effect being transferred to the interaction with the mean export values. Again, let me go through the net effects, assuming zero tariffs. The positive effect of a 1% increase of $mean\_export\_USA$ on the number of shipments to USA is 0.0632% for both $pre-FTA$ experimentation rounds and those done by $post-FTA$ firms; whereas it is 0.2161% for $post-FTA$ rounds by $pre-FTA$ firms. As for the effect of the $pre\_postfta$ dummy, taking the 10^{th} percentile of $mean\_export\_USA$ for $post-FTA$ rounds by $pre-FTA$ firms (US $ 215.29), that effect is approximately -6%, and turns into positive when the mean export value exceeds US$ 384.84, which lies far below the median and average of that variable.

The described outcome can be interpreted as follows: the effect of being a $pre-FTA$ firm experimenting after the FTA enactment is mostly a slow-down effect, compared to experimenting before the agreement; but it is an accelerating one for rounds preceded by very small shipments of products already introduced, i.e. after starting small with those products. This result is consistent with the outcome from Equation 14a of my theoretical model, in that the effect of a tariff change on experimentation speed is lower the larger the mean value of previous shipments is. No significant effect is found for the interaction of $pre\_postfta$ with tariffs.

Columns (5)-(8) replicate the analysis, but replacing the tariff variable by the new_wpref regressor, accounting for the $pre-FTA$ unilateral trade preference share of the new exports in an experimentation round. From the Kaplan-Meier survival analysis, I would expect a positive coefficient for that variable, which actually occurs. That means, experimentations mostly embracing products with a trade preference tend to be postponed –more previous shipments of old products– longer than rounds comprising non-preference products. That effect is more evident for $post-FTA$ firms, given the positive coefficient of the $postfta*pref$ interaction, which is also an expected outcome, since products not enjoying any preferential treatment before the FTA, now can be more easily exported, leading to a lower waiting time.

Table 12: N° Shipments by Peruvian Firms Abroad Before Introduction of New Export to USA

Dependent Variable	num_shipments_total							
Estimation	OLS							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	-0.300***	0.164	0.00574	0.0558	-0.301***	-0.0123	0.00800	-0.170
	(0.0354)	(0.165)	(0.0458)	(0.231)	(0.0354)	(0.165)	(0.0459)	(0.224)
mean_export_total	0.0962***	0.137***	0.0904***	0.0488**	0.0964***	0.134***	0.0904***	0.0462**
	(0.0167)	(0.0179)	(0.0166)	(0.0230)	(0.0168)	(0.0179)	(0.0167)	(0.0229)
postfta*export_total		-0.0682***		0.0240		-0.0645***		0.0265
		(0.0190)		(0.0242)		(0.0191)		(0.0241)
new_wmean_tariff		0.891**		1.240*				
		(0.453)		(0.666)				
postfta*tariff		-1.224**		-1.591**				
		(0.547)		(0.735)				
new_wpref					0.0264	-0.00565	0.0455	-0.0791
					(0.0514)	(0.0615)	(0.0510)	(0.0883)
postfta*pref						0.148*		0.224**
						(0.0774)		(0.0990)
pre_postfta			0.466***	-0.496**			0.472***	-0.573**
			(0.0494)	(0.239)			(0.0495)	(0.230)
pre_postfta*export_total				0.140***				0.139***
				(0.0256)				(0.0255)
pre_postfta*tariff				-0.487				
				(0.796)				
pre_postfta*pref								0.116
								(0.105)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5859	5826	5859	5826	5847	5847	5847	5847
r2_o	0.0977	0.135	0.111	0.139	0.0981	0.135	0.111	0.139
F	78.12	42.88	79.90	37.12	69.55	43.21	72.18	37.41

Robust standard errors controlling for heteroskedasticity.
These estimations consider all firms' experimentation rounds in the USA market.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table 12 presents a complementary exercise, now including the first experimentation rounds.[14] For that purpose, I replace the dependent variable by $num\_shipments\_total$, the log of the number of shipments by a firm to all destinations before experimentation round i, from round $i-1$ inclusively. It was also pertinent to employ instead the $mean\_export\_total$ regressor, the log of mean value of exports to all markets before the round of interest. Figures are fairly similar to Table 11; but I remark the loss of significance for the $postfta$ dummy. Conversely, there is a significance gain by the tariff variable, showing the expected positive sign in Columns (2) and (4). The $postfta*tariff$ interaction also gains significance, showing a stronger negative effect, as expected. The significance loss of the $postfta$ dummy reflects the lack of explanatory power

[14]This exercise does not include first experimentation rounds not preceded by any shipment elsewhere.

over the total number of shipments prior to an experimentation round, given the inclusion of other controllers, such as firms' experience in other markets. In fact, the *elsewhere* dummy, not reported in this table, always shows highly significant positive coefficients, implying that focusing on other markets may prompt firms to postpone the decision to export a new product to USA, especially for the first experimentation.

Appendix B shows replications of this OLS approach, considering either only the first experimentation round per firm, using the shipments to all destinations, or only the second round. For the latter, I run regressions for both types of dependent variables. On first experimentation rounds, it is striking that $postfta$ is positive in all specifications, and significant when adding the $pre\_postfta$ dummy. That may be explained by the aforementioned time difference between an experimentation round made in 2013 by a $post-FTA$ firm founded early in 2009, compared to a round produced in 2008 by a $pre-FTA$ firm founded in 2006. Additionally, the new_wpref variable on USA unilateral trade preferences always gives negative and significant coefficients, which makes sense, since firms starting their export activity in USA before 2009, tend to do it with fully liberalised products, as discussed in the survival analysis.

When it comes to analysing the second experimentation rounds, taking $num\_shipments\_USA$ as dependent variable, it is remarkable that $postfta$ keeps its negative and significant value even when controlling for $post-FTA$ rounds by $pre-FTA$ firms. This may imply that trade liberalisation exerts a trigger to grow in the USA market at the early extensive margin for $post-FTA$ firms. That effect does not seem to come from the tariff elimination, given the insignificant coefficients for the tariff variables. I did the same exercise for $num\_shipments\_total$, and no major differences from the main outcomes in Table 12 are found.

Appendix C presents a panel data model with fixed effects at the firm level. This strategy does not allow to distinguish the effect of being a $post-FTA$ firm *per se*, since that dummy gets omitted; but we can interact it. The mean exports to USA or all destinations keeps its positive and significant effect; but the interaction with $postfta$ loses significance in most specifications. Tariff variables are not significant, but they show consistency in the signs across columns. In fact, higher tariffs are associated with a longer delay in experimentation; but the interaction for $post - FTA$ firms is linked to an acceleration. All this gives support to the main findings presented earlier. Equal consistency is shown by the trade preference variables. Positive values, although insignificant, for new_wpref; but negative and significant coefficient for the interaction with $postfta$, implying an experimentation acceleration for $post-FTA$ firms exporting products not subject to any $pre-FTA$ preference. No relevant changes for the $pre\_postfta$ combinations, confirming the tendency for $pre - FTA$ firms to experiment quicker since the enactment of the FTA after starting small in the USA market. Although not reported, the *many* dummy, on experimentation rounds with more than one product, is consistently negative and significant, presumably providing a sign of the relaitve ease to introduce similar products in one shipment.

Overall, the results described show an apparent incompatibility between my theory's prediction and the empirical finding on the role of export values. That outcome leads me to think about the limitations of my approach. The observed delay in the introduction of a new product associated with larger shipments of previous goods might be due to a firm-specific decision to sufficiently enjoy the profitability in market d generated by exporting product A, which is not contemplated in my theory. Additionally, my empirical approach accounts in a preliminary way for firms' experience in other markets, by including a dummy taking value 1 if, between experimentation rounds $i-1$ and i, the firm has exported elsewhere. Clearly, further attempts can be made to account for that experience.

I am aware as well that the number of shipments of a product is not a perfect indicator of experimentation speed, since few shipments may occur within a long period of time, and the shipment frequency may also depend on the industry the product belongs to. This is to some extent tackled here by controlling for sector fixed effects of the new product introduced; but it would also be relevant to control for the industry of the old products; although most old and new products belong to the same industry.

6.2 Duration Model

Aiming to offer a closer complement to the earlier Kaplan-Meier survival analysis, I run a Cox Proportional Hazard Model, a continuous-time duration model proposed by Cox (1972), which estimates the hazard function for every individual from a sample, in the following general shape:

$$h(t) = h_0(t)exp(\beta_1 x_1 + \ldots + \beta_k x_k) \tag{17}$$

where $h(t)$ is the hazard at time t for an observation; $h_0(t)$ is the baseline hazard, not estimated in this model; and the rest of the right hand side stands for the covariates considered. The Cox Model calculates the probability of a failure to occur to an individual at time t. I opted for a continuous-time model like Cox given the nature of the time spells constructed.

As in my earlier approach, observations are at the experimentation round level; and the time spell considered is the number of days prior to the event of a firm's experimentation round i since the day of firm's round $i-1$ inclusively. Hence, the event of a Peruvian firm introducing a new export to the USA market is the "failure" in this analysis, and I measure the probability of that "failure" occurring at day t since the firm's previous "failure", or since the firm's foundation date, in case of its first experimentation round.

It is important to point out that, as many of my covariates are at the product level, this exercise does not include censored observations. And, more importantly, given the likely existence of risk heterogeneity at the firm level, I run a Cox model with shared frailty at such level.

Tables 13 and 14 report the hazard ratios ($exp(\beta_k)$) using the same regressors from the OLS analysis. Hazard ratios above unity mean that the covariate increases the probability of introducing new exports to USA; whereas ratios below unity represent a fall in that likelihood.

Table 13: Peruvian Firms' Probability of Introducing New Exports to USA (Hazard Ratios) Excluding First Experimentation Rounds

Time Spell	Days After Firm i's Last Experimentation Round in USA							
Estimation	Cox Proportional Hazard Model - Shared Frailty at Firm Level							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.629***	1.796***	0.985	0.293***	1.626***	2.199***	0.982	0.345***
	(0.0857)	(0.329)	(0.0608)	(0.0742)	(0.0853)	(0.401)	(0.0603)	(0.0864)
mean_export_USA	0.846***	0.861***	0.849***	0.857***	0.846***	0.863***	0.849***	0.860***
	(0.0146)	(0.0160)	(0.0147)	(0.0217)	(0.0146)	(0.0161)	(0.0147)	(0.0217)
postfta*export_USA		1.022		1.026		1.019		1.021
		(0.0208)		(0.0273)		(0.0208)		(0.0271)
new_wmean_tariff	1.908**	0.649	1.784*	1.023				
	(0.582)	(0.263)	(0.546)	(0.671)				
postfta*tariff		4.327***		2.759				
		(2.272)		(2.037)				
new_wpref					0.901**	0.967	0.886**	1.032
					(0.0431)	(0.0559)	(0.0425)	(0.0919)
postfta*pref						0.851**		0.795**
						(0.0678)		(0.0833)
pre_postfta			0.477***	0.171***			0.474***	0.162***
			(0.0245)	(0.0407)			(0.0242)	(0.0380)
pre_postfta*export_USA				1.003				1.003
				(0.0249)				(0.0248)
pre_postfta*tariff				0.475				
				(0.353)				
pre_postfta*pref								0.911
								(0.0922)
FE_2009		0.283***		2.023***		0.275***		2.009***
		(0.0372)		(0.134)		(0.0356)		(0.133)
FE_2010		0.219***		1.542***		0.213***		1.548***
		(0.0290)		(0.0910)		(0.0279)		(0.0913)
FE_2011		0.169***		1.187***		0.165***		1.192***
		(0.0225)		(0.0637)		(0.0216)		(0.0638)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5025	5025	5025	5025	5044	5044	5044	5044
chi2	340.4	764.1	539.3	766.9	341.2	772.4	545.9	774.4
theta	0.350	0.282	0.339	0.282	0.349	0.283	0.338	0.283

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table 13 shows the results excluding the first experimentation round per firm, in order to see the effect of the mean exports to USA only. To understand the interpretation of hazard ratios, let me focus on Column (1). Being a $post-FTA$ firm increases in 62.9% a Peruvian firm's probability of introducing a new set of products to the USA market at time t, compared to a $pre-FTA$ firm. For covariates in natural logs, the interpretation is different: an e-fold rise in a firm's mean export value to USA (multiplied by $e = 2.718$) since its last experimentation round reduces the new experimentation likelihood in 15% approximately; and an e-fold rise in the $pre-FTA$ tariff on products raises the experimentation probability in about 91%.

As in the OLS approach, the $postfta$ dummy changes sign when including the $pre\_postfta$ regressors; and the mean export value keeps its hazard-reducing function across all specifications. Regarding the tariff variable, when including its interaction with $postfta$, it loses significance and even gets its role reversed; while the interaction turns out highly significant, with a clear role of increasing the experimentation probability in Column (2), meaning that $post-FTA$ firms tend to experiment faster in the USA market with goods previously charged with high tariffs. The figures for the new_wpref variables are consistent with the outcome from the previous analyses: firms tend to experiment earlier in the USA market with products with no $pre-FTA$

unilateral trade preference by USA, especially in the case of firms founded after 2009.

An important difference with respect to the OLS estimates occurs with the variables accounting for $post-FTA$ experimentation rounds by $pre-FTA$ firms. The significant coefficients below unity for $pre\_postfta$ in all specifications imply that this category of experimentation tends to take more days to occur than experimentation rounds made before the FTA enactment, which makes sense given the time comparisons mentioned earlier between pre and $post-FTA$ experimentation rounds by $pre-FTA$ firms. However, interactions, especially that with the mean export value, are all insignificant. This differs from the previous analysis, where $pre\_postfta$ experimentation rounds preceded by small shipments tended to occur faster.

Apparently, the inclusion of the $pre\_postfta$ covariates discards any accelerating effect of trade liberalisation. Nevertheless, Columns (4) and (8) control for year fixed effects, which hazard ratios are worth referring to. While 2007 and 2008 dummies have a slow-down effect on experimentation, that effect dramatically reverses into acceleration for 2009, the year of the FTA enactment. In fact, the experimentation probability increases by more than 100% in that year with respect to 2006, the base year. In other words, a Peruvian firm in 2009 is over 100% more likely to experiment in USA than a firm in 2006, t days after their last experimentation rounds. That effect decreases to around 54% for 2010 and 19% for 2011. Hence, these results confirm that there is an effect from trade liberalisation in favour of faster export experimentation by Peruvian firms in the USA market.[15]

[15]The estimations from the Cox Proportional Hazard approach control for year fixed effects from 2007 to 2013; but only coefficients for 2009-2011 dummies are reported in this paper.

Table 14: Peruvian Firms' Probability of Introducing New Exports to USA (Hazard Ratios) Including First Experimentation Rounds

Time Spell	Days After Firm i's Last Experimentation Round in USA or Entry into Business (1st Round)							
Estimation	Cox Proportional Hazard Model - Shared Frailty at Firm Level							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.710***	1.576**	1.090	0.211***	1.524***	1.808***	1.141**	0.288***
	(0.0849)	(0.297)	(0.0615)	(0.0529)	(0.0867)	(0.373)	(0.0736)	(0.0780)
mean_export_total	0.820***	0.856***	0.823***	0.865***	0.802***	0.838***	0.805***	0.835***
	(0.0143)	(0.0155)	(0.0143)	(0.0210)	(0.0151)	(0.0168)	(0.0151)	(0.0228)
postfta*export_total		1.052**		1.035		1.043*		1.047
		(0.0216)		(0.0270)		(0.0238)		(0.0305)
new_wmean_tariff	1.396	0.658	1.230	0.628				
	(0.415)	(0.249)	(0.367)	(0.377)				
postfta*tariff		5.255***		5.309**				
		(2.533)		(3.575)				
new_wpref					0.893**	0.964	0.886**	1.045
					(0.0433)	(0.0556)	(0.0430)	(0.0927)
postfta*pref						0.841**		0.773**
						(0.0670)		(0.0808)
pre_postfta			0.501***	0.157***			0.641***	0.166***
			(0.0238)	(0.0371)			(0.0325)	(0.0417)
pre_postfta*export_total				0.973				1.004
				(0.0238)				(0.0272)
pre_postfta*tariff				0.883				
				(0.601)				
pre_postfta*pref								0.890
								(0.0899)
FE_2009		0.225***		2.577***		0.276***		1.986***
		(0.0263)		(0.162)		(0.0358)		(0.132)
FE_2010		0.159***		1.810***		0.218***		1.556***
		(0.0189)		(0.100)		(0.0286)		(0.0917)
FE_2011		0.120***		1.337***		0.168***		1.193***
		(0.0143)		(0.0677)		(0.0221)		(0.0639)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5832	5832	5832	5832	5853	5853	5853	5853
chi2	498.6	1808.4	708.7	1786.1	595.2	795.0	673.9	797.3
theta	0.473	0.245	0.438	0.263	0.665	0.287	0.642	0.287

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

No major changes to the commented results occur in Table 14 where I add the first experimentation rounds to measure the effect of mean export values to all destinations. Perhaps, I may highlight that in the first four columns the accelerating role of the $postfta$ variables is stronger, since the interaction with export values recovers its significance, as in the OLS approach; and the interaction with tariffs provides a more evident effect in favour of experimentation. That means, $postfta$ firms experiment faster with products with higher $pre-FTA$ tariffs after having shipped large export values abroad.

Very similar results are obtained for Cox estimations without shared frailty, with standard errors clustered at the firm level, presented in Appendix D. I also present in Appendix E separate Cox estimations for first and second experimentation rounds. Results do not differ from the shared frailty exercise nor the OLS estimations; but I can remark that the aforementioned acceleration effects arising from the year fixed effects after the FTA enactment get dramatically inflated for these first two experimentation rounds, especially the first one. The 2009 dummy provides a 2,000% jump in the probability to send a first shipment to USA; while a 660% and 350% probability rise are given by the 2010 and 2011 dummies, respectively.

7 Conclusions

This paper investigates the strategy firms undertake to penetrate into one particular destination, by exporting new products sequentially. More precisely, I am interested in how quickly firms experiment with a new product in that market, after having done so with other previous products.

For that purpose, I develop a theoretical model where product demands follow a joint bivariate distribution, imperfectly correlated. By sending shipments of the cheaper product A to market d, thereby realising the demand for A, a firm gradually updates its expected demand for the more costly product B. Thus, the expected demand for B is in function of the number of shipments of A, as well as the demand correlation of both products, and the mean value of those shipments.

As a result, my model predicts that *experimentation speed* in a sequential exporting strategy is greater (i.e. fewer shipments of A before introduction of B) with (i) lower trade costs of product B; (ii) larger mean export values of A to market d; and (iii) higher correlation between the two products' demand in d. The magnitude of these effects clearly depend on the initial values of those variables.

This prediction is empirically tested with a survival analysis, comprising a Kaplan-Meier survival estimation and a Cox proportional hazard model, along with an OLS and panel data approach, using a very rich dataset of Peruvian exports to the USA market, covering the 2006-2013 period. The data was processed to obtain a set of observations, each representing the event in which a Peruvian firm introduces one or more new products to the USA market, known in this paper as an *experimentation round*. I give special emphasis on the role of trade liberalisation, expressed as the tariff elimination by the United States on Peruvian products, under the Free Trade Agreement signed by both countries in 2009. Thus, this paper is one of the first attempts to measure the effects of this FTA on Peruvian exporters' performance in the USA market.

Overall, the prediction from my theoretical approach finds empirical support regarding the effect of trade liberalisation on *experimentation speed*. This can be observed in several ways. Firstly, $post-FTA$ firms, founded between 2009 and 2013, tend to introduce new products to USA faster than $pre-FTA$ firms, expressed in either fewer previous shipments of other products to that market or fewer days since the introduction of the previous product. Secondly, that process is even quicker when the product used to face a high tariff prior to the FTA enactment and/or the product was not subject to a $pre-FTA$ unilateral trade preference regime by USA, such as ATPDEA or MFN zero tariff. Thirdly, the probability of a firm experimenting in USA (the hazard ratio) dramatically jumps if the round takes place in 2009, the year of the FTA enactment, and in 2010, to a minor extent.

The effect of the mean export value of old products on experimentation speed appears to be opposite to my theory's prediction. Indeed, higher mean shipments of product A are associated with a delay in the introduction of product B, expressed in more prior shipments of A or more days since the first shipment of A. This outcome may be related with the dynamics of my prediction, in that the negative association between mean export values of A and prior shipments is smaller for larger mean exports. Moreover, when linking this factor with trade liberalisation, I find interesting results. $Post-FTA$ firms, compared to $pre-FTA$ firms, are boosted to experiment faster in the USA market after shipping larger values of old products. However, since 2009, $pre-FTA$ firms are prompted to experiment faster with a new product after shipping lower amounts of other products (i.e. after starting small with them).

There are clearly several issues to be addressed in the future. The role of correlation between the products demand in the market of interest is yet to be tested empirically. Hence, for further research I may control for that by, for instance, including a variable controlling for the degree of similarity between products A and B; although that aim gets more complicated for further experimentation rounds, and if those rounds comprise more than one product. Moreover, it can be argued that firms' better performing products –"core competence" products– tend to be exported more rapidly and earlier than worse performing ones. That is another issue to address in the future.

Finally, more data availability on firm-specific characteristics to account for heterogeneity, as well as product-specific information on production costs, or information on the buyer side, will be other important inputs to better investigate these export dynamics. To my knowledge, this is the first attempt to analyse the determinants of experimentation speed across products in a market, and surely future researches may arise for other firms and destinations.

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Appendix A Derivation: Moments of x^A

The derivation of the moments of the random vector $x^A \equiv [x_1^A, \dots, x_j^A, \dots, x_J^A]$ is based on a previous work by Nguyen (2012). This vector is formed of an arbitrarily large number J of possible shipments of product A, and is normally distributed:

$$x^A \sim (0_J, \Xi) \tag{A.1a}$$

$$\Xi = \sigma_0^2 \begin{bmatrix} 1 & \rho & \dots & \rho \\ \rho & 1 & \dots & \rho \\ \dots & \dots & \dots & \dots \\ \rho & \rho & \dots & 1 \end{bmatrix} \tag{A.1b}$$

The vector x^A can be partitioned, defining $x^A = [x_1^A, x_I^A]$, where x_I^A is a vector of $J-1$ elements and x_1^A is a single element. As a result, matrix A.1b is partitioned as follows:

$$\Xi^I = \left[\begin{array}{c|ccc} 1 & \rho & \dots & \rho \\ \hline \rho & 1 & \dots & \rho \\ \dots & \dots & \dots & \dots \\ \rho & \rho & \dots & 1 \end{array}\right] = \begin{bmatrix} 1 & \Xi_{1I} \\ \Xi_{I1} & \Xi_{II} \end{bmatrix} \tag{A.2}$$

Since, from Equation 9a, at the initial stage of the decision-making process in market d, $E[x^A] = E[x^B] = 0$, and the firm decides on B given its previous shipments of A, I can take the single element x_1^A as the perceived demand from the first shipment of product B, x_1^B. Then, following a theorem on *Marginal and Conditional Normal Distributions*, explained at the *Econometric Analysis* textbook by Greene (2012), I can calculate the conditional distribution of x_1^B given x_I^A, which is normal with the following moments:

$$E[x_1^B \mid x_I^A] = \Xi_{1I}\Xi_{II}^{-1}x_I^A \tag{A.3a}$$

$$Var[x_1^B \mid x_I^A] = \sigma_0^2 - \Xi_{1I}\Xi_{II}^{-1}\Xi_{I1} \tag{A.3b}$$

Subsequently, I follow Nguyen (2011), guided by a previous work by Paltseva (2010), in order to simplify the term $\Xi_{1I}\Xi_{II}^{-1}$. The challenge is to obtain the inverse matrix of Ξ_{II}^{-1}. Paltseva (2010) achieved the following simplification:

$$\begin{aligned} \Xi_{1I}\Xi_{II}^{-1} &= \frac{[\rho \ \dots \ \dots \ \rho]}{(1-\rho)(1+(I-1)\rho)} \begin{bmatrix} 1+(I-2)\rho & -\rho & \dots & -\rho \\ -\rho & 1+(I-2)\rho & \dots & -\rho \\ \dots & \dots & \dots & \dots \\ -\rho & -\rho & \dots & 1+(I-2)\rho \end{bmatrix} \\ &= \frac{\rho}{(1+(I-1)\rho)}[1 \ \dots \ \dots \ 1] \end{aligned} \tag{A.4}$$

By that simplification, I can rewrite the moments from Equations A.3a and A.3b:

$$E[x_1^B \mid x_I^A] = \Xi_{1I}\Xi_{II}^{-1}x_I^A = \frac{\rho\Sigma_{i\in I_A}x_i^A}{(1+(I-1)\rho)} \tag{A.5a}$$

$$Var[x_1^B \mid x_I^A] = \sigma_0^2 \ - \Xi_{1I}\Xi_{II}^{-1}\Xi_{I1} = \sigma_0^2\left(1 - \frac{I\rho^2}{(1+(I-1)\rho)}\right) \tag{A.5b}$$

Note that if I multiply both the numerator and denominator of Equation A.5a by I_A, I obtain the expected value of x^B given I_A of Equation 11a. Additionally, the denominator $(1+(I-1)\rho)$ is a rearrangement of $I_A\rho + (1-\rho)$ from Equations 11a and 11b.

Appendix B OLS Estimations: First and Second Experimentation Rounds

Table B.1: N° Shipments by Peruvian Firms to USA Before Second Experimentation Round in That Market

Dependent Variable	num_shipments_USA							
Estimation	OLS							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	-0.119*	0.368	-0.139*	-0.135	-0.119*	0.352	-0.130*	-0.274
	(0.0640)	(0.284)	(0.0741)	(0.329)	(0.0638)	(0.284)	(0.0739)	(0.356)
mean_export_USA	0.0653**	0.0939***	0.0653**	0.0250	0.0615**	0.0833**	0.0615**	0.00901
	(0.0291)	(0.0325)	(0.0291)	(0.0380)	(0.0295)	(0.0327)	(0.0294)	(0.0384)
postfta*export_USA		-0.0614*		0.0112		-0.0586*		0.0115
		(0.0333)		(0.0386)		(0.0333)		(0.0381)
new_wmean_tariff		-0.824		0.896				
		(0.825)		(1.098)				
postfta*tariff		0.699		-1.040				
		(0.931)		(1.170)				
new_wpref					0.243**	0.192	0.242**	0.188
					(0.0966)	(0.124)	(0.0977)	(0.149)
postfta*pref						0.0752		0.0843
						(0.141)		(0.165)
pre_postfta			-0.0401	-0.813**			-0.0221	-1.123***
			(0.0926)	(0.365)			(0.0934)	(0.407)
pre_postfta*export_USA				0.117***				0.128***
				(0.0449)				(0.0457)
pre_postfta*tariff				-2.967**				
				(1.351)				
pre_postfta*pref								0.0262
								(0.202)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes				Yes		Yes
N	1117	1108	1117	1108	1115	1115	1115	1115
r2_o	0.0470	0.0579	0.0472	0.0610	0.0535	0.0624	0.0535	0.0699
F	6.512	3.744	5.885	4.828	6.762	4.335	6.233	4.094

Robust standard errors controlling for heteroskedasticity.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table B.2: N° Shipments by Peruvian Firms Abroad Before First Experimentation Round in USA

Dependent Variable	num_shipments_total							
Estimation	OLS							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	0.0426	0.618	0.264**	1.428**	0.0294	0.523	0.240*	1.102*
	(0.108)	(0.608)	(0.126)	(0.710)	(0.108)	(0.589)	(0.126)	(0.640)
mean_export_total	0.0895*	0.140***	0.0949**	0.0624	0.0973**	0.138**	0.102**	0.0609
	(0.0473)	(0.0536)	(0.0478)	(0.0682)	(0.0477)	(0.0541)	(0.0481)	(0.0681)
postfta*export_total		-0.0904		-0.0141		-0.0930		-0.0174
		(0.0599)		(0.0674)		(0.0600)		(0.0669)
new_wmean_tariff		3.205**		4.155**				
		(1.392)		(1.813)				
postfta*tariff		-0.646		-1.546				
		(1.638)		(2.035)				
new_wpref					-0.453***	-0.514***	-0.434***	-0.542**
					(0.148)	(0.189)	(0.146)	(0.245)
postfta*pref						0.196		0.220
						(0.220)		(0.269)
pre_postfta			0.397**	0.0602			0.377**	-0.225
			(0.155)	(0.930)			(0.154)	(0.881)
pre_postfta*export_total				0.164*				0.160*
				(0.0901)				(0.0899)
pre_postfta*tariff				-1.802				
				(2.315)				
pre_postfta*pref								0.0796
								(0.315)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	813	807	813	807	809	809	809	809
r2_o	0.109	0.142	0.116	0.148	0.120	0.146	0.127	0.150
F	13.24	7.624	12.43	7.499	13.45	7.872	12.59	7.779

Robust standard errors controlling for heteroskedasticity.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table B.3: N° Shipments by Peruvian Firms Abroad Before Second Experimentation Round in USA

Dependent Variable	num_shipments_total							
Estimation	OLS							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	-0.228***	0.404	-0.0430	0.158	-0.228***	0.375	-0.0318	0.0902
	(0.0780)	(0.368)	(0.0887)	(0.414)	(0.0779)	(0.375)	(0.0883)	(0.407)
mean_export_total	0.109***	0.149***	0.106***	0.0650	0.104***	0.138***	0.101***	0.0467
	(0.0336)	(0.0379)	(0.0336)	(0.0450)	(0.0343)	(0.0384)	(0.0344)	(0.0452)
postfta*export_total		-0.112***		-0.0204		-0.107***		-0.00845
		(0.0412)		(0.0478)		(0.0413)		(0.0472)
new_wmean_tariff		-0.878		-0.309				
		(1.214)		(1.339)				
postfta*tariff		0.563		-0.125				
		(1.318)		(1.438)				
new_wpref					0.247**	0.238*	0.268**	0.355**
					(0.117)	(0.144)	(0.116)	(0.176)
postfta*pref						0.0395		-0.0608
						(0.170)		(0.197)
pre_postfta			0.370***	-0.897*			0.392***	-0.977*
			(0.113)	(0.499)			(0.113)	(0.507)
pre_postfta*export_total				0.156***				0.170***
				(0.0578)				(0.0579)
pre_postfta*tariff				-1.058				
				(2.077)				
pre_postfta*pref								-0.189
								(0.243)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes				Yes		
N	1117	1108	1117	1108	1115	1115	1115	1115
r2_o	0.130	0.154	0.139	0.151	0.133	0.157	0.143	0.155
F	18.59	9.988	17.55	12.52	17.08	10.25	16.37	12.82

Robust standard errors controlling for heteroskedasticity.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Appendix C Panel Data Regressions - Fixed Effects at Firm Level

Table C.1: N° Shipments by Peruvian Firms to USA Before Introduction of New Export to That Market

Dependent Variable	num_shipments_USA							
Estimation	Panel Fixed Effects							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mean_export_USA	0.177***	0.160***	0.117***	0.0632***	0.175***	0.158***	0.118***	0.117***
	(0.0212)	(0.0214)	(0.0226)	(0.0208)	(0.0211)	(0.0214)	(0.0231)	(0.0275)
postfta*export_USA	-0.0163	0.00359	0.0470*	0.00915	-0.0157	0.00462	0.0442	0.0454
	(0.0255)	(0.0253)	(0.0267)	(0.0209)	(0.0255)	(0.0253)	(0.0272)	(0.0301)
new_wmean_tariff	0.207	0.525	0.514	-0.158				
	(0.402)	(0.417)	(0.647)	(0.614)				
postfta*tariff	-0.707	-0.833	-0.987	-0.685				
	(0.518)	(0.524)	(0.718)	(0.660)				
new_wpref					-0.0518	-0.0420	-0.0949	-0.0986
					(0.0631)	(0.0643)	(0.0925)	(0.0975)
postfta*pref					0.183**	0.159**	0.222**	0.216**
					(0.0812)	(0.0808)	(0.104)	(0.107)
pre_postfta*export_USA			0.0793***	0.106***			0.0732***	0.0593**
			(0.00891)	(0.0222)			(0.0102)	(0.0266)
pre_postfta*tariff			-0.283	0.470				
			(0.693)	(0.734)				
pre_postfta*pref							0.0741	0.0756
							(0.0947)	(0.0982)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5009	5009	5009	5009	5028	5028	5028	5028
r2_o	0.0491	0.0284	0.0523	0.0370	0.0436	0.0226	0.0457	0.0314
N_clust	1115	1115	1115	1115	1117	1117	1117	1117

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table C.2: N° Shipments by Peruvian Firms Abroad Before Introduction of New Export to USA

Dependent Variable	num_shipments_total							
Estimation	Panel Fixed Effects							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
mean_export_total	0.232***	0.194***	0.147***	0.134***	0.233***	0.193***	0.153***	0.130***
	(0.0271)	(0.0283)	(0.0285)	(0.0330)	(0.0269)	(0.0282)	(0.0293)	(0.0329)
postfta*export_total	-0.0281	0.00997	0.0566*	0.0692*	-0.0289	0.0106	0.0496	0.0715**
	(0.0318)	(0.0329)	(0.0328)	(0.0360)	(0.0318)	(0.0328)	(0.0338)	(0.0359)
new_wmean_tariff	0.227	0.689	0.792	0.846				
	(0.443)	(0.458)	(0.726)	(0.717)				
postfta*tariff	-0.675	-0.877	-1.210	-1.034				
	(0.575)	(0.582)	(0.807)	(0.795)				
new_wpref					-0.0665	-0.0348	-0.147	-0.147
					(0.0699)	(0.0695)	(0.0964)	(0.0994)
postfta*pref					0.149	0.117	0.227**	0.230**
					(0.0958)	(0.0934)	(0.115)	(0.116)
pre_postfta*export_total			0.0985***	0.0892***			0.0864***	0.0911***
			(0.00939)	(0.0313)			(0.0101)	(0.0310)
pre_postfta*tariff			-0.579	-0.212				
			(0.768)	(0.791)				
pre_postfta*pref							0.156	0.167
							(0.100)	(0.103)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5826	5826	5826	5826	5847	5847	5847	5847
r2_o	0.0447	0.0326	0.0580	0.0449	0.0422	0.0277	0.0530	0.0408
F	1563	1563	1563	1563	1564	1564	1564	1564

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Appendix D Cox Proportional Hazard Model - No Shared Frailty at Firm Level

Table D.1: Peruvian Firms' Probability of Introducing New Exports to USA (Hazard Ratios) Excluding First Experimentation Rounds

Time Spell	Days After Firm i's Last Experimentation Round in USA							
Estimation	Cox Proportional Hazard Model							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.336***	1.447*	0.851***	0.340***	1.335***	1.673***	0.850***	0.383***
	(0.0677)	(0.289)	(0.0458)	(0.0763)	(0.0677)	(0.317)	(0.0458)	(0.0800)
mean_export_USA	0.898***	0.908***	0.899***	0.911***	0.898***	0.909***	0.899***	0.913***
	(0.0149)	(0.0166)	(0.0145)	(0.0215)	(0.0148)	(0.0165)	(0.0144)	(0.0212)
postfta*export_USA		1.022		1.019		1.020		1.015
		(0.0206)		(0.0247)		(0.0205)		(0.0243)
new_wmean_tariff		0.808		1.116				
		(0.309)		(0.650)				
postfta*tariff		3.156**		2.295				
		(1.567)		(1.467)				
new_wpref					0.913**	0.964	0.902**	1.022
					(0.0395)	(0.0515)	(0.0388)	(0.0809)
postfta*pref						0.903		0.850*
						(0.0685)		(0.0776)
pre_postfta			0.530***	0.250***			0.529***	0.242***
			(0.0327)	(0.0627)			(0.0327)	(0.0573)
pre_postfta*export_USA				0.993				0.991
				(0.0256)				(0.0252)
pre_postfta*tariff				0.596				
				(0.433)				
pre_postfta*pref								0.918
								(0.0911)
FE_2009		0.383***		1.867***		0.372***		1.854***
		(0.0374)		(0.125)		(0.0369)		(0.124)
FE_2010		0.295***		1.428***		0.288***		1.433***
		(0.0305)		(0.0917)		(0.0303)		(0.0922)
FE_2011		0.236***		1.148**		0.232***		1.155***
		(0.0246)		(0.0626)		(0.0244)		(0.0627)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5052	5025	5052	5025	5044	5044	5044	5044
N_clust	1118	1116	1118	1116	1118	1118	1118	1118
chi2	213.7	773.9	259.8	777.0	215.8	772.6	267.1	772.6

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table D.2: Peruvian Firms' Probability of Introducing New Exports to USA (Hazard Ratios) Including First Experimentation Rounds

Time Spell	Days After Firm i's Last Experimentation Round in USA or Entry into Business (1st Round)							
Estimation	Cox Proportional Hazard Model							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.368***	1.329	0.889**	0.265***	1.366***	1.540**	0.888**	0.308***
	(0.0701)	(0.273)	(0.0460)	(0.0579)	(0.0700)	(0.302)	(0.0459)	(0.0644)
mean_export_total	0.892***	0.907***	0.891***	0.924***	0.893***	0.907***	0.892***	0.924***
	(0.0136)	(0.0167)	(0.0135)	(0.0208)	(0.0135)	(0.0167)	(0.0134)	(0.0208)
postfta*export_total		1.048**		1.025		1.046**		1.023
		(0.0216)		(0.0244)		(0.0215)		(0.0244)
new_wmean_tariff		0.866		0.789				
		(0.318)		(0.409)				
postfta*tariff		3.374***		3.597**				
		(1.582)		(2.046)				
new_wpref					0.922**	0.985	0.909**	1.065
					(0.0359)	(0.0499)	(0.0353)	(0.0762)
postfta*pref						0.902		0.835**
						(0.0626)		(0.0679)
pre_postfta			0.535***	0.244***			0.534***	0.249***
			(0.0329)	(0.0599)			(0.0328)	(0.0575)
pre_postfta*export_total				0.960				0.960
				(0.0238)				(0.0237)
pre_postfta*tariff				0.996				
				(0.652)				
pre_postfta*pref								0.875
								(0.0801)
FE_2009		0.329***		2.307***		0.324***		2.302***
		(0.0297)		(0.157)		(0.0294)		(0.157)
FE_2010		0.240***		1.676***		0.236***		1.681***
		(0.0236)		(0.103)		(0.0234)		(0.104)
FE_2011		0.186***		1.296***		0.184***		1.309***
		(0.0185)		(0.0694)		(0.0185)		(0.0698)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	5865	5832	5865	5832	5853	5853	5853	5853
N_clust	1566	1563	1566	1563	1564	1564	1564	1564
chi2	254.8	2355.4	298.0	2299.9	262.2	2309.2	310.8	2254.5

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Appendix E Cox Proportional Hazard Model - First and Second Experimentation Rounds

Table E.1: Peruvian Firms' Probability of Introducing New Exports to USA - Second Experimentation Round (Hazard Ratios)

Time Spell	Days After Firm i's First Experimentation Round in USA							
Estimation	Cox Proportional Hazard Model							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.451***	1.905**	0.835**	0.226***	1.448***	2.333***	0.831**	0.285***
	(0.0893)	(0.547)	(0.0600)	(0.0787)	(0.0891)	(0.644)	(0.0606)	(0.0947)
mean_export_USA	0.936**	0.917***	0.927***	0.921***	0.938**	0.918***	0.929***	0.920***
	(0.0240)	(0.0229)	(0.0234)	(0.0293)	(0.0238)	(0.0229)	(0.0233)	(0.0293)
postfta*export_USA		1.052*		1.047		1.046		1.043
		(0.0322)		(0.0367)		(0.0318)		(0.0369)
new_wmean_tariff		0.965		0.681				
		(0.750)		(0.725)				
postfta*tariff		5.260*		7.416*				
		(4.905)		(8.635)				
new_wpref					0.851*	0.875	0.834**	0.954
					(0.0705)	(0.0866)	(0.0702)	(0.127)
postfta*pref						0.902		0.829
						(0.118)		(0.128)
pre_postfta			0.379***	0.119***			0.377***	0.130***
			(0.0321)	(0.0424)			(0.0324)	(0.0460)
pre_postfta*export_USA				0.992				0.994
				(0.0363)				(0.0367)
pre_postfta*tariff				1.885				
				(2.495)				
pre_postfta*pref								0.850
								(0.148)
FE_2009		0.396***		3.354***		0.387***		3.312***
		(0.0591)		(0.434)		(0.0585)		(0.427)
FE_2010		0.230***		1.958***		0.230***		1.981***
		(0.0368)		(0.236)		(0.0372)		(0.240)
FE_2011		0.163***		1.381***		0.161***		1.385***
		(0.0260)		(0.163)		(0.0261)		(0.163)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	1118	1109	1118	1109	1116	1116	1116	1116
R2_p	0.0107	0.0277	0.0190	0.0277	0.0110	0.0278	0.0194	0.0278
chi2	134.2	367.6	238.5	370.8	143.2	366.4	245.7	373.1

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table E.2: Peruvian Firms' Probability of Introducing New Exports to USA - First Experimentation Round (Hazard Ratios)

Time Spell	Days After Firm i's Entry into Business							
Estimation	Cox Proportional Hazard Model							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	2.291***	10.73***	0.654***	0.0300***	2.282***	12.12***	0.651***	0.0394***
	(0.169)	(3.956)	(0.0550)	(0.0138)	(0.169)	(4.227)	(0.0553)	(0.0171)
mean_export_total	0.988	0.922**	0.970	0.940	0.987	0.925**	0.970	0.957
	(0.0317)	(0.0309)	(0.0316)	(0.0374)	(0.0316)	(0.0312)	(0.0317)	(0.0393)
postfta*export_total		1.045		1.023		1.039		1.006
		(0.0393)		(0.0436)		(0.0388)		(0.0431)
new_wmean_tariff		7.108**		2.121				
		(6.271)		(2.583)				
postfta*tariff		2.773		9.111*				
		(2.928)		(12.13)				
new_wpref					1.023	0.886	0.964	0.886
					(0.0949)	(0.109)	(0.0998)	(0.152)
postfta*pref						1.002		1.003
						(0.147)		(0.186)
pre_postfta			0.133***	0.00337***			0.133***	0.00464***
			(0.0140)	(0.00181)			(0.0140)	(0.00239)
pre_postfta*export_total				0.952				0.931
				(0.0476)				(0.0464)
pre_postfta*tariff				8.207				
				(11.56)				
pre_postfta*pref								0.994
								(0.191)
FE_2009		0.0549***		21.30***		0.0526***		21.55***
		(0.0107)		(3.732)		(0.00998)		(3.747)
FE_2010		0.0195***		7.580***		0.0183***		7.460***
		(0.00395)		(1.197)		(0.00360)		(1.173)
FE_2011		0.0117***		4.511***		0.0111***		4.520***
		(0.00245)		(0.693)		(0.00227)		(0.694)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	813	807	813	807	809	809	809	809
R2_p	0.0140	0.0849	0.0423	0.0852	0.0138	0.0836	0.0423	0.0838
chi2	138.6	934.1	411.5	938.8	136.7	904.4	409.5	908.0

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.

Table E.3: Peruvian Firms' Probability of Introducing New Exports to USA - Second Experimentation Round (Hazard Ratios)

Time Spell	Days After Firm i's First Experimentation Round in USA							
Estimation	Cox Proportional Hazard Model							
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
postfta	1.443***	1.372	0.833**	0.160***	1.440***	1.732*	0.830**	0.205***
	(0.0885)	(0.429)	(0.0596)	(0.0599)	(0.0883)	(0.529)	(0.0603)	(0.0727)
mean_export_total	0.917***	0.890***	0.913***	0.889***	0.919***	0.892***	0.916***	0.889***
	(0.0241)	(0.0231)	(0.0243)	(0.0289)	(0.0240)	(0.0231)	(0.0242)	(0.0289)
postfta*export_total		1.090**		1.090**		1.082**		1.086**
		(0.0365)		(0.0420)		(0.0360)		(0.0418)
new_wmean_tariff		0.792		0.606				
		(0.613)		(0.645)				
postfta*tariff		6.086*		7.941*				
		(5.637)		(9.232)				
new_wpref					0.854*	0.894	0.837**	0.974
					(0.0713)	(0.0888)	(0.0708)	(0.130)
postfta*pref						0.878		0.808
						(0.114)		(0.126)
pre_postfta			0.382***	0.113***			0.380***	0.121***
			(0.0323)	(0.0448)			(0.0326)	(0.0484)
pre_postfta*export_total				1.002				1.005
				(0.0410)				(0.0418)
pre_postfta*tariff				1.674				
				(2.205)				
pre_postfta*pref								0.853
								(0.149)
FE_2009		0.405***		3.388***		0.397***		3.352***
		(0.0612)		(0.434)		(0.0603)		(0.427)
FE_2010		0.233***		1.956***		0.233***		1.984***
		(0.0376)		(0.236)		(0.0378)		(0.240)
FE_2011		0.164***		1.375***		0.162***		1.377***
		(0.0266)		(0.164)		(0.0265)		(0.163)
Sector FE / Other Regressors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes		Yes		Yes		Yes
N	1118	1109	1118	1109	1116	1116	1116	1116
R2_p	0.0110	0.0282	0.0192	0.0282	0.0112	0.0283	0.0195	0.0283
chi2	136.0	370.9	241.1	375.4	143.5	371.2	248.5	380.9

Robust standard errors adjusted for clusters in firms.
*Denotes statistical significance at the 10% level; **Denotes statistical significance at the 5% level;
***Denotes statistical significance at the 1% level.