The Distributional Impacts of Entry Cost: 
A Randomized Field Experiment *

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Abstract

I study a randomized field experiment that generates exogenous variation in the export entry cost for U.S. sellers on eBay. Specifically, eBay’s global shipping program (GSP) removes sellers’ “hassle” cost of understanding the export procedures, as eBay handles the international shipping and customs clearance for them. I identify the program’s distributional impacts on sellers of different sizes using an experiment: Prior to the full launch of the GSP, 20% of eBay sellers selected randomly were offered the opportunity of early enrollments in the program. The intent-to-treat (ITT) estimates show that the program caused a 2.7% increase in exports on eBay. The effect occurred exclusively on the extensive margin of exports defined on the seller or seller-destination level, and from small and medium-sized sellers. I exploit rich micro data to show that the result is driven by a reduction in entry cost, not by changes in variable cost or demand. Finally, the full launch of the GSP caused a 1% rise in product variety, an increase in marketplace quality, and an increase in competition in foreign markets, which is larger for differentiated goods markets. These findings shed light on the 2012 state of the union address of facilitating exports from small and medium-sized enterprises (SME), and suggest that reducing entry costs is the key for promoting their exports.

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1 Introduction

Small and medium-sized enterprises (SME) are the backbone of the world economy.\(^1\) Despite their economic significance, less than 5\% of SMEs in the United States export. Recently, promoting SMEs’ export has drawn attention from many governments. For example, the National Export Initiative made a top priority of removing trade barriers for SMEs in 2012.\(^2\) Also, many countries developed public export promotion programs (EPP), with annual budgets ranging from 100 million to more than 400 million dollars in developed countries (Jordana et al. [2009]).\(^3\)

Despite the ubiquity of EPPs, we have limited understanding of the mechanisms that drive heterogeneous impacts for firms of different sizes. This understanding is important for efficiently targeting SMEs and building political support for these policies.\(^4\) There are two crucial challenges in identifying the impacts of different mechanisms. The first challenge is that three sources of endogeneity can contaminate empirical estimates: 1) firms self-select into using EPPs, 2) EPPs advertise to particular firms, and 3) EPPs often coincide with other national changes. In these cases, differential changes in exports from participating firms and non-participants may simply stem from firm heterogeneity or other confounding policy changes. The second challenge is that EPPs operate simultaneously through the entry cost, variable cost, and demand mechanisms.\(^5\) Thus, this complexity of the EPPs makes it hard to disentangle their different mechanisms.

This paper examines a randomized field experiment on eBay to study the distributional impacts of a reduction in export entry cost for sellers of different sizes. This reduction is through an EPP on eBay, the global shipping program (GSP), which was introduced in 2013 to remove sellers’ hassle cost of understanding the export procedures. Specifically, sellers can enroll in the GSP for free and simply ship sold items to eBay’s U.S. Shipping Center, which handles the international shipping and customs clearance. Essentially, the GSP is an entry cost subsidy from eBay.\(^6\) The experiment is to offer 20\% of randomly selected eBay sellers the opportunity of early enrollments in the GSP in

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\(^1\)In the United States, SMEs are defined as firms with up to 500 employees in most sectors. According to several reports from United States International Trade Commission, SMEs account for 99.9\% of private nonfarm businesses in 2006, half of the 120 million employment, and half of the GDP between 1998 and 2004.

\(^2\)Similarly, the European Commission (EC) prioritized the notion of Digital Single Market in 2011.

\(^3\)Most popular export promotion programs are trade shows and trade fairs.

\(^4\)First, from the allocative efficiency standpoint, a precise understanding of the mechanism that helps SMEs’ exports allows governments to target policies efficiently to SMEs. Second, from the political economy standpoint, ex-ante knowledge of the beneficiary group’s identity from a policy reform removes the bias towards the status quo and facilitates the adoption of welfare-enhancing policies, as shown in Fernandez and Rodrik [1991]. In Lincoln and McCallum [2011], the authors call for future research on a closely related topic.

\(^5\)EPPs could affect demand by actively matching buyers with sellers and by standing as a buyer guarantee, as listed in Ahn et al. [2011].

\(^6\)Refer to section 2 for a discussion of the cost structure of the program.
October 2012, and examine exports between the treatment and control groups in the three-month experiment window.\(^7\) To my knowledge, this is the first randomized field experiment to study the distributional impacts of an entry cost reduction.\(^8\)

This random assignment directly confronts the first challenge of endogeneity biases. The intent-to-treat (ITT) estimate compares mean outcomes between treatment and control groups, and yields causal effects of the program in the presence of seller selections and macroeconomic trends.

The second challenge in disentangling the different mechanisms of the EPP is addressed by the feature of the GSP and the export procedures on eBay. Specifically, the GSP is designed to reduce sellers’ export entry costs, and it barely changes the export variable costs. First, the GSP reduces export-related costs by homogenizing the procedures of selling domestically and internationally. In particular, sellers need not incur the hassle cost of learning export procedures on eBay or customs regulations for each country. Second, given that sellers have acquired necessary knowledge for exporting, the variable export cost on eBay is almost negligible, involving sellers clicking the “agree to terms” checkbox and the “continue” button on the customs form page, as item specifics are automatically filled by eBay based on listing and postage information (Step 3 in Appendix A).\(^9\) Therefore, these two features imply that the GSP mainly reduces the export entry cost on eBay.

The ITT estimate shows that the average export volume in the treatment group is 2.7% larger than that in the control group in the three-month experiment window (i.e., October–December). Due to the symmetry between the treatment and control groups, I interpret this result as that the opportunity to enroll in the GSP increases average sellers’ export volume by 2.7% on eBay in the experiment window. Furthermore, this increase stems entirely from small and medium-sized sellers and from the extensive margin of exports defined on either the seller or seller-country level.

The primary focus of this paper is to empirically establish the distributional impacts of the entry cost mechanism. Although the program rules and platform features suggest that the GSP changes mainly the entry cost, I empirically test this statement by exploiting the rich micro-level data. Specifically, I present two pieces of evidence to argue that the results are not driven by the

\(^7\)Treatment group consists of sellers that were offered the opportunity of early enrollment.

\(^8\)The only other field experiment in international trade is by Atkin et al. [2014], which establishes strong evidence for learning-by-exporting with a sample of hundreds of small rug manufacturers in Egypt.

\(^9\)Less often, some sellers go to the post office to pay for postage. In this case, the marginal export cost involves the effort of filling out the customs forms. Another dimension of marginal export cost is the non-delivery risk for different countries. This does not appear to be a serious problem since these 18 countries have low non-delivery risk. According to Kaufmann et al. [2011], all these countries have very low to below-median corruption level, which is positively correlated with non-delivery risk. Furthermore, sellers are incentivized to ship internationally with tracking, as they will have no responsibility for non-delivered packages with tracking information. Therefore, the GSP does not appear to lower non-delivery risk.
demand mechanism, and then three pieces of evidence to show that the results are not driven by the variable cost mechanism. These two exercises combined imply that the established results are mainly driven by the entry cost mechanism.

I test the demand mechanism with two approaches. First, I analyze the change in the number and share of internationally available listings, sold or unsold, which can be thought as a supply/cost side change. Second, I directly estimate the demand mechanism with the seller experiment approach (Elfenbein et al. [2012] and Einav et al. [2015]). Seller experiments are listings matched by their item and seller, with only a fraction using the GSP shipping option. The cross-sectional variation in sales probability conditional on relative sales prices shows that the GSP listings have a 0.1% higher sales probability (less than 1% of the mean) than non-GSP listings for the same item-seller pair. Both exercises show that the increase in exports is not driven by the demand mechanism.

Subsequently, I test the variable cost mechanism. First, note that my finding of a statistically insignificant change in the intensive margin is consistent with negligible changes in variable cost. However, this argument is subject to the data sparsity issue raised by Armenter and Koren [2014] and applied by Lendle and Vézina [2015] in the context of eBay: Increases in exports could stem mechanically from the extensive margin if the number of sales is sparse relative to the number of potential destination countries. I mitigate this issue with two methods. First, I assume a global entry cost and perform the previous analyses on margins defined on the U.S. and non-U.S. levels. Second, I exploit data on listing availability and study sellers’ intention of selling more along the extensive margin. Similar patterns on the intensive and extensive margins are observed in both approaches.

An alternative approach to test the variable cost mechanism is to “mute” it and check whether the change in export patterns persists. There are three variable cost channels: First, enrolled sellers need not fill out customs forms at the post office; second, they automatically receive 5 stars on shipping Detailed Seller Ratings (DSR) if they ship out the item within one business day; third, they are not responsible for damages in the international shipping process. Correspondingly, I constrain and analyze sellers who 1) printed eBay-generated prepaid shipping labels or customs forms, 2) received zero low shipping DSRs, and 3) purchased no insurance for any of their shipments in the year before the experiment window. The results from the above three exercises show that the variable cost mechanism does not drive the established results.

The Detailed Seller Ratings (DSR) system is a rating mechanism from buyers to sellers in the following four categories: item as described, communication, shipping time, and shipping and handling charges. Buyers can give sellers 1 to 5 stars after each transaction.
Although not as clean as the randomized experiment approach, it is interesting to study the impacts of the GSP’s full launch on U.S. exports and market competition in foreign markets on eBay. This analysis is based on the difference-in-difference (DiD) framework performed at the country, country-product, and country-product-seller levels. The results show a 1.27% increase in aggregate U.S. exports and a 1% increase in product variety in foreign markets. The smaller increase in exports is not surprising given the competition effect from more U.S. exporters. Moreover, the average quality of foreign markets increases, as evidenced by a 1.2% drop in the share of negative feedback, which mainly comes from a change in seller composition. Finally, the increase in competition measured by the Herfindahl index in foreign markets is larger for differentiated goods markets than for homogeneous goods markets.

To my knowledge, this is the first randomized experiment to estimate the distributional impact of the export entry cost mechanism. The results indicate strong and robust internal validity that a decrease in entry cost increases exports for small and medium-sized sellers through the extensive margin of export. For the external validity of my findings, I must assume that the distributional impacts of the entry cost mechanism work in similar ways in marketplaces outside eBay. I believe that this is a reasonable assumption for a few reasons. First, eBay is a large marketplace and accounts for about 12% of the 306 billion e-commerce industry in the United States, containing around 157 million users and 800 million live listings in 2014. Second, many authors have shown that both sellers and buyers on eBay behave strategically in response to changes in market conditions (e.g., Elfenbein et al. [2012], Einav et al. [2014], Einav et al. [2015], Saeedi [2014], Hui et al. [2015], and Nosko and Tadelis [2015]). Third, similar to many conventional marketplaces, seller size on eBay measured by their annual sales quantity and revenue follows Zipf’s law (Figure 1a and 1b). However, I acknowledge the limitation of this study that eBay sellers are much smaller than their offline counterparts and are mainly in the retail sector; additionally, export entry costs outside eBay are much larger and include more dimensions. After all, the external validity of my findings is an empirical question, as is the case for any analysis of a particular country or industry. Nevertheless, we can still learn from this exercise that the distributional impact of entry cost, as would be a priori predicted by many economic models, is at least cleanly identified in one competitive and sizable marketplace. Moreover, a qualitative extrapolation of the results suggests that

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11 Einav et al. [2014] estimates that eBay accounts for 11-13% of e-commerce sales in 2011, compared to 13-16% for Amazon in the United States. U.S. census shows e-commerce sales in the United States in 2014 account for 6.5% of the 4.7 trillion dollar retail industry. According to EU Digital Scoreboard, online cross-border trade in the European Union is about 8.7% of total intra-EU trade for the same goods.
governments that try to promote SMEs’ exports should target their entry costs.

This paper contributes to three literatures. First, it contributes to the literature on evaluating export promoting programs (EPP). Many studies, as summarized in Freixanet [2012], are cross-sectional, rarely have stratified contrast groups, and use survey data. One critical challenge in this literature is to solve the endogeneity issue from EPPs’ targeting and firms’ self-selection. Recently, a few papers rigorously address the endogeneity biases using confidential census data with the matching DiD method. Even if we think this method solves the endogeneity bias, it remains challenging to disentangle different mechanisms of EPPs. As a result, the literature finds changes in exports through both the extensive and intensive margins (e.g., Martincus and Carballo [2008]), and from both small and big exporters (e.g., Martincus and Carballo [2010]). In comparison, the experimental approach in this paper directly confronts the endogeneity biases; moreover, the granular data enables us to isolate the distributional effects from the entry cost mechanism.

Second, this paper contributes to the empirical literature that quantifies the significance of entry costs on firm-level export participation. This literature indirectly quantifies the impact of entry costs on export participation by estimating the state dependence of firms’ export status. These works carefully control for unobserved firm heterogeneities that can cause spurious state dependence, as discussed in Heckman [1981] and Chamberlain [1979]. Using the same variation, Das et al. [2007] structurally identify the entry cost parameters and then simulate the change in export volume after a counterfactual reduction in entry cost. In this paper, I directly estimate this change using an instrumental variable (IV) for entry cost without the assumptions on the economic and econometric structure.

Finally, this paper relates to the literature on quantifying the effects of economic integration agreements (EIA) on different margins of trade. Recent papers address the concern of the endogeneity that quantifies the significance of entry costs on firm-level export participation. This literature indirectly quantifies the impact of entry costs on export participation by estimating the state dependence of firms’ export status. These works carefully control for unobserved firm heterogeneities that can cause spurious state dependence, as discussed in Heckman [1981] and Chamberlain [1979]. Using the same variation, Das et al. [2007] structurally identify the entry cost parameters and then simulate the change in export volume after a counterfactual reduction in entry cost. In this paper, I directly estimate this change using an instrumental variable (IV) for entry cost without the assumptions on the economic and econometric structure.

12 Important papers include Kotabe and Czinkota [1992], Gençtürk and Kotabe [2001], Czinkota [2002], and Alvarez [2004].
13 As pointed out by Wilkinson and Brouthers [2006], time-series data of firms’ export performance simply does not exist since neither firms nor governments collect it.
14 E.g., Görg et al. [2008], Martincus and Carballo [2008], and Cadot et al. [2013].
15 E.g., Roberts and Tybout [1997], Bernard and Wagner [2001], Campa [2004], and Bernard and Jensen [2004]. This empirical test is motivated by the theoretical papers of export hysteresis (Baldwin [1988], Baldwin and Krugman [1989], and Dixit [1989]).
16 Note that my paper does not attempt to establish the change in world welfare with general equilibrium models, such as Atkeson and Burstein [2007], Feenstra [2010], and Di Giovanni and Levchenko [2013].
17 EIAs are programs and policies that reduce trade frictions on a national level, such as free trade agreements, customs union, and preferential trade agreements. Margins are defined on the goods level (Hillberry and McDaniel [2002], Foster et al. [2011], Kehoe and Ruhl [2013], and Baier et al. [2014]), or on the firm level (Eaton et al. [2008] and Bernard et al. [2009]).
nous formation of EIAs with panel estimation and matching methods.\textsuperscript{18} One interesting finding from Bernard et al. [2009] and Baier et al. [2014] is that short-term effects of policy shocks are often through the intensive margin of trade. Ruhl [2008] explains this by the existence of fixed export cost, while Kortum et al. [2011] by consumers’ loyalty to their suppliers, similar to Calvo pricing. My results suggest that short-term effects can come from the extensive margin if the shock is on entry cost, which is consistent with the findings of Ruhl [2008].

The remainder of this paper is organized as follows: Section 2 explains the rules of the GSP; section 3 illustrates a simple framework of the GSP; section 4 gives an overview of the export pattern on eBay; section 5 evaluates the overall program effect; section 6 disentangles various channels through which the GSP works; section 7 estimates program effects on the foreign markets after its full launch; and section 8 concludes this paper.

2 Global Shipping Program

Launched to the full U.S. site in March 2013, the Global Shipping Program (GSP) aims at removing sellers’ export entry cost. In particular, sellers need not incur the entry (hassle) cost of learning export procedures on eBay or customs regulations for each country (the Step 3 in Appendix A). Specifically, eBay contracted with Pitney Bowes to handle customs clearance and international shipping for enrolled sellers, thereby homogenizing the procedures of selling domestically and internationally.

The cost structure of the program is as follows. Sellers enroll in the GSP on a voluntary base for free. Buyers pay the same amount of importing and shipping charges to Pitney Bowes as they would pay if sellers use the same shipping service themselves. Pitney Bowes earns the difference between the shipping prices that buyers pay and the bulk-discounted prices that the company pays. eBay incurs a one-time cost for setting the GSP up, and benefits from more transactions on the platform thereafter. In essence, the GSP is a subsidy to foreign market entry costs, and therefore does not change sellers’ price or quantity decisions conditional on being an exporter.

For each listing, the seller chooses whether the item is available for domestic buyers only or also available for international buyers. In the latter case, sellers have two options: listing with the GSP option or with their own international shipping method. Sellers whose GSP listings are purchased by international buyers only need to ship sold items to a domestic shipping center in Kentucky.

\textsuperscript{18}For example, Baier and Bergstrand [2007], Helpman et al. [2007], and Egger et al. [2011]. Early research papers treat EIAs as exogenous, e.g., Aitken [1973] and Frankel et al. [1997].
After making sure items arrive intact, Pitney Bowes (PB) will handle the entire export process, including preparing customs clearance forms, sending importing charges that have been pre-paid by buyers, and choosing a shipping service with tracking and insurance. Sellers will not be responsible for package damage, loss, or delayed delivery.\textsuperscript{19} The GSP was available for one exporting country, namely the United States, and 18 importing countries during the field experiment period.

GSP listings look different than non-GSP ones to international buyers (see Appendix C). Buyers see a globe icon that indicates international shipping is fulfilled by the GSP. They also see shipping and import charges upfront, and pay everything during checkout. In comparison, international buyers do not see import charges in non-GSP listings and may be surprised by additional customs charges once they receive the package. In terms of shipping quality, items shipped through the GSP automatically come with end-to-end tracking information.

\section{A Simple Framework}

I illustrate the main mechanism of the GSP through a parsimonious framework, reminiscent of Hopenhayn [1992] and Melitz [2003]. Each seller sells a distinct product domestically and potentially internationally. There is no entry cost for selling domestically, but selling internationally for the first time requires paying an entry (sunk) cost. There is no entry cost for subsequent exporting. Sellers differ in two time-invariant dimensions, namely their productivity levels, $s \sim G(s)$, and entry costs into the international market, $F \sim U(0,1)$. $G$ and $F$ are assumed to be independent distributions.

Following Das et al. [2007], I assume that the domestic profit function, $\Pi_D(q_D, s)$, is separable from the international profit function, $\Pi_I(q_I, s)$. Therefore, sellers choose domestic and international quantities to separately maximize the respective profit functions. For international operations, sellers make two decisions sequentially. First, sellers decide whether to sell internationally. Second, sellers choose the optimal quantities for international sales, $q_I$, to maximize the sum of discounted life-time profit from international sales conditional on international operation (henceforth the international profit function), $\max_{q_I} \frac{1}{1-\delta} \Pi_I(q_I, s)$, where $\delta$ is the discrete time discount factor.

I assume that the international profit function, $\Pi_I(q_I, s)$ is twice continuously differentiable in

\textsuperscript{19}Note that the GSP is different from typical export intermediaries because besides reducing export entry cost, typical export intermediaries also increases marginal export cost and possibly demand (e.g., acting as a buyer guarantee). Empirical studies of these intermediaries include Felbermayr and Jung [2008], Blum et al. [2009], Akerman et al., and Ahn et al. [2011].
both arguments, concave in $q_I$, and \( \frac{\partial \Pi_I(q_I, s)}{\partial q_I} = 0 \) for some $q_I$.\(^{20}\) The satisfaction of the first order condition and the concavity of the international profit function ensure the existence of a unique profit-maximizing quantity, $q_I^*(s) = \text{argmax}_{q_I} \Pi_I(q_I, s)$, which yields the maximized international profit, $\Pi_I^*(s) = \Pi_I(q_I^*, s)$. Given $s$ and $F$, sellers use backward induction to find the optimal export decision. First, they compute the maximal international profit $\Pi_I^*(s)$ conditional on operation. Second, they decide to enter the international market in the first stage if 1) they have paid the entry cost in the previous periods, or 2) if $\Pi_I^*(s) \geq F$.

The profit function is assumed to be supermodular: given any change in sales $q_m$ in market $m, m \in \{D, I\}$, the difference in profits increases in seller’s productivity, i.e., \( \frac{\partial^2 \Pi_m(q_m, s)}{\partial q_m \partial s} > 0 \). Supermodularity implies two things. First, more productive sellers sell larger quantities and receive higher profits domestically and internationally, i.e., \( \frac{dq_m^*(s)}{ds} > 0 \) and \( \frac{d\Pi_m^*(s)}{ds} > 0 \). Second, there exists a productivity threshold $\underline{s}$ such that a seller’s international profit equals 0 for $s < \underline{s}$, and equals $\Pi_I^*(s)$ for $s \geq \underline{s}$.

After the GSP introduction, the entry cost decreases by $\Delta F$ and stays non-negative for each seller, i.e., it decreases by $\min\{\Delta F, F\}$. Given a productivity level $s$, the shares of exporters before and after the introduction of the GSP are

\[
Pr(\text{exporter}|s) = Pr\left( F \leq \frac{\Pi_I^*(s)}{1 - \delta} \right) = \frac{\Pi_I^*(s)}{1 - \delta} \\
Pr'(\text{exporter}|s) = Pr\left( F \leq \frac{\Pi_I^*(s)}{1 - \delta} + \min\{\Delta F, F\} \right) = \frac{\Pi_I^*(s)}{1 - \delta} + \min\{\Delta F, F\},
\]
respectively.\(^{21}\) It therefore follows that the percentage change in the share of exporters is

\[
\Delta Pr(\text{exporter}|s) = \frac{Pr'(\text{exporter}|s) - Pr(\text{exporter}|s)}{Pr(\text{exporter}|s)} = \frac{\min\{\Delta F, F\}}{\Pi_I^*(s)/(1 - \delta)}.
\]

It follows that the percentage change of the share of exporters decreases in seller productivity, i.e., \( \frac{d\Delta Pr(\text{exporter}|s)}{ds} < 0 \). Additionally, supermodularity implies that this change also decreases in seller’s domestic sales quantity, i.e., \( \frac{d\Delta Pr(\text{exporter}|s)}{dq_D(s)} < 0 \).

This simple framework is consistent with the empirical observations and results. First, the share of exporters increases in sellers’ domestic sales. This is because larger domestic sales imply higher seller productivity, which makes exporting more likely to be profitable. Second, the share of exporters is convex in sellers’ domestic sales. This stems from the export threshold productivity $\underline{s}$.

\(^{20}\)This is satisfied if the underlying production function is strictly concave and inputs are bounded.

\(^{21}\)Figure 3b shows these two shares are always bounded by 0 and 1 in the data. Therefore, we do not need to model boundary solutions.
induced by the entry cost. Finally, the percentage increase in exports after the GSP introduction is larger for smaller sellers. The reason is that, for sellers who already incurred the sunk cost, who are more likely to be big sellers, a decrease in this cost does not change their operation decisions. Therefore, this change affects smaller sellers more due to a larger composition of non-exporters.

4 Export Pattern on eBay

In this section, I illustrate some key export patterns on eBay. First, I calculate the export volume on eBay relative to the total U.S. export volume. Hortaçsu et al. [2009] points out that most items on eBay are household durable goods. Hence, for an apple-to-apple comparison, I adopt the approach by Lendle et al. [2012], which matches products on eBay with the six-digit level HS product classification.\(^{22}\) I first compute the total U.S. export volume in GSP-eligible categories to the 18 initial GSP-eligible importing countries on eBay in 2013. Next, I obtain the sum of U.S. exports to these 18 countries in product categories that are sold on eBay in 2013 from UN Comtrade.\(^{23}\) The ratio of these two numbers, 1.38%, is the share of U.S. exports that took place on eBay in the eligible categories in 2013. In fact, eBay is one of the largest international e-commerce platforms in the world. The marketplace contains about 157 million buyers and 800 million live

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\(^{22}\) For the exact matching table, please refer to table 8 in Lendle et al. [2012].

\(^{23}\) The reason for using these 18 countries is that they were eligible for GSP throughout 2013 and UN Comtrade only gives annual figures.
listings, with an average of 230 million clicks on item listings every day.

Next, I show that Zipf’s law holds on the eBay marketplace to illustrate that eBay is similar to other conventional marketplaces. In figure 1a, I define sellers’ size to be their quantities sold in the 12 months before the field experiment. The figure shows that seller sizes follow the Zipf’s law, i.e., the logarithm of sellers’ ranks is approximately a linear function of the logarithm of sellers’ sales quantity. Alternatively, I define sellers’ sizes based on their past revenue in Figure 1b. We see that Zipf’s law mostly holds under the new definition except for occasional sellers, whose logarithm of total sales is less than 5 (total sales less than $150).

Before diving into regression analyses, I provide graphical illustrations of exporting on eBay and how this has changed after the introduction of the GSP. In Figure 2a, I plot the average number of internationally available listings as a function of sellers’ size in terms of their domestic sales. The averages are taken within each $1,000 intervals of sellers’ domestic sales. The pre-GSP and post-GSP periods are from October 2011 to September 2012 and from October 2012 to September 2013, respectively.\textsuperscript{24}

Three patterns emerge: First, sellers with larger domestic sales intend to export more items. This is consistent with the framework in section 3: Sellers with larger domestic sales are associated with higher productivity, which makes entering international markets more profitable. Second, consistent with findings in Lendle and Vézina [2015], even the smallest sellers on eBay intend to export, which suggests lower entry costs than the offline cross-border trade. Third, the dots clearly

\textsuperscript{24}These two periods are chosen to avoid the period containing the field experiment and the period in which GSP is not the default listing option.
shifted up after the introduction of the GSP, except the change for large sellers was noisy. This pattern of change in export will be quantified in section 5. The explanation from the framework is that many large sellers have already paid the entry cost before the GSP, and a reduction in entry costs does not change their optimal export amount for countries they previously operated in.

In Figure 2b, I use the total number of domestic and international listings as the definition for seller size, and change the dependent variable to the average share of internationally available listings out of all listings for each seller. The averages are taken within each 100-unit intervals. Similar to my previous findings, this figure shows that sellers make a larger proportion of their listings available to international sellers after the introduction of the GSP. Additionally, this increase shrinks from over 20% for small sellers to less than 10% for large sellers.

We observe that not all listings are internationally available after the introduction of the GSP, even for the largest sellers. This is because sellers may choose parts of their listings to be internationally available due to various constraints, such as items prohibited by customs, or seller strategies, such as unwillingness to export fragile items. Therefore, it is illustrative to plot the share of sellers who intend to export any item, ignoring how individual sellers optimize which items to export. Figure 3a plots this share over the deciles of sellers’ domestic sales in USD. Consistent with previous results, the share of potential exporters increased after the introduction of the GSP, and this share is more than 90% for the largest sellers after the GSP.

To eliminate casual sellers from my analysis, I restrict my attention to sellers with at least 10 sales. The x-axis is capped at 50, which covers 99.7% of the sample.

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25 The x-axis is capped at 50, which covers 99.7% of the sample.
sales annually in Figure 3b. The deciles in this graph are determined using this subsample of sellers only. We see that the increase in share of potential exporters, about 50% for smaller sellers and 20% for larger sellers, shrinks with seller size.

Another interesting observation is that the curve for share of potential exporters is convex before the GSP but becomes almost linear after the GSP. This suggests the existence of an entry cost to sell internationally that is consistent with the theory framework: Given a distribution of sellers’ productivity $G(s)$ and a fixed entry cost $F$ drawn from another independent distribution, there exists a cutoff domestic profit level $\Pi^*_D(s)$ such that the share of exporters is zero for $\Pi^*_D(s) \leq \Pi^*_D(s)$ and increases in $s$ for $\Pi^*_D(s) > \Pi^*_D(s)$.

After the introduction of the GSP, this curve becomes almost linear since the majority of the entry cost is removed.

## 5 Field Experiment: Overall Program Effect

### 5.1 Intent-to-Treat Estimation

Recent researches on export promotion programs (EPP) address the selection bias, e.g., firms self-selecting into using EPPs, or EPPs advertise to only a subset of all firms, by using panel models and matching methods. These econometric methods correct some but not all selection bias and estimate program’s average treatment effect on treated (TOT).

In this section, I evaluate the distributional impacts of the opportunity to use the Global Shipping Program (GSP) on sellers of different sizes using a randomized field experiment in October 2012. The intend-to-treat (ITT) estimation from this experiment yields unbiased estimates of program effects in the presence of self-section. In particular, the ITT estimates $E[Y_i|Z_i = 1] - E[Y_i|Z_i = 0]$, where $Y_i$ is the outcome of individual $i$ and $Z_i$ is the dummy variable for being in the treatment group. The estimate is the simple difference of average outcomes between the treatment and control groups. The independence assumption for unbiased estimation is achieved since the treatment is randomly assigned. Notice that this is not the average treatment effect (ATE) of the GSP, $E[Y_i(1)] - E[Y_i(0)]$, since non-compliance occurs and therefore receiving the treatment is not random, i.e., $E[D_i|Z_i = 1] < 1$, where $D_i$ indicates voluntary enrollments.

Although the ITT estimation is particularly relevant for programs with voluntary participation,

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26 The implicit assumption is that retail markups are the same across sellers.
27 For example, the DiD approach assumes that the average export of non-enrolled firms is the correct counterfactual for that of enrolled firms; the matching methods assume firms’ selections are random conditional on observables; finally, the matching DiD approach assumes that firms’ selections are not based on serially correlated unobservables.
we may also be interested in the TOT, \( E[Y_i(1)|D_i = 1] - E[Y_i(0)|D_i = 1] \), which is the average treatment effect on enrolled sellers. In our case, TOT equals to the complier average causal effect (CACE), or the local average treatment effect (LATE), because of one-way non-compliance, i.e., \( D_i(0) = 0 \). The TOT estimate is obtained from the two stage least square (2SLS) regression of outcome variables on program enrollment, using the random assignment of program eligibility as an instrumental variable. The TOT estimate is computationally equivalent to the ITT estimate divided by the compliance rate, i.e., \( \text{ITT} / (E[D_i|Z_i = 1] - E[D_i|Z_i = 0]) \). We need three assumptions for the unbiasedness of LATE: first, random assignment, \( Z_i \perp (Y_i, D_i) \); second, exclusion restriction, \( Y_i(z',d) = Y_i(z,d) \quad \forall z, z', d \); and third, monotonicity, \( D_i(1) \geq D_i(0) \), which is implied by the one-way non-compliance.\(^{28}\)

The experiment was carried out as follows: Five months before the full launch of the GSP, eBay randomly selected 20% of all active users who interacted with eBay in any way, and offered them the opportunity of early enrollment in the GSP through ads banner on the listing page, site messages, and emails. There was no change for the other 80% of the users. The take-up rate is 6% in the treatment group, and sellers who enrolled are in general small and medium-sized sellers who have never exported before.\(^{29}\) In my study, I compare seller-level international sales in July to September (henceforth the preceding period) to international sales in October to December 2012 (henceforth the experiment window) across treatment and control groups. This short window is chosen to avoid the full launch of the GSP to the entire site.\(^{30}\) Finally, note that another advantage of my study is that the size of the treatment group is only 20% of all active users. This small size is unlikely to change competition in foreign markets in the experiment window.\(^{31}\)

In my sample, sellers on average export $165 to 7.3 countries in the preceding period.\(^{32}\) To show the validity of the randomization, I first report the differences in mean variables between the treatment and control groups and their corresponding t-statistics in Table 1. These averages are taken in the preceding period, namely July, August, and September. The table shows that there are no statistically significant pre-existing difference between the average domestic sales in dollars and quantity, international sales in dollars and quantity, number of destination countries, number of domestic-only listings, and number of internationally available listings.

\(^{28}\)For a discussion of causal inference, see Rubin [1974], Holland [1986], and Angrist et al. [1996].
\(^{29}\)Low take-up rate could be a result of people ignoring ads banner and site messages on eBay in a short period. The take-up rate of the GSP rises over time, so does the program effect on export.
\(^{30}\)Another reason is to reduce costs of retrieving session-level user data in my sample (more than one petabyte).
\(^{31}\)Blake and Coey [2014] discuss the “equilibrium effect” as a result of the treatment-control interference.
\(^{32}\)Disclaimer: Summary statistics are from 2012 and are not representative of current averages on eBay.
Table 1: Baseline Balance

<table>
<thead>
<tr>
<th>t-tests Between Group Means</th>
<th>Domestic Sales</th>
<th>Domestic Quantity</th>
<th>Export Sales</th>
<th>Export Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control − Treatment</td>
<td>-7.80</td>
<td>-0.15</td>
<td>-1.41</td>
<td>-0.07</td>
</tr>
<tr>
<td>t-statistics</td>
<td>-0.43</td>
<td>-0.10</td>
<td>-0.35</td>
<td>-0.45</td>
</tr>
<tr>
<td>No. Countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control − Treatment</td>
<td>0.07</td>
<td>0.29</td>
<td>-0.94</td>
<td></td>
</tr>
<tr>
<td>t-statistics</td>
<td>0.03</td>
<td>0.21</td>
<td>-0.36</td>
<td></td>
</tr>
</tbody>
</table>

Notes: This table reports the differences in mean variables and the corresponding t-statistics between the control and treatment groups in the preceding period, July, August, and September.

Upon seeing a good balance, the natural candidate for estimating ITT is the cross-sectional comparison between the treatment and control groups. In addition, I adopt two robust estimators, namely the difference-in-difference (DiD) and the first-difference (FD) estimators, similar to Blake et al. [2014]. In particular, the specifications are as follows:

\[
\log(S_{i,\text{Post}}) = \alpha + \beta_1 \text{Treatment}_i + \epsilon_i
\]

\[
\log(S_{it}) = \alpha + \beta_1 \text{Interaction}_{it} + \beta_2 \text{Post}_t + \beta_3 \text{Treatment}_i + \epsilon_{it} \tag{2}
\]

\[
\Delta \log(S_i) = \beta_1 \text{Treatment}_i + \beta_2 + \Delta \epsilon_i \tag{3}
\]

where \(S_{it}\) is the export sales for seller \(i\) at period \(t \in \{\text{Pre}, \text{Post}\}\); \(\text{Post}_t\) is the dummy variable for the experiment window; \(\text{Treatment}_i\) is the dummy variable for the treatment group; \(\text{Interaction}_{it}\) is the interaction of the two variables, \(\text{Post}_t \times \text{Test}_i\); \(\Delta \log(S_i)\) is the first difference in logs of exports, \(\log(S_{i,\text{Post}}) - \log(S_{i,\text{Pre}})\); \(\Delta \epsilon_i\) is the first difference in errors, \(\epsilon_{i,\text{Post}} - \epsilon_{i,\text{Pre}}\). In this section, \(\log\) is approximated by the inverse hyperbolic sine (IHS) transformation to deal with negative or zero change in seller-level export sales (see Appendix D for a graphical illustration).\(^{33}\) This method is often used in regional economics, and was discussed extensively in Burbidge et al. [1988].\(^{34}\)

The first three columns in Table 2 show the estimation results from equations (1)–(3). Cross-sectional estimation in column (1) shows that the opportunity to enroll in the GSP increases the average export volume by 2.9%. Consistently, the robust DiD specification in column (2) shows

\(^{33}\)I also used a measure of percentage changes, \([S_{i,\text{Post}} - S_{i,\text{Pre}}]/S_i\), where \(S_i = [S_{i,\text{Post}} + S_{i,\text{Pre}}]/2\). This measure yields qualitatively similar results on change in exports, margins of exports, and distributional impacts for sellers of different sizes as the IHS transformation. For example, average seller-level increase in exports is 3.5% in this specification. However, the IHS transformation is preferred since it gives less weight on outliers and it does not drop out sellers with \(S_i = 0\), in which case percentage changes are not properly defined.

\(^{34}\)I also compare my estimate with conventional estimates from non-experimental settings in Appendix F.
Table 2: Change in Export Volume, and Extensive and Intensive Margins of Export

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log(S_{i,post})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log(S_{it})</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>\Delta log(S_i)</td>
<td>0.029***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>\log(\Delta S_i)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>\log(\Delta Ext_i)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>\log(\Delta Int_i)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interaction: 0.029*** (0.004)

Treatment Group: 0.029*** 0.006 0.029*** 0.032*** 0.032*** 0.001
(0.003) (0.007) (0.003) (0.004) (0.004) (0.002)

Post Period: 0.0878*** (0.002)

Intercept: 1.165*** 1.077*** 0.088*** 0.124*** 0.113*** 0.028***
(0.001) (0.001) (0.001) (0.002) (0.002) (0.001)

Notes: \( S_{it} \) refers to seller \( i \)'s export sales at time \( t \in \{ \text{Pre, Post} \} \). \( \log(\Delta Ext_i) \) and \( \log(\Delta Int_i) \) are logs of changes in the extensive and intensive margin of export, respectively, from the preceding period to the experiment window. These margins are defined on the seller-country level. \( \log \) is approximated by the inverse hyperbolic sine transformation.

*** indicates significance at p = 0.01; ** indicates p = 0.05 ; * indicates p = 0.1.

that the average export from the treatment group increases by 2.9% even though no significant difference exists prior to the experiment. The FD specification also gives the same estimate as expected. The TOT estimate is 48.3%, which inflates the program effect by the reciprocal of the take-up rate. In the rest of this section, I will use the FD estimation to facilitate the comparison between changes in margins of export.

One potential confounding factor for the above causal interpretation is the change in the number of impressions (exposures of listings to consumers). Specifically, number of impressions for enrolled sellers’ listings should increase due to their exposure to foreign buyers. Therefore, the increase in exports due to increased impressions will be mistakenly attributed to a reduction in the entry costs. Column (1) in Table 3 handles this concern by controlling for the change in seller-level impressions, and allows its effect to differ across the treatment and control groups. The estimate falls to 2.7%, suggesting slightly improved positioning of the GSP listings, but is still statistically significant.

5.2 Extensive and Intensive Margins of Export

Having established the causal impact of the GSP on export volume, I then study whether this increase comes from the extensive or intensive margins of export. The distinction between the intensive and the extensive margins is important in the trade literature because it could have different welfare implications in the presence of heterogeneous firms (Arkolakis et al. [2012] and Melitz and Redding [2015]); also, it helps disentangling the entry cost and variable cost. Hummels and Klenow [2005] define these margins on the goods level. A few studies define these margins.
Table 3: Heterogeneous Treatment Effects for Different Seller Sizes

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>∆log(S&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>log(∆Ext&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>log(∆Int&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>log(∆Int&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>log(∆Int&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>log(∆Int&lt;sub&gt;i&lt;/sub&gt;)</td>
</tr>
<tr>
<td>Treatment Group*Small Seller</td>
<td>0.027***</td>
<td>0.029***</td>
<td>4E-4</td>
<td>-1E-4</td>
<td>0.003</td>
<td>(0.004)</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Treatment Group*Medium Seller</td>
<td>0.028***</td>
<td>0.030***</td>
<td>0.039***</td>
<td>-0.010</td>
<td>(0.013)</td>
<td>(0.015)</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Treatment Group*Large Seller</td>
<td>0.003</td>
<td>-0.028</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.050)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.023)</td>
</tr>
</tbody>
</table>

Notes: In (1), (3), and (5), I also control for intercepts. In (2), (4), and (6), I also control for Seller Size FEs, ∆log(IMP<sub>i</sub>)*Seller Size FEs, and ∆log(IMP<sub>i</sub>)*Seller Size FE*Treatment Group. ∆log(IMP<sub>i</sub>) is the change in log of the impression that seller <i>i</i> receives. Small, Medium, and Large sellers are defined as sellers who had ($0, $10,000], ($10,000, $120,000], and ($120,000, ∞] sales, respectively, in the past year. log is approximated by the inverse hyperbolic sine transformation.

*** indicates significance at p = 0.01; ** indicates p = 0.05 ; * indicates p = 0.1.

35 In this paper, I define these margins on the the seller-country level (and subsequently seller level) due to the nature of the research question: Does a reduction in entry costs induce more sellers to start exporting and to export to new countries? Under this definition, a change in the intensive margin comes from a seller exporting more to countries that it has exported to previously. On the other hand, a change in the extensive margin happens when a seller starts exporting for the first time or starts exporting to a new country. Note that this definition of margins requires the knowledge of sellers’ export activities in the preceding period. For example, if a seller exported $1,000 to Canada in the preceding period and exported $1,100 to Canada and $900 to China in the experiment window, the total change in export sales is ∆S<sub>i</sub> = $1,000, the change in extensive margin is ∆Ext<sub>i</sub> = $900, and the change in intensive margin is ∆Int<sub>i</sub> = $100.

Estimates for these changes are reported in columns (4)–(6) in Table 2. First, note that the estimate in column (4) should not be interpreted as the export elasticity with respect to the policy change, as was the case in columns (1)–(3). Rather, I report column (4) as a benchmark for comparisons with columns (5) and (6), i.e., ∆S<sub>i</sub> = ∆Ext<sub>i</sub> + ∆Int<sub>i</sub>; the reason for taking the inverse hyperbolic sine transformation is to reduce the weights on outliers. Comparing columns

35 For example, Pavcnik [2002], Trefler [2004], Eaton et al. [2008], and Arkolakis et al. [2008].

36 Most heterogeneous firm trade models adopt country-specific entry cost. McCallum [2013] provides a formal test and confirms this assumption. I also try a global entry cost for robustness checks later.
(4) to (6), the majority of the changes in exports (3.20%) originates from the extensive margin of export (3.19% without rounding), and the change in the intensive margin is negligible (0.1%) and statistically insignificant. In columns (3) and (5) in Table 3, I additionally control for changes in number of impressions. The qualitative results remain the same, with the change in extensive margin falling to 2.9% and the change in intensive margin falling to 0.04%. Another measure for the change in the extensive margin is the change in number of exporters, which is 2.65% in the experimental period.

5.3 Heterogeneous Seller Sizes

One major goal of this paper is to study the distributional impact of a reduction in entry cost. For this analysis, I define small, medium, and large sellers to be those with [0, 10,000], (10,000, 120,000], and (120,000, ∞] sales in the past year, respectively. Decomposing the total increase in exports, 71% of the increase comes from small sellers and 28% comes from medium sellers. For seller-level average treatment effects, column (2) in Table 3 shows export increases by 2.8% and 3.8% for small and medium sellers, respectively. If I exclude sellers with zero sales in the preceding period, the estimate for small sellers becomes 3.7%, which is interpreted as the increase in export for small sellers who are more active. On the other hand, the program’s effect on average export from larger sellers is 0.3% but not statistically significant at the 10% level. In columns (4) and (6), previous patterns on changes in the extensive and the intensive margins reemerge: Increases in exports from small (3%) and medium sellers (3.9%) stem entirely from the extensive margin. For large sellers, the 2.56% increase in the intensive margin is not statistically significant at the 10% level.

The findings on different seller sizes are consistent with the model framework. Large sellers with higher productivity were more likely to become exporters prior to the introduction of the GSP; therefore, reducing entry costs that they have incurred does not change their entry decisions. However, after a major reduction in the entry costs, many small sellers start to export or export to more countries because entry costs are substantially reduced and are less than their international operating profit.

37 I checked different definitions on seller sizes and the qualitative results do not change.
38 In Appendix G, I present estimates of the distributional program effect for sellers who were exporters prior to the experiment and for those who only sold domestically.
<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Group</td>
<td>0.040***</td>
<td>0.040***</td>
<td>0.029***</td>
</tr>
<tr>
<td>Δlog(IL_{i,post})</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Δlog(IL_{i})</td>
<td></td>
<td></td>
<td>0.029***</td>
</tr>
<tr>
<td>Δlog(TL_{i})</td>
<td>0.171***</td>
<td></td>
<td>(2.2E-04)</td>
</tr>
<tr>
<td>Treatment Group*Δlog(TL_{i})</td>
<td>0.009***</td>
<td></td>
<td>(5.0E-04)</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.528***</td>
<td>0.007***</td>
<td>-0.027***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(4.8E-04)</td>
<td>(4.5E-04)</td>
</tr>
</tbody>
</table>

Notes: Δlog(IL_{i}) is the change in the log of numbers of internationally available listings. Δlog(TL_{i}) is the change in the log of numbers of total listings. log is approximated by the inverse hyperbolic sine transformation. *** indicates significance at p = 0.01

6 Disentangle Different Mechanisms

In the previous section, I established the overall program effect of the GSP. This policy evaluation is interesting in its own right since e-commerce platforms are of growing importance in the economy by removing various information frictions between buyers and sellers. In this section, I push the analyses further and ask the following questions: What mechanisms of the GSP contribute to the increase in exports from small and medium-sized sellers? Is the increase due to an outward shift in the demand or the supply curve? If the GSP causes supply side responses, is it through a reduction in entry costs or in marginal/variable costs?

6.1 Supply or Demand?

I have used trade data to establish the causal impact of the GSP on exports. The elevated export level is an equilibrium outcome, which could originate from both supply and demand. It is possible that the GSP increases demand through the two features of the GSP listings: 1) buyers see all costs in the GSP listings and pay for everything during checkout, with no extra fees when they receive the items; 2) GSP shipping comes with end-to-end tracking information. However, buyers pay on average 10% more for the GSP shipping service, making it unclear whether buyers at large prefer the more expensive premium shipping service. In this section, I show that the increase in exports we have seen is mainly from a reduction in sellers’ export costs, i.e., through the supply mechanism, as opposed to the demand mechanism.
6.1.1 Intention to Export

The above simultaneity problem occurs because of the nature of trade data. Fortunately, I also observe data on sellers’ entire listings, regardless of being eventually sold or not, which is roughly seller-level supply curves. I use this data to study whether there is any difference in the number of internationally available listings between the treatment and control groups after the GSP.

The validity of this analysis hinges on the implausibility of sellers’ rational expectation in this case: It is highly unlikely for sellers (especially the small ones) to anticipate whether consumers will like the the GSP service at the beginning of the program introduction and raise their supply in expectation of higher demand. If anything, the general opinion on the appealingness of GSP was the opposite at the beginning of the full launch. Therefore, the change in the number of internationally available listings is due to pure cost/supply side shocks.

In column (1) in Table 4, I regress the log of number of internationally available listings in the experiment window on the treatment group dummy. This is a cross-sectional regression, which is equivalent to a simple t-test. The result indicates a 4% increase in the number of listings that sellers intend to export. Additionally, this change is larger than the 2.7% increase in trade from Table 2. Similar to previous exercises, I check the robustness of this estimator with the FD estimator in column (2), which gives the same estimate. In column (3), I additionally control for the number of total listings to account for changes in sellers’ domestic-only listings. The change in the share of internationally available listings out of total listings is 2.9%. These analyses show that seller-level supply curves shift outwards, indicating a decrease in export costs.

6.1.2 Seller Experiments

In this section, I employ an alternative approach to disentangle the demand and supply mechanisms. In particular, I directly estimate consumers’ preference for the GSP service by exploiting an institutional detail of this program, namely that sellers can still choose to offer the GSP or their own shipping methods for international sales on a listing by listing base after enrolling in the GSP. Since it is unclear if buyers will be willing to pay higher fees for the GSP, I expect that some sellers will experiment with different shipping options to discover consumers’ preference, reminiscent of the seller experiment in Einav et al. [2015]. This feature thus provides an excellent opportunity to evaluate consumers’ preference.

First seen in Elfenbein et al. [2012], seller experiments are defined as contemporaneous matched
Table 5: Demand Channel: Evidence from Seller Experiments

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>0.001**</td>
<td>0.003***</td>
</tr>
<tr>
<td></td>
<td>(1.5E-04)</td>
<td>(2.5E-04)</td>
</tr>
<tr>
<td>GSP</td>
<td>0.031***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>eTRS</td>
<td>-0.003***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.1E-04)</td>
<td></td>
</tr>
<tr>
<td>Relative Price</td>
<td>-0.066***</td>
<td>-0.053***</td>
</tr>
<tr>
<td></td>
<td>(3.8E-04)</td>
<td>(6.0E-04)</td>
</tr>
<tr>
<td>Relative Price*eTRS</td>
<td>-0.022***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>Impression Count</td>
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<td>9.4E-07***</td>
</tr>
<tr>
<td></td>
<td>(1.0E-08)</td>
<td>(1.0E-08)</td>
</tr>
<tr>
<td>Experiment Fixed Effects</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Notes: This table uses seller experiments (matched listings) in Buy It Now format in 2014. Success indicates whether a listing converts to any sale. GSP is the dummy for GSP listings, and eTRS is the dummy for eBay Top Rated Seller. Relative price is the price of item normalized by its reference value. *** indicates significance at p = 0.01

listings in which the following dimensions are identical: seller identity, item listing title, item listing subtitle, and item category. The second qualification for seller experiments is to have within-experiment variation in whether the GSP service is used for some listings. I then exploit cross-sectional variation in sales probability from the GSP and non-GSP listings within each experiment, conditional on a given price (so the data used here corresponds to the year after the full launch of GSP), and estimate the difference in intercepts of listing-level demand curves.

The data used in this exercise is from Buy It Now listings in 2014. The basic estimation equation is

\[
Success_{ij} = \alpha P_{ij} + \beta GSP_{ij} + \gamma Impression_{ij} + \mu_i + \epsilon_{ij},
\]

where \(Success_{ij}\) is an indicator for whether listing \(j\) within experiment \(i\) results in at least one sale. \(P_{ij}\) is the relative price of listing \(j\), which equals to the price of the item divided by its reference value; this value is defined as the average Buy It Now price in the sample period (as in Einav et al. [2015]). \(GSP_{ij}\) is the dummy variable for whether listing \(j\) is listed with GSP shipping.

\[\text{Hui et al. [2015] uses seller identity and Product ID as controls. Product IDs are good for identifying the same products but limit to only cataloged products (electronics and books etc.). In this setting, many exports are in the fashion and clothing category, which are not cataloged.}\]
Impression\textsubscript{ij} is the number of impressions that listing \( j \) receives.

Table 5 shows the demand estimation. Column (1) indicates that GSP listings sell with a 0.1\% higher probability, which is less than 1\% of the average sales probability in the sample period. The negative coefficient for relative price is consistent with the law of demand.\footnote{I checked robustness by controlling for monthly dummies and the estimate is smaller than the ones in the table.} In column (2), I study whether consumers’ preference towards the GSP differs by sellers’ eBay Top Rated Seller (eTRS) status.\footnote{eBay Top Rated Seller is an eBay-certified badge that is awarded to high-quality sellers that meet several quality requirements established by eBay.} The column shows that this value is 0.3\% for non-eTRS and close to zero for eTRS. This suggests that foreign buyers value the GSP for unestablished sellers who are likely to have little experience in international shipping. The coefficient for relative price is -7.5\% for non-eTRS and -2.2\% for eTRS, indicating that eTRS enjoy a higher sales probability given any price.

In summary, the outward shift in seller-level supply curve during the experiment window suggests that export costs have been reduced and sellers intend to export more due to the GSP. The demand effect for the GSP is small and does not drive the overall increase in exports. This indicates that even if we impose perfect foresight on sellers, they should not change their supply much in anticipation of their expected change in demand.

6.2 Entry Costs or Marginal Costs?

In the previous section, I have shown that the increase in exports is driven by a reduction in trade cost. The next task is to study whether this change is driven by the the entry cost or the marginal/variable cost mechanisms. One platform feature offers some heuristics: Sellers are allowed to charge different shipping and handling fees for international sales. As a result, if not-exporting is merely caused by high marginal costs, sellers could have marked up the international shipping fee by the amount of higher marginal costs and listed items as internationally available. For a formal argument, note that my previous finding of an increase in the extensive margin of export and no change in the intensive margin is consistent with the entry cost mechanism. In this section, I provide further evidence that the increase in exports is mainly due to a reduction in entry costs.

6.2.1 Data Sparsity

Economic theory implies that a reduction in entry costs can only increase the extensive margin of export: The change in fixed costs does not affect sellers’ optimal outputs conditional on operation; rather, the magnitude of fixed costs determines sellers’ decisions of whether to enter the market. On
the other hand, a reduction in marginal/variable costs can affect the intensive margin by altering sellers’ optimal levels of output, and can also change the extensive margin if the new level of profit suffices to cover the entry costs but the old level does not.

Therefore, my previous finding of no change in the intensive margin after the GSP introduction is consistent with two things. First, the increase in export is not driven by reductions in marginal costs. Second, the increase in export must stem from reductions in entry costs. However, this argument hinges on an implicit assumption, i.e., the fact that firms export to more countries after the introduction of the GSP is equivalent to them intending to export to more countries.

The validity of this assumption is subject to the data sparsity issue (Armenter and Koren [2014] and Lendle and Vézina [2015]), that is, the number of listings is sparse relative to the number of countries, especially for small sellers. In this case, the increase from exports to new countries happens by chance and does not necessarily reflect sellers’ intention to export to more countries.

To mitigate the data sparsity issue, I assume a global entry cost, as opposed to country-specific entry costs, and redefine margins to be on the U.S. and non-U.S. levels. In other words, the new extensive margin captures instances when sellers start or stop exporting to any country other than the United States. In the previous example where firm exported $1,000 to Canada in the preceding period and exported $1,100 to Canada and $900 to China after, the change in extensive margin is 0 and the change in intensive margin equals to the change in total export volume. This aggregation method should mitigate the data sparsity issues.

I repeat the previous regression analyses under the new definition of margins. For easy comparison, I copied the previous results on changes in overall export volume in columns (1) and (2) of Table 6. The program’s average treatment effects on the extensive margin are 2.74% and 2.68%, respectively, for with and without controlling changes in sell-level impression count. These estimates are smaller compared to the estimates calculated when defining margins on the seller-country level, 3.2% and 3.0%, respectively. This is because changes in the old extensive margin from exporting to new countries is subsumed under the new definition of margins, such as the example above.

More interestingly, columns (5) and (6) of Table 6 show the 0.1% increase in the intensive margin is only statistically significant at the 10% level if I do not control for changes in impression counts. This provides a stronger evidence that the increase in exports is not driven by the intensive margin, as the new definition of margins should make the program’s effect on intensive margin appear more salient. Finally, I maintain the new definition of margins and use listing data to study whether sellers intend to sell more on extensive margin defined on the U.S. and non-U.S. levels.
Table 6: The Extensive Margin Defined on U.S. and Non-U.S. Levels

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Group</td>
<td>0.029***</td>
<td>0.027***</td>
<td>0.027***</td>
<td>0.027***</td>
<td>0.001*</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>log(ΔImp&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>0.254***</td>
<td>0.123***</td>
<td>0.132***</td>
<td>0.132***</td>
<td>(2.4E-04)</td>
<td>(2.4E-04)</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(2.4E-04)</td>
<td>(2.4E-04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment* log(ΔImp&lt;sub&gt;i&lt;/sub&gt;)</td>
<td>0.011***</td>
<td>0.007*</td>
<td>0.004***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.001)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.088***</td>
<td>0.083***</td>
<td>0.080***</td>
<td>0.077***</td>
<td>0.008***</td>
<td>0.006***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(2.3E-04)</td>
<td>(2.2E-04)</td>
</tr>
</tbody>
</table>

Notes: The margins are defined on the U.S. and non-U.S. levels. \(\log(\Delta Int<sub>i</sub>)\) is the log of change in the intensive margin of export from the preceding period to the experiment window. Intensive margin is defined on the country level. \(\log(\Delta Ext<sub>i</sub>)\) is the log of change in the extensive margin of export, which equals to the change in total international sales minus the change in intensive margin. \(\Delta \log(\text{Imp}_{i})\) is the change in the \(\log\) of impression that seller \(i\) receives. \(\log\) is approximated by the inverse hyperbolic sine transformation.

*** indicates significance at \(p = 0.01\); * indicates \(p = 0.1\).

The results are similar and are reported in Appendix E.

6.2.2 “Muting” the Marginal Cost Mechanism

An alternative approach to show the prevalence of the entry cost effect is to “mute” the marginal cost mechanism and check whether the increase in export and extensive margin persists.

There are three possible marginal cost channels through which GSP works. First, enrolled sellers do not need to fill out customs forms in the post office. Second, enrolled sellers automatically receive 5 stars on shipping time and shipping charges Detailed Seller Ratings (DSR) if they ship out the item within one business day. Finally, once the item arrives in Kentucky intact, sellers are not responsible for damages in the international shipping process.

To reduce the impact of these marginal cost mechanisms as much as possible, I constrain and analyze sellers that 1) printed eBay-generated prepaid shipping labels, customs forms, or both from www.ebay.com in the year before the experiment window, 2) received zero low shipping charge and shipping time DSRs in the year before, and 3) purchased no insurance for any of their domestic or international shipments. Note that this subsample is no longer random and the estimate should not be interpreted as the average treatment effect of GSP.

42The Detailed Seller Ratings (DSR) system is a rating mechanism from buyers to sellers in the following four categories: item as described, communication, shipping time, and shipping and handling charges. Buyers can give sellers 1 to 5 stars after each transaction.
Table 7: A Subset of Sellers: “Muting” the Marginal Cost Mechanism

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>$\log(\Delta S_i)$</th>
<th>$\log(\Delta Ext_i)$</th>
<th>$\log(\Delta Int_i)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>0.025***</td>
<td>0.029***</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>$\log(\Delta Imp_i)$</td>
<td>0.388***</td>
<td>0.833***</td>
<td>0.258***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Treatment*$\log(\Delta Imp_i)$</td>
<td>0.006***</td>
<td>0.019***</td>
<td>0.023***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.114***</td>
<td>-0.082***</td>
<td>0.053***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
</tbody>
</table>

Notes: $\log(\Delta Int_i)$ and $\log(\Delta Ext_i)$ are the log of changes in the intensive and extensive margins of export defined on the U.S. and non-U.S. levels, respectively. $\Delta \log(\text{Imp}_i)$ is the change in the $\log$ of seller $i$’s impression. $\log$ is approximated by the inverse hyperbolic sine transformation. *** indicates significance at p = 0.01.

The results are reported in Table 7. First, note that the share of shipments with insurance is somewhat surprising, only less than 1 in 6 million. This suggests that almost all sellers trust the shipping service they choose. Column (1) shows that the export increase due to the GSP is 2.5%, which is slightly smaller than the 2.7% average treatment effect in Table 3. This is because sellers that meet both restrictions 1) and 2) are likely to be bigger sellers and therefore have a smaller increase in export. Columns (2) and (3) indicate that the increase in export is mainly from the extensive margin, and the change in intensive margin of exports is statistically insignificant.

In summary, the exercises of increasing the level of aggregation for the definition of margins and the analyses of “muting” the marginal cost mechanism support the statement that the majority of the increase in exports comes from the extensive margin, which mainly results from a reduction in export entry costs, rather than marginal/variable costs.

7 Aggregate Level Analysis

The field experiment approach provides a clean identification of the program effect on exports for sellers of different sizes. However, to get closer to policy implications, we need some aggregate level analyses on the domestic and foreign marketplaces for longer periods. In this section, I take a more conventional approach, namely the natural experiment approach, to study how overall U.S. exports on eBay and competition in foreign markets change after the full launch of the GSP.
7.1 Difference-in-Difference Estimation

The field experiment was conducted in October 2012. In March 2012, the GSP was launched to the entire U.S. site. At the time of launch, the GSP was available for one exporting country, namely the United States, and 26 importing countries. By the end of 2013, the GSP had been released to 41 more countries, in four rollouts.43

The data in this section consists of monthly aggregate U.S. exports to all countries in the five months before and the five months after the GSP launch dates for each country. I choose to analyze the ten-month window around the policy discontinuity to minimize the chance of having other contemporaneous changes that affect trade. Having panel data on monthly trade flows for ten months enables me to perform the difference-in-difference (DiD) estimation, which is equivalent to a standard state-year fixed effect model. This methodology allows me to control for two things: first, country-specific propensities to import from the United States, which is invariant over time; and second, time-specific effect such as holiday season effect on sales. In addition, I allow for country-specific linear time trends in addition to the month dummies to capture idiosyncratic shocks such as movement in bilateral exchange rate or an aggregate shock to a particular economy.

The basic empirical models are given as

\[
\log(Y_{ct}) = \beta Policy_{ct} + \eta_c + \xi_t + \gamma_c * t + \epsilon_{ct} \tag{5}
\]

\[
\log(Y_{cpt}) = \beta Policy_{ct} + \eta_{cp} + \xi_t + \gamma_c * t + \epsilon_{cpt} \tag{6}
\]

\[
\log(Y_{cpst}) = \beta Policy_{ct} + \eta_{cps} + \xi_t + \gamma_c * t + \epsilon_{cpst}, \tag{7}
\]

where \(Y_{ct}\) is the outcome variable (e.g., U.S. export in USD) to country \(c\) at time \(t\); \(t\) is a normalized time index that takes values of \(-5, -4, \ldots, 5\); \(Policy_{ct}\) is the dummy for GSP eligibility in importing country \(c\) at \(t\); \(\eta_c\) are importing country fixed effects; \(\xi_t\) are monthly fixed effects; \(\gamma_c\) differ by importing countries \(c\) to allow for country-specific monthly trend in trade. Therefore, the coefficient \(\beta\) represents the average treatment effect of the GSP on U.S. exports across all GSP-eligible countries, using U.S. exports to non-GSP eligible countries as counterfactuals. The other two equations are on the country-product-month and the country-product-seller-month levels, respectively.
7.2 GSP’s Impacts on U.S. Exports and Foreign Sales

ITT estimation from the field experiment shows a 2.7% increase in seller-level U.S. exports during the three-month experiment window. This value could change after the full launch. In particular, when all sellers in the United States are eligible for the GSP, competition among U.S. exporters should increase, which slows the increase in export for each seller. On the other hand, rollouts of new importing countries expand the countries sellers can export to with the GSP, which should increase the export volume.

Estimated $\beta$ values from equation (5) are reported in Table 8. The regressions are estimated by weighted least square, where each observation is weighted by the size of sales/exports to country $c$. Column (1) shows that overall U.S. exports increase by 1.27% after the full launch of the GSP, whereas the changes in sales from non-U.S. sellers and all sellers to the GSP-eligible importing countries are statistically insignificant. 44 The smaller increase in exports compared to that in the experiment window is consistent with a higher level of competition since the GSP is available to all sellers. It is a little surprising to see no cannibalization of non-U.S. sales to the affected countries. As will be seen shortly, one reason is that new U.S. exporters sell new products, resulting in little change in competition for products that were already traded.

---

Table 8: GSP’s Impacts on U.S. Exports and Foreign Sales

<table>
<thead>
<tr>
<th>Dependent Variable: $\log(Y_{ct})$</th>
<th>(1) Sales $$</th>
<th>(2) Sales Qty</th>
<th>(3) $#$ Sellers</th>
<th>(4) % Neg Feedback</th>
<th>(5) Prod Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Sellers Policy</td>
<td>0.0127***</td>
<td>0.0134***</td>
<td>0.0112***</td>
<td>-0.0093***</td>
<td>0.0101***</td>
</tr>
<tr>
<td></td>
<td>(0.0026)</td>
<td>(0.0022)</td>
<td>(0.0014)</td>
<td>(0.0027)</td>
<td>(0.0008)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.996</td>
<td>0.997</td>
<td>0.998</td>
<td>0.916</td>
<td>0.998</td>
</tr>
<tr>
<td>Non-U.S. Sellers Policy</td>
<td>-0.0011</td>
<td>-0.0049**</td>
<td>0.0024</td>
<td>-0.0048**</td>
<td>0.0022***</td>
</tr>
<tr>
<td></td>
<td>(0.0022)</td>
<td>(0.0022)</td>
<td>(0.0018)</td>
<td>(0.0024)</td>
<td>(0.0007)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.943</td>
<td>0.998</td>
</tr>
<tr>
<td>All Sellers Policy</td>
<td>0.0031</td>
<td>-0.0021</td>
<td>0.0065***</td>
<td>-0.0035*</td>
<td>0.0020***</td>
</tr>
<tr>
<td></td>
<td>(0.0020)</td>
<td>(0.0021)</td>
<td>(0.0018)</td>
<td>(0.0020)</td>
<td>(0.0006)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.956</td>
<td>0.998</td>
</tr>
</tbody>
</table>

Notes: The estimates are $\beta$ in equation (5). Country and month fixed effects, and country-specific linear trends are controlled in all these regressions. The regressions are estimated by weighted least square, where each observation is weighted by the size of sales/exports to each country. *** indicates significance at $p = 0.01$; ** indicates $p = 0.05$ ; * indicates $p = 0.1$.

---

44 The rollout for GSP-eligible importing countries is in Appendix B. GSP also became available for UK sellers at the end of 2014.
44 Non-U.S. sellers here contain domestic sellers and non-U.S. foreign sellers. I have performed regressions for domestic sellers only. The results are qualitatively similar to the ones for non-U.S. sellers and are therefore omitted for brevity.
Table 9: GSP’s Impacts on Market Competition and Quality

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>log($Y_{cpt}$)</th>
<th>log($Y_{cpst}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Avg. Sales Price</td>
<td>-0.0044***</td>
<td>-0.0144*</td>
</tr>
<tr>
<td>% Neg Feedback</td>
<td>0.994</td>
<td>0.937</td>
</tr>
<tr>
<td></td>
<td>(0.0003)</td>
<td>(0.0078)</td>
</tr>
<tr>
<td>R²</td>
<td>0.994</td>
<td>0.937</td>
</tr>
</tbody>
</table>

U.S. Sellers Policy

| Non-U.S. Sellers Policy | -0.0007***     | -0.0111***      | -0.0034***     | 0.0002         |
|                        | 0.982          | 0.959           | 0.997          | 0.969          |
|                        | (0.0002)       | (0.0040)        | (0.0001)       | (0.0002)       |
| R²                     | 0.982          | 0.959           | 0.997          | 0.969          |

All Sellers Policy

|                      | -0.0011***     | -0.0122***      | -0.0032***     | -0.0016        |
|                      | 0.985          | 0.965           | 0.997          | 0.982          |
|                      | (0.0002)       | (0.0036)        | (0.0001)       | (0.0029)       |

Notes: The estimates are $\beta$ in equations (6) and (7). The first two regressions are on the country-product-month level and the last two are on the country-product-seller-month level. The corresponding fixed effects in these two equations are controlled in all regressions. The regressions are estimated by weighted least square, where each observation is weighted by the size of sales/exports to each group. *** indicates significance at $p = 0.01$; ** indicates $p = 0.05$.

Export quantity in column (2) displays similar patterns to those of export sales, except that the quantity from non-U.S. sellers decreases slightly by 0.49% at the 5% significance level. Column (3) shows that the number of active U.S. exporters to the GSP-eligible importing countries increases by 1.12%, suggesting entries into foreign markets. The total number of sellers rises by 0.65%, while the number of non-U.S. active sellers does not change, consistent with the previous finding, i.e., no cannibalization from non-U.S. sales to the affected countries.

One other important perspective is the change in quality of the marketplace. Column (4) of Table 8 shows that the percentage of negative or neutral feedback from U.S. sellers decreases by 0.93%. In the next section, I will show that this decrease stems from existing U.S. exporters. The decrease of this percentage for non-U.S. and all sellers is not as large, being 0.48% and 0.35%, respectively. For non-U.S. sellers, this decrease comes from the new marginal sellers. Besides benefiting from less negative shopping experience, buyers in the GSP-eligible importing countries also enjoy 1.01% more product variety measured by the number of distinct leaf categories on eBay. This represents a channel for a rise in consumer welfare.
7.3 GSP’s Impacts on Competition and Market Quality

Out of 42 importing countries in the sample, the median share of U.S. imports is 21% in 2013. Therefore, it is likely that market structures in these markets are affected. In particular, lower export costs induce U.S. sellers to enter GSP-eligible importing countries, causing a higher level of competition in these markets.

To test this hypothesis, I first examine whether there are changes in average sales price and in market quality measured by the percentage of negative or neutral feedback; furthermore, I examine how these changes differ for U.S. and non-U.S. sellers. These analyses are performed on the country-product-month level using equation (6), as well as on the the country-product-seller-month level with equation (7).

Column (1) of Table 9 indicates a 0.11% decrease in the overall average sales price for all sellers. The decrease is -0.44% and -0.07% for U.S. and non-U.S. sellers, respectively. Similar minor decreases occur in column (3) when I additionally control for seller fixed effects. These estimates suggest that the overall increase in competition is small.

Regarding the quality of the marketplace, column (2) of Table 9 shows that the percentage of negative or neutral feedback reduces by 1.44% and 1.11% for U.S. and non-U.S. sellers, respectively, with an average effect of 1.22%. This indicates improved consumer satisfaction for transactions from both U.S. and non-U.S. sellers.

The smaller share of negative experience could come from reduced “moral hazard” (within-seller reductions) or from reduced “adverse selection” (a change in seller composition). To investigate, I additionally control for sellers, by constraining and using transactions from sellers who are active both before and after the policy change. Column (4) of Table 9 shows two interesting results. First, the reduction in negative experience from U.S. sellers is from the “moral hazard” channel: The introduction of the GSP induces existing U.S. exporters to raise their service quality to compete with the new U.S. exporters. Second, this reduction for non-U.S. sellers stems from the “adverse selection” channel: The entry of U.S. exporters offers foreign buyers more options, so they stop buying from some low-quality non-U.S. sellers, thereby increasing the average quality of non-U.S. sellers through the change in seller composition. The differential responses between U.S. and non-U.S. sellers to the new entrants is consistent with the difference in the levels of advertisement on the U.S. and non-U.S. sites.

Leaf categories are the finest product category on eBay for non-catalogued products. Examples of leaf categories are: Boys’ Outerwear (Newborn-5T), LED Light Key Chains, and Circuit Breaker & Fuse Boxes.
Figure 4: Event Study: Change in Normalized Herfindahl–Hirschman Index Over Time

Notes: The circles are estimates of regressing HHIs on dummies for each normalized month, controlling for importing country-leaf category fixed effects and holiday dummies. The coefficient for \( t = 11 \) is normalized to 0. HHIs are computed for each market, which is an importing country-leaf category combination. The change in the intercept after GSP is 0.007 (standard error 0.003), which is about 2% of the mean HHI.

Subsequently, I analyze changes in market concentrations, measured by the Herfindahl–Hirschman Index (HHI), over time and across markets. Figure 4 uses transactions in the GSP-eligible countries in the 11 months before and 11 months after they became GSP-eligible. I define a market to be an importing country-leaf category combination. I then compute the monthly HHI for each market by summing up individual seller’s market share squared in a given month. Subsequently, I regress HHIs on dummy variables for each normalized month, controlling for importing country-leaf category fixed effects and holiday dummies. This is an event study of how HHI changes over time. The estimates are plotted in Figure 4 with the coefficient for \( t = 11 \) normalized to 0. The graph shows that HHI has decreased slightly after the introduction of the GSP, suggesting higher levels of competition in these markets. In particular, the fitted line shows the change in intercept after GSP is 0.007 with a standard error of 0.003, which is about a 2% change. Kelly [1981] gives an interpretation of the HHI: The reciprocal of the HHI measure is the number of equal-sized firms which would generate the same level of competition. In this regards, this number is 2.82 before the GSP introduction and 2.87 after. This small change in competition in the short run is reasonable given that the increase in U.S. exports is only 1.27%.

Having established the average effect of the GSP on HHI, I explore the change in competition across heterogeneous product categories. I expect the competition effect to differ along two dimensions. First, the increase in competition should be larger for products with a larger value to weight ratio, which makes exporting more profitable.
Figure 5: Event Study: Changes in the Herfindahl–Hirschman Index Across Markets

Notes: This figure plots the estimated change in the HHI for each meta category using the methodology in Figure 4. Note that negative changes in HHI indicate an increase in competition, while positive changes indicate a decrease in competition. Red bars indicate that the estimates are statistically significant at the 1% level.
Second, the competition effect should be larger for differentiated goods market, i.e., goods with more variations in product attributes, such as collectibles and clothing, and smaller for homogeneous goods markets, such as books and electronics. The increase in competition in the former markets comes from consumers’ preference for variety. Imagine a scenario where a French buyer shops for a decorative porcelain vase; without knowing precisely the attributes, she will benefit from an increased variety in porcelain vases offered by U.S. sellers. On the other hand, if she shops for *A Brief History of Time* by Stephen Hawking, she may choose to buy from domestic sellers due to their advantages in delivery time and costs, despite the presence of the same book from U.S. sellers.

I test this hypothesis in Figure 5. I adopt the same definition of markets, namely importing country-leaf category combinations, and report the estimated changes in the HHI for each meta category using the methodology in Figure 4.\(^{46}\) Note that a negative change in HHI indicates an increase in competition, and a positive change indicates a decrease in competition. Red bars indicate that the estimates are statistically significant at the 1% level.

Figure 5 shows three things. First, most statistically significant estimates are negative, indicating an increased level of competition in the GSP-eligible importing countries. Second, categories with more variations of product attributes experienced higher increase in competition (e.g., Clothing, Shoes & Accessories and Collectibles). Finally, homogeneous goods markets, such as the ones for Consumer Electronics, DVDs, and Books, either experienced a decrease or no statistically significant change in competition after the introduction of the GSP.\(^{47}\)

### 8 Conclusion

In this paper, I study a randomized field experiment that generates exogenous variation in the export entry cost for U.S. sellers on eBay. The results show that, once the “hassle” cost of figuring out the process of exporting is removed, cross-border trade on eBay increases by 2.7%. Specifically, this increase stems from the extensive margin defined on either seller or seller-country level, and from small and medium-sized sellers. Additionally, foreign markets experience a 1% rise in product variety, a 1.2% drop in the share of negative feedback, and an increase in competition in foreign markets, which is larger for differentiated goods markets.

\(^{46}\)Meta categories are the highest-level category that eBay uses, and there are many leaf categories under each meta category.

\(^{47}\)I also run an analogous regression: for each product category, I estimate the average change in HHI across products. I then regress these estimates on an intercept, a dummy variable for whether these categories are expensive, and a dummy variable for whether at least 10% of products in a category are catalogued. The regression analysis shows that the HHI changes by -0.026 and 0.017 for differentiated goods and homogeneous goods, respectively.
To my knowledge, this is the first randomized field experiment to estimate the distributional impact of the export entry cost mechanism. The results indicate strong and robust internal validity that a decrease in entry cost increases exports for small and medium-sized sellers through the extensive margin of exports on eBay. Whether this entry cost mechanism holds in other marketplaces is an empirical question, as is the case for any analysis of a particular country or industry. However, we can still learn from this exercise that the distributional impact of entry cost, as would be a priori predicted by many economic models, is at least cleanly identified in one competitive and sizable marketplace. Moreover, a qualitative extrapolation of the results suggests that governments that try to promote SMEs’ exports should target their entry costs.

A final note is that the export entry cost on eBay is much smaller than that in offline marketplaces, as eBay matches international buyers with sellers, maintains a functional trust system, and integrates purchasing postage and filling out customs forms in the seller dashboard—it only takes sellers a few extra clicks to print out the customs forms (refer to the discussion in section 1). As such, the export rates of commercial sellers on eBay dramatically exceed the reported levels of traditional small business. Yet further reducing the hassle cost of exporting by having an intermediary handle sellers’ exports is still powerful enough to generate a 2.7% increase in exports. This result suggests that some sellers are simply unaware of the easiness to export on eBay, or believe that exporting is too complicated and not suitable for them. Interestingly, a report by the Department of Commerce shows that the third most popular reason that firms do not export is “We are just too small for exporting—it is for large firms” (15 percent of surveyed firms). Therefore, it might be more cost-effective for governments to make sure SMEs are fully aware and take advantage of the existing export promotion programs and platforms, rather than building new facilities and adding features to existing ones.

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A  Steps for Selling Internationally on eBay

(a) Step 1: Receiving a Payment Notification (Domestic and International Sales)

(b) Step 2: Purchasing a Shipping Postage (Domestic and International Sales)

(c) Step 3: Filling out a Customs Form (The Extra Step for International Sales)

(d) Step 4: Printing the Shipping Label/Customs Form (Domestic and International Sales)
B  GSP Roadmap

- October 2012, field experiment, 18 countries: Australia, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Spain, Finland, United Kingdom, Greece, Hungary, Lithuania, Latvia, Malta, Portugal, Romania, Slovakia, and Slovenia.

- March 2013, full launch, 8 more countries: Japan, China, Thailand, South Korea, Taiwan, Indonesia, Sweden, and South Africa.

- June 2013, full launch, 8 more countries: Belgium, France, Hong Kong, Ireland, Italy, Netherlands, Poland, and Spain.

- July 2013, full launch, 2 more countries: Germany and Austria.

- September 2013, full launch, 1 more country: Russia.

- November 2013, full launch, 5 more countries: Singapore, Mexico, New Zealand, Israel, and the Philippines.

![Figure 7: Change in U.S. Exports by Importing Countries](image)

Notes: This figure plots the percentage change in U.S. exports by importing countries. Specifically, my data includes U.S. monthly exports in the five months before and the five months after GSP became effective. I then run one regression for each importing country and regress the logarithm of U.S. exports on the policy dummy, controlling for monthly trends. This figure is consistent with traditional gravity results, which indicate that entry costs are higher for farther countries. (Distance is a proxy for trade barriers.)
C Examples of a GSP and a non-GSP listing

(a) A GSP Listing

(b) A Non-GSP Listing

Notes: These screen shots are captured from the eBay Canada Site. Sellers in both listings are in the U.S.
Notes: The inverse hyperbolic sine (IHS) is an approximate of logarithms when dependent variables have negative and zero values. For positive values, IHS is approximately $\log(x)$ plus a constant; for negative values, IHS is approximately $-\log(-x)$ plus a constant. This method is often used in public economics (e.g. on household wealth), and was discussed extensively in Burbidge et al. [1988]
E Resolving Data Sparsity Using Listing Data

In this section, I use listing data to study whether sellers intend to sell more on extensive margin defined on the U.S. and non-U.S. levels. This method ameliorates the data sparsity issue discussed extensively in section 6.2.1. For easy comparison, I report the previous results in Table 4 on the change in number of internationally available listings in columns (1) and (2) of Table 10. The changes in extensive margin of export are 3.5% and 2.6%, depending on whether I control for change in seller-level impression counts. The change in intensive margin, for the first time in this study, becomes statistically significant at the 1% level. These changes are 0.5% and 0.3%, respectively, with and without controlling for the change in number of total listings. This is due to the aggregation of all foreign countries into the non-U.S group, which gives the change in intensive margin the maximum chance of being significant. Therefore this exercise shows that, even if we define margins of trade in the way that makes the change in intensive margin more salient, the increase in exports through the intensive margin contributes to about 10% of the overall increase in export.

Table 10: The Extensive Margin Defined on U.S. and Non-U.S. Levels: Listings Data

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log($\Delta IL_i$)</td>
<td>0.040***</td>
<td>0.029***</td>
<td>0.035***</td>
<td>0.026***</td>
<td>0.005***</td>
<td>0.003***</td>
</tr>
<tr>
<td>log($\Delta ExtIL_i$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log($\Delta IntIL_i$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment Group</td>
<td>log($\Delta TL_i$)</td>
<td>0.171***</td>
<td>0.145***</td>
<td>0.026***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.2E-04)</td>
<td>(2.0E-04)</td>
<td>(1.0E-04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment*log($\Delta TL_i$)</td>
<td>0.009***</td>
<td>0.008***</td>
<td>0.001***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.0E-04)</td>
<td>(4.5E-04)</td>
<td>(2.3E-04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>log($\Delta TL_i$)</td>
<td>-0.027***</td>
<td>-0.024***</td>
<td>0.003***</td>
<td>-0.003***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.8E-04)</td>
<td>(4.4E-04)</td>
<td>(2.1E-04)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The margins are defined on the U.S. and non-U.S. levels. $\Delta log(II_i)$ is the change in log of numbers of internationally available listings. $\Delta log(TL_i)$ is the change in log of numbers of total listings. log is approximated by the inverse hyperbolic sine transformation. *** indicates significance at p = 0.01.
Comparing ITT Estimator with Non-Experimental Estimators

In this section, I compare the intent-to-treat (ITT) estimator with non-experimental estimators used in the literature, namely the difference-in-difference (DiD) and the matching DiD estimators. Note that since the non-experimental estimators yield the average treatment effect on treated (ATT), we need to divide the ITT estimate by the take-up rate of 6% for a valid comparison. Column (1) is copied from Table 2 and the corresponding ATT estimate is 0.483. In column (2), I perform a DiD analysis, which yields the unbiased ATT if selections into using the GSP only stems from time-invariant seller heterogeneity. In column (3), I perform a DiD analysis with controls of 100 equal stratas based on propensity scores (PS).\textsuperscript{49} The identification assumption is that there is no unobserved time-varying factors that cause selections and exports. In column (4), I repeat the estimation in column (3) with WLS, where the weights are given by the inverse probability of treatment weights (IPTW).\textsuperscript{50}

<table>
<thead>
<tr>
<th></th>
<th>Column (1)</th>
<th>Column (2)</th>
<th>Column (3)</th>
<th>Column (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable:</strong> (\log(S_{it}))</td>
<td>ITT (\log(S_{it}))</td>
<td>DiD (\log(S_{it}))</td>
<td>DiD with PS Strata (\Delta \log(S_{i}))</td>
<td>IPTW (\Delta \log(S_{i}))</td>
</tr>
<tr>
<td>Interaction</td>
<td>0.029***</td>
<td>0.798***</td>
<td>0.539***</td>
<td>0.576***</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.040)</td>
<td>(0.029)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Treatment/Enrolled</td>
<td>0.006</td>
<td>1.674***</td>
<td>0.504***</td>
<td>0.288***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.029)</td>
<td>(0.021)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Post</td>
<td>0.088***</td>
<td>-0.094***</td>
<td>0.446***</td>
<td>0.518***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.077***</td>
<td>1.833***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** The ATT estimate is 0.483 given the take-up rate of 6%.
\(S_{it}\) refers to seller \(i\)’s export sales at time \(t \in \{Pre, Post\}\). \(\log\) is approximated by the inverse hyperbolic sine transformation.

*** indicates significance at \(p = 0.01\); ** indicates \(p = 0.05\).

\textsuperscript{49}The propensity scores are estimated from a logistic regression on the following variable: sellers’ international GMV in the past three months, international GMV in the past 12 months, domestic GMV in the past three months, domestic GMV in the past 12 months, ages, Top Rated Seller status, indicator for previously exporting, feedback score, and percentage of transactions with low feedback or buyer disputes. I then run t-tests for each strata and one cannot reject the equality of the means for 96 out of the 100 strata.

\textsuperscript{50}This approach is proposed by Harder et al. [2010]. The weight equals to the reciprocal of the PS for the treated and equals to the reciprocal of one minus the PS for the non-treated.
In this section, I estimate the heterogeneous program effects for sellers who were exporters prior to the experiment and for those who only sold domestically. For previous exporters, the increase in export comes from the extensive margin on the seller-country level. On the other hand, the increase for non-exporters comes from the extensive margin on the seller level. Estimates in columns (1) and (2) are copied from Table 3 for easy comparisons. Columns (3) and (5) show that the program increases seller-level export by 2.1% and 7.2%, respectively, for non-exporters and exporters. To understand the discrepancy, I decompose the increase in exports into different seller sizes defined previously for both groups in columns (4) and (6). Two observations are useful in understanding the difference: first, there are much more small sellers from the non-exporter group than that from the exporter group; second, the increase in export from small sellers in the former group is only 2.1%, compared to an increase of 7.2% from small sellers in the latter group. These two findings suggest that the discrepancy is driven by the heterogeneity across non-exporters and exporters, in that previous exporters are on average larger and more active than non-exporters.

Table 12: Heterogeneous Treatment Effects for Different Export Status

<table>
<thead>
<tr>
<th>Dependent Variable: Δ log(S_i)</th>
<th>All Sellers</th>
<th>Non Exporters</th>
<th>Exporters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Group</td>
<td>0.029*** (0.003)</td>
<td>0.021*** (0.002)</td>
<td>0.072*** (0.008)</td>
</tr>
<tr>
<td>Treatment Group*Small Seller</td>
<td>0.029*** (0.003)</td>
<td>0.020*** (0.002)</td>
<td>0.066*** (0.009)</td>
</tr>
<tr>
<td>Treatment Group*Medium Seller</td>
<td>0.049*** (0.013)</td>
<td>0.086*** (0.021)</td>
<td>0.061*** (0.016)</td>
</tr>
<tr>
<td>Treatment Group*Large Seller</td>
<td>0.028 (0.042)</td>
<td>0.063 (0.164)</td>
<td>0.015 (0.050)</td>
</tr>
</tbody>
</table>

Notes: In (1), (3), and (5), I also control for intercepts. In (2), (4), and (6), I also control for Seller Size FEs. Small, Medium, and Large sellers are defined as sellers who had [0, $10,000], [$10,000, $120,000], and [$120,000, ∞] sales, respectively, in the past year. log is approximated by the inverse hyperbolic sine transformation. *** indicates significance at p = 0.01.