E-commerce Platforms and International Trade: A Large-Scale Field Experiment *

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Abstract

Information technology facilitates trillion-dollar international trade. This paper studies whether the efficiency of IT-enabled trade on e-commerce platforms can be improved by integrating export logistic services. Exploiting a site-wide randomized experiment on eBay, I show that integrating the service of handling customs clearance and international shipping profitably increased cross-border trade on eBay by 2.9% to 12.3% through the extensive margin of export. The increase comes from "disadvantaged" groups where export entry costs are prohibitive: Small and medium sellers, distant countries, and products with smaller profit margin. Foreign consumers benefited from higher marketplace quality and an 8.4% increase in product variety. Foreign sellers experienced no sales cannibalization overall but faced higher competition in differentiated goods categories. Back-of-the-envelope calculations suggest that 92% of the export response comes from a reduction in export entry cost–the hassle cost of learning export procedures. I discuss implications for e-commerce platforms and government agencies.

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1 Introduction

Information technology (IT) has improved commerce efficiency. One prominent example is that IT brings small firms into commerce, i.e., the "great equalizer" effect. Recently, IT enables smaller players to participate in international trade, which used to be the exclusive preserve of large firms. Inclusive IT-enabled international trade increases efficiency for three reasons: First, the inclusion of small firms is important because they are the main driver of job creations and innovations.[1] Second, IT reduces resource waste in supply chain, unlike tariff reductions. Third, growing evidence shows exporting increases productivity, i.e., learning-by-exporting.[2] These efficiency gains can be huge as 80% purchasing power is outside the United States.[3] Realizing these benefits, the U.S. Department of Commerce announced a partnership with eBay in 2014 to promote exports from small businesses.[4]

What can be done to increase the efficiency of IT-enabled trade? Motivated by this broad question, we focus on one specific combination of IT and policy: e-commerce platforms and the integration of export logistic intermediaries.[5] Small firms traditionally rely on export intermediaries for identifying customers and handling logistics. The first of these is now provided by e-commerce platforms. The question then naturally arises: Can the integration of export logistics complement e-commerce platforms to improve export outcomes? While the answer may seem positive, studies of supply-side interventions on micro businesses showed mixing evidence.[6] Even if the policy works, it is unclear how different sellers, countries, and products will be affected, and what are its underlying mechanisms. On the quality dimension, foreign consumers may experience lower transaction quality from new exporters because they are systematically of lower quality than existing ones, shown in Melitz [2003] and in my data. Reputation ratings based on domestic sales may be poor indicators of exporting quality given differences in taste (Blum and Goldfarb [2006]) and language barriers (Lendle et al. [2012]). Export growth may be unsustainable if transaction quality decreases.

In this paper, I investigate this question by analyzing the introduction of eBay's global shipping program (GSP) in 2013, which integrates the service of an export intermediary on eBay. Specifically, sellers can enroll in the GSP for free and simply ship sold items to eBay's U.S. Shipping Center, where the intermediary handles international shipping and customs clearance. The GSP represents

[1] Small firms accounted for 63% of net new job creations between 1993 and 2013 and produced 16 times more patents per employee than large patenting firms. Souce: https://www.sba.gov/sites/default/files/FAQ_March_2014_0.pdf

[2] For example, Harrison and Rodríguez-Clare [2009], De Loecker [2007], and Atkin et al. [2016].

[3] Chris Rasmussen (DoC) estimates that every billion dollars of exports support about 5,000 domestic jobs in 2014.

[4] Similarly, the European Commission prioritized the notion of Digital Single Market and IT-enabled trade in 2011.

[5] According to USCTAD, e-commerce was valued at $16 Trillion in 2013. About 20% sales is cross-border trade

[6] McKenzie and Woodruff [2013] finds only two out of nine studies on evaluating business training programs detect significant impacts. Studies on evaluating access to credit and export promotion programs also yield mixed results.

a better export logistics technology.[7] eBay and GSP provide an ideal environment for this question since eBay moderated $15 billion of exports in 2014 and the GSP is its workhorse trade policy.[8]

I first evaluate the GSP with a randomized field experiment: Prior to the full launch of the GSP, 20% of eBay U.S. sellers selected randomly were offered the opportunity of early enrollment in this program. The intent-to-treat (ITT) estimate compares mean outcomes between the treatment and control groups in the three-month experiment window, which yields causal effects of the GSP in the presence of sellers self-selecting into the program. In addition, I adopt a difference-in-difference (DiD) estimation that exploits GSP's gradual rollouts to importing countries to study program's impacts after its full launch and its inclusion of more importing countries.

The ITT estimates show that the opportunity to enroll in the GSP increases exports on eBay by 2.9% in the experiment window from October to December 2012.[9] This increase comes exclusively from the extensive margin of exports, i.e., from new exporters or importing countries. Subsequently, I perform the DiD estimation for the first five rollouts as the take-up rate and the number of eligible importing countries increase to more than 80% and 42, respectively. The overall estimated change in export is 12.3%; separate estimates for the five rollouts range from 3% to 36%.

Next, I study the program's heterogeneous treatment effects (HTEs). The export increase is larger for groups where export entry costs are prohibitive. First, the increase came exclusively from small sellers and small commercial sellers.[10] Second, gravity models show the increase is larger in more distant countries. Third, the export increase, which positively correlates with changes in market competition, is larger for products with smaller profit margin. The HTEs are consistent with the hypothesis that GSP reduces export entry cost, thereby allowing increase from "disadvantaged" groups that were disproportionately affected by this cost due to lack of economies of scale.

Subsequently, I analyze GSP's impacts on foreign consumers, sellers, and eBay. Foreign buyers benefit from an 8.3% larger product variety in the year after GSP's full launch.[11] Although transaction quality from new U.S. exporters is lower than existing U.S. ones, this difference is halved in international sales, and foreign consumers do not experience change in transaction quality from U.S. exporters. However, they experienced an increase in quality from non-U.S. sellers, from both within-seller change and from change in seller composition. Foreign sellers experienced no sales cannibalization overall, but they faced higher competition in the differentiated goods category since

[7] The GSP is not an export subsidy since neither buyers, sellers, or eBay is paying for it. Details in Section 2.
[8] President Obama appointed eBay's CEO to the President's Export Council in 2011 to develop trade policy.
[9] The take-up rate was 6% and the number of eligible importing countries was 18 in these three months.
[10] Commercial sellers on eBay sell at least $10,000 annually (Lendle et al. [2012] and Lendle and Vézina [2015]).
[11] This implies welfare gain: Brynjolfsson et al. [2003], Hummels and Klenow [2005], and Forman et al. [2009].

consumers are more likely to endure high international shipping cost for new product varieties. eBay's annual profit from the GSP is estimated to be at least $40 million.

Lastly, I investigate GSP's potential mechanisms: demand, export variable cost, and export entry cost mechanisms.[12] To begin with, GSP could increase demand because, although 10% more expensive, buyers see all costs upfront and enjoy tracked shipping in GSP listings. I test the demand mechanism in two ways. First, I analyze the change in number/share of internationally available listings, *sold or unsold*, which represents export supply curve. Second, I directly estimate demand for GSP using matched listings where sellers experiment with shipping options for otherwise identical listings, similar to the approach in Elfenbein et al. [2012] and Einav et al. [2015].

GSP could also reduce export variable costs for three reasons. First, enrolled sellers do not need to fill out customs forms in the post office. Second, sellers automatically receive five stars on two shipping Detailed Seller Ratings (DSRs).[13] Finally, sellers are not responsible for damages in the international shipping process. To begin with, we find no export change on the intensive margin, i.e. export changes to the same country, which is consistent with negligible changes in variable cost, subject to changes in competition and data sparsity issue.[14] I mitigate the sparsity issue with two methods. First, I adopt a global entry cost and redo the analyses on margins of the U.S. and foreign levels. Second, I exploit listing data to capture sellers' intention of exporting along the extensive margin, which is net of the demand and competition effects. Finally, I examine sellers who unlikely benefited from the variable cost channels. These sellers 1) always printed eBay-generated shipping labels, 2) never received low shipping DSRs, and 3) never purchased shipping insurance in the year before the experiment. We see similar export increase even for this group of sellers, indicating the GSP works mainly through reducing export entry cost. A back-of-the-envelope calculation suggests that the entry cost mechanism accounts for 92% of the export increase.

This paper contributes to the literature of IT and international trade. Earlier work found that online trade is subject to "gravity", although to a lesser extent than offline (Blum and Goldfarb [2006]; Hortaçsu et al. [2009]; Overby and Forman [2009]; Gomez-Herrera et al. [2014]). My paper studies a policy that further increases the efficiency of IT-enabled cross-border trade. Using general equilibrium approaches, Lendle et al. [2012] and Fan et al. [2015] estimate welfare gain from reduced search friction on eBay and from larger product variety on Taobao, respectively.[15] In comparison,

[12] Finding causal mechanisms of a policy is necessary (but insufficient) for external validity (Levitt and List [2007]).

[13] Buyers rate sellers in four categories: item as described, communication, shipping time, and shipping charges.

[14] 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.(Armenter and Koren [2014] and Lendle and Vézina [2015])

[15] The authors adopt variations of the "sufficient statistics" approach developed by Arkolakis et al. [2012]: welfare

my paper uses micro-econometric techniques and granular data to focus on clean identification of the policy's causal impact on various market outcomes, and on teasing out its underlying mechanisms.

This paper also contributes to studies of evaluating export promotion programs (EPPs). Many of these studies are cross-sectional, rarely have stratified contrast groups, and use survey data (Freixanet [2012]). Although a few recent papers address this issue with matching estimators, they are still unable to disentangle programs' mechanisms.[16] This issue also appears in studies on export intermediaries.[17] In comparison, my paper addresses these two concerns with a randomized experiment and methods of separating mechanisms. More broadly, studies on supply-side intervention in micro businesses find little impact.[18] My results show that even a simple intervention works in a marketplace where transaction costs are already low. But the impact is small in the short run and requires much more than 100-500 firms as in typical studies to detect. Larger-scale experiments on these interventions may be worthwhile since a small percentage translates to billions of dollars.

In terms of managerial implications, our results suggest that integrating logistic intermediaries complements e-commerce platforms to profitably promote exports while increasing transaction quality. The program's "distributional" impact depends on the type of services offered. GSP mainly reduces export entry costs, and hence it disproportionately helps the "disadvantaged" groups, i.e., groups where entry cost is large relative to export revenue. We should note that GSP is a simple intervention as it merely "nudges" sellers to export through the integration of an existing technology, yet it is powerful enough to increase exports at a high profit margin.[19] Finally, our results also shed light on the increasing policy attention of promoting exports from small and medium-sized enterprises (SMEs) and suggest that reducing export entry costs is the key to promoting SME's exports. We discuss potential external validity of our findings in Section 9.

2 The Global Shipping Program

The Global Shipping Program (GSP) was fully launched on eBay's U.S. site in March 2013 after its pilot experiment in October 2012. Specifically, eBay integrated Pitney Bowes' service of handling customs clearance and international shipping. Sellers can enroll in the GSP for free on a voluntary base. For each listing, the seller chooses whether the item is available for domestic buyers only or

gains from trade is summarized by the aggregate share of expenditure on domestic goods and the elasticity of imports.

[16] E.g., Görg et al. [2008], Martincus and Carballo [2008], Martincus and Carballo [2010], and Cadot et al. [2013].

[17] E.g., Felbermayr and Jung [2008], Blum et al. [2009], Akerman et al., and Ahn et al. [2011].

[18] Examples include business training programs, access to credit, and export promotion programs. (See footnote 4)

[19] Small intervention causing big response is also seen elsewhere (Leonard [2008]).

Table 1: Potential GSP Mechanisms

Export Entry Cost Mechanism	Export Variable Cost Mechanism	Demand Mechanism
Reducing costs of...	Reducing costs of...	Increases consumer demand...
1. Learn eBay export procedures	1. Fill out forms in the P.O.	1. See all costs upfront
2. Learn customs regulations	2. Low intl shipping DSRs	2. Intl tracking included
3. Choose intl shipping carriers	3. Damage in intl shipping	3. 10% more expensive

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. The selling procedure for exporting with GSP is the same as selling domestically. The procedure for exporting without GSP involves one extra step of acknowledging that the exported product is not prohibited by foreign countries (Step 3 in Appendix C).

If the GSP option is chosen and the item is purchased by a buyer from GSP-eligible importing countries, sellers simply ship sold items to eBay's U.S. Shipping Center in Kentucy. 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. The GSP was available for one exporting country, namely the United States, and 26 importing countries during the first rollout (GSP roadmap in Appendix A).

GSP listings look different than non-GSP ones to international buyers (Appendix B). 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.

The GSP represents a better technology of export logistics, rather than an export subsidy from eBay. This can be seen from the program's cost structure. Sellers enroll in the GSP for free. Buyers pay the same amount of importing and shipping charges for the same shipping services. Pitney Bowes profits from bulk-shipping discount and is regulated by eBay to charge market price for its service. eBay incurs a one-time cost for setting the GSP up, and benefits from more transactions on the platform thereafter.

We note that the GSP could potentially work simultaneously through three mechanisms: the export entry cost, the export variable cost, and the demand mechanisms. The reasons are listed in

Table 1. This simultaneity feature is present for almost all export promotion programs (EPP) and there has not been a good way to disentangle the mechanisms to date.

3 Data and Simple Framework

In this paper, I use eBay data from 2012 to 2014, including characteristics of products, listings, checkout, shipping, buyer, seller, and feedback. In the randomized experiment, sellers on average export $165 to 7.3 countries in the preceding period, namely July, August, and September 2012.[20] We normalize the number of all active sellers on eBay during the experimental window (October to December 2012) to be 100 throughout our experimental analyses.

eBay is a massive marketplace: it contains 157 million buyers and 800 million live listings at any given time, with an average of 230 million clicks on item listings every day in 2014.[21] eBay is one of the largest international e-commerce platforms with $15 billion dollars of exports in 2014. It accounted for 1.38% of total U.S. exports in categories that are sold on eBay.[22] Figure 1a shows that the trend of U.S. exports on eBay is similar to that of total U.S. exports. Much like traditional marketplaces, eBay is a competitive marketplace where both buyers and sellers behave strategically.[23] Like in conventional marketplaces, seller size distribution on eBay is approximately log-normal (Bar-Gill et al.), as shown in figure 1b the seller size distribution in 2012.

Next, I plot sellers' willingness to export on eBay before and after the introduction of the GSP. Figure 2a depicts the relationship between average number of internationally available listings and sellers' domestic revenue in the year before and after the experiment in October 2012. The averages are taken within $1,000 intervals of sellers' domestic revenue.[24] Two interesting patterns emerge: First, sellers with larger domestic sales intend to export more items; second, sellers are willing to export more after the program introduction with some noise for the largest sellers.

Sellers may not want to export their entire inventory due to logistic constraints, such as items prohibited by customs or items being fragile. Therefore, it is illustrative to plot the share of sellers who intend to export any item and ignores how they choose export mix. Figure 2b plots this share

[20] Disclaimer: These statistics are from 2012 and are not representative of current averages on eBay. Other summary statistics are not reported due to eBay's data policy.

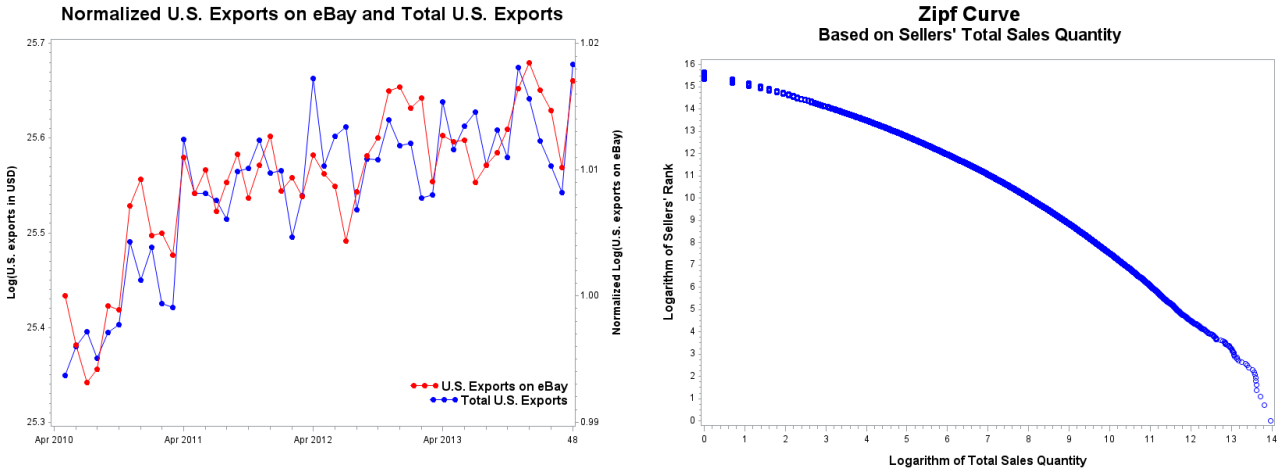
[21] Source: https://www.sec.gov/Archives/edgar/data/1065088/000119312515240245/d944939dex992.htm

[22] To obtain this share, I match products on eBay with the six-digit level HS product classification as in Lendle et al. [2012], since most items on eBay are household durable goods. Fixing this "basket of goods", I divide the U.S. exports on eBay on overall U.S. exports (obtained from UN Comtrade) in 2013.

[23] E.g., sellers experiment with different sales parameters (Einav et al. [2015]); they sacrifice short-term revenue to become badged (Saeedi [2014]); buyers value reputation less after the buyer warranty introduction (Hui et al. [2015]).

[24] The x-axis is capped at 50, which covers 99% of the sellers.

Figure 1: U.S. Exports and Seller Size Distribution on eBay



(a) (b)

Notes: The logarithm of U.S. exports on eBay is normalized to the value of April 2010. Sellers' size defined as their quantities sold in the 12 months before the field experiment.

over the deciles of sellers' domestic sales in USD. We restrict our attention to more serious sellers with at least 10 annual sales. We observe that the share of intended exporters increased after the GSP introduction. Another interesting observation is that this curve become less convex after the policy change.

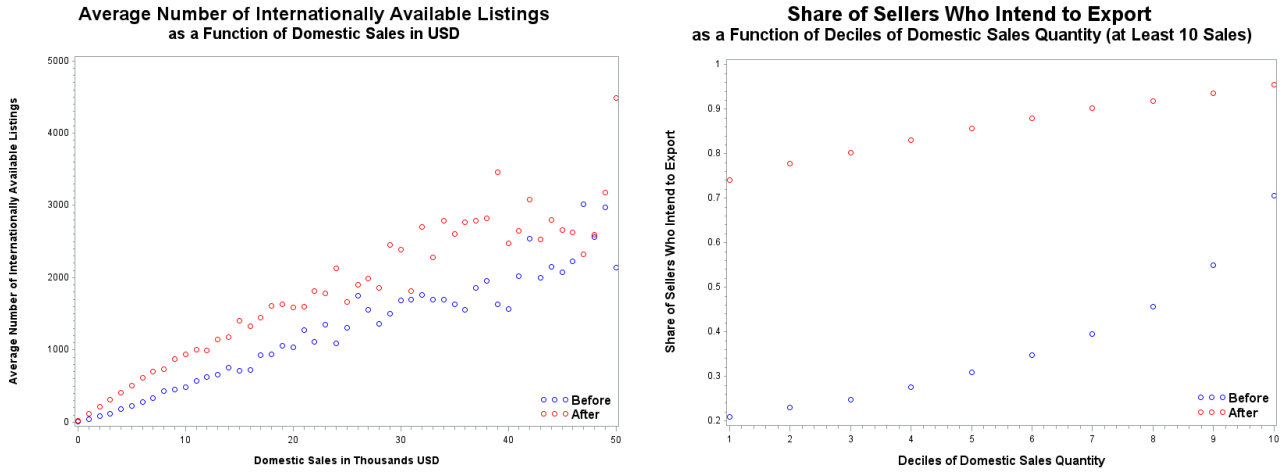
To rationalize these observations, let us consider a simple framework similar to Melitz [2003]. We assume that sellers differ in two dimensions, namely their productivity s_j and export entry cost F_j, which are drawn from two independent distributions. Higher productivity can also be thought of as lower marginal cost. Exporting for the first time requires paying an entry cost. Given foreign demand, seller j makes sequential export decisions: 1) Export or not? and 2) How much to export? Solved the problem backwards, seller j solves for the export profit-maximizing quantity $q_E^*(s_j)$ conditional on exporting; then she decides to enter foreign market if the (sum of discounted life-time) export profit covers her export entry cost, i.e., $\Pi_E(s_j, q_E^*(s_j)) > F_j$.[25]

Under some regularity conditions, we have that the export quantity $q_E^*(s_j)$ and export profit $\Pi_E(s_j, q_E^*(s_j))$ increase in productivity s_j.[26] In words, more productive sellers export more and receive higher export profits. We do not observe productivity s, but we could index it by seller's

[25] Folowing Das et al. [2007], we assume that sellers maximize domestic and export profit functions separately.

[26] To ensure the existence of a unique profit-maximizing quantity, I assume that $\Pi_E(q_E, s)$ is twice continuously differentiable in both arguments, concave in q_E, and $\frac{\partial \Pi_E(q_E,s)}{\partial q_E} = 0$ for some q_E. Furthermore, we assume $\Pi_E(q_E, s)$ is supermodular: for any change in sales q_E, the difference in profits increases in seller's productivity, i.e., $\frac{\partial^2 \Pi_E(q_E,s)}{\partial q_E \partial s} > 0$.

Figure 2: Willingness to Export as a Function of Sellers' Domestic Sizes



(a) (b)

Notes: Blue and red dots are for the year before and after the experiment in October 2012, respectively. Sellers intend to export if they have at least one internationally available listing in the corresponding period.

domestic sales $q_D^*(s_j)$ under analogous assumptions. It therefore follows that sellers with larger domestic sales also want to export more, consistent with Figure 2a. We also have that the share of intended exporters, $Pr[F_j \leq \Pi_E(s, q_E^*(s))]$, increases in s, which is seen in Figure 2b. Additionally, the convexity of this curve is expected due to the existence of the export entry cost F and heterogeneity in seller productivity s.[27]

The introduction of GSP could increase export from the three mechanisms for reasons listed in Table 1. If GSP reduces export entry cost, export increase should come from the extensive margin, namely from new exporters. The reason is that existing exporters have paid the entry cost before the GSP, and a reduction in entry costs should not change their operation decisions. If GSP changes export variable cost or demand, we should see export changes along the intensive margin as existing exporters re-optimizes their export quantity; export change should also occur on the extensive margin because domestic sellers that are close to the old export productivity threshold start exporting due to increased export profit levels. The model could be extended to incorporate country-specific entry cost, and these reasonings would carry through new definition of the extensive margin, which is the sum of changes from new exporters and from exisiting exportings to new destination countries.

Two observations in Figure 2b suggest that GSP reduces export entry cost. First, the vertical

[27] For example, if F is the same for all sellers, there exists a productivity threshold $\underline{s}$ such that the share of exporter is 0 for $s < \underline{s}$, and increases with s for $s \geqslant \underline{s}$.

rise in the share of intended exporters is larger for small sellers, the majority of whom are domestic sellers. The caveat is that the growing trend of exporters is not controlled in this graph and we will address this concern in our regression analyses. Second, the "export supply" curve in Figure 2b is less convex after the GSP introduction, hinting a smaller distortion from the entry cost.

4 Empirical Strategies

I adopt two methodologies to estimate the effects of the GSP. First, I adopt the ITT estimator using the randomized field experiment in October 2012. The experiment was carried out as follows: Five months before the full launch of the GSP, eBay randomly selected 20% of all active sellers on the U.S. site 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 and site emails. The other 80% of the sellers on the U.S. site did not receive invitation for enrollment and did not have the option to enroll. The number of GSP-eligible importing countries was 18 at time.

For the ITT estimation, we compare seller-level export outcomes across treatment and control groups. The ITT estimation yields unbiased estimates of program effects in the presence of sellers' self-section into adopting the program. 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 independence assumption for unbiased estimation is achieved since the treatment is randomly assigned. Note that ITT estimation is particularly relevant for programs with voluntary participation. We may also be interested in the Treatment-on-the-treated (TOT) estimator $E[Y_i(1)|D_i = 1] - E[Y_i(0)|D_i = 1]$, 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., $\text{ITT}/(E[D_i|Z_i = 1] - E[D_i|Z_i = 0])$. [28]

The natural candidate for the ITT is the cross-sectional comparison between the treatment and control groups. I also adopt two other estimators for robustness, namely the difference-in-difference (DiD) and the first-difference (FD) estimators, similar to Blake et al. [2014]. In particular, the

[28] For more details on causal inference, see Rubin [1974], Holland [1986], and Angrist et al. [1996].

specifications are as follows:

$$log(S_{i,Post}) = \alpha + \beta_1 Treatment_i + \epsilon_i \tag{1}$$

$$log(S_{it}) = \alpha + \beta_1 Interaction_{it} + \beta_2 Post_t + \beta_3 Treatment_i + \epsilon_{it} \tag{2}$$

$$\Delta log(S_i) = \beta_1 Treatment_i + \beta_2 + \Delta\epsilon_i, \tag{3}$$

where S_{it} is the export sales for seller i at period $t \in \{Pre, Post\}$; $Post_t$ is the dummy variable for the experiment window; $Treatment_i$ is the dummy variable for the treatment group; $Interaction_{it}$ is the interaction of the two variables, $Post_t * Ttreatment_i$; $\Delta log(S_i)$ is the first difference in logs of exports, $log(S_{i,Post}) - log(S_{i,Pre})$; $\Delta\epsilon_i$ is the first difference in errors, $\epsilon_{i,Post} - \epsilon_{i,Pre}$. In this exercise, *log* is approximated by the inverse hyperbolic sine (IHS) transformation to deal with negative or zero change in seller-level export sales (see Appendix E for a graphical illustration). This method is often used in regional economics, and was discussed extensively in Burbidge et al. [1988].[29]

While the ITT estimation yields the unbiased estimated program effect in the three-month experimental window, we should be cautious about the representativeness of this estimate for the treatment effect after program's full launch due to three reasons. First, take-up rates in the short experiment window could be lower than the equilibrium take-up rate. The reason is that sellers might not have checked their eBay email or have not done so until the end of the three-month experiment period.[30] This suggests that the ITT estimate when all sellers with intention of enrollment have taken up the GSP should be higher than the ITT estimate from the experiment.

Second, after the program's full launch, all sellers on the eBay U.S. site can enroll and export with the GSP. A larger participation in the export market will lead to a higher competition among U.S. exporter. A higher competition implies that the ITT estimate after the full launch should be smaller than that when only 20% sellers were eligible. This is referred to as the "general equilibrium" effect).[31] Additionally, we cannot learn much about the program impact on marketplace quality and competition from the experiment because the level of competition is directly affected by the number of GSP-eligible sellers.

Third, more importing countries became GSP-eligible after the full launch of the program. The number was 18 in the experiment but increased to 42 after the 5th rollout. This increase should increase the ITT estimate since enrolled sellers have higher demand for their products.

[29] I also compare my estimate with conventional estimates from non-experimental settings in Appendix H.
[30] eBay wants a short experiment window because they can potentially lose billion-dollar exports every month.
[31] E.g., Blake and Coey [2014] in email advertising on eBay and Fradkin [2014] in search ranking on Airbnb.

To address these three concerns, I complement the experimental approach with a difference-in-difference (DiD) estimation that exploits GSP's gradual rollouts to importing countries as a natural experiment. In particular, we estimate the program effects by comparing changes in monthly export outcomes before and after importing countries become GSP-eligible, against changes in export outcomes in importing countries that were not GSP-eligible for the same period. This methodology allows me to control for three types of unobservables: 1) country-specific time-invariant propensities to import from the United States (e.g., Canadian consumers are more likely to buy from U.S. sellers than Chinese consumers); 2) time-specific factors that are the same across countries (e.g., increasing awareness of the benefit of international trade); and 3) country-specific trends in linear or quadratic forms (e.g., differential bilateral exchange rate movements across countries). The empirical models are given as

$$log(Y_{ct}) = \beta Policy_{ct} + \eta_c + \xi_t + \gamma_c * t + \epsilon_{ct} \tag{4}$$

$$log(Y_{cpt}) = \beta Policy_{ct} + \eta_{cp} + \xi_t + \gamma_c * t + \epsilon_{cpt} \tag{5}$$

$$log(Y_{cpst}) = \beta Policy_{ct} + \eta_{cps} + \xi_t + \gamma_c * t + \epsilon_{cpst}, \tag{6}$$

where Y_{ct} is the outcome variable (e.g., U.S. export in USD) to country c at time t; $Policy_{ct}$ is the dummy for GSP eligibility in importing country c at t; η_c are importing country fixed effects; ξ_t are monthly fixed effects; γ_c allows for country-specific monthly trends in trade, such as from changes in bilateral exchange rate. Therefore, the coefficient β represents the average treatment effect of the GSP on export outcomes across all GSP-eligible countries, analogous to the ITT estimator from the experiment. The other two equations are on the country-product-month and the country-product-seller-month levels, which are used when fixing products or sellers is necessary.

We should bear in mind that the DiD estimation cannot control for serially-correlated unobservable error terms. These errors will cause biases in the estimation if they correlate with both exports and countries' GSP eligibility. As shown extensively in the trade literature, trade flows are positively serially correlated after controlling for observables, i.e., a country with larger imports from the United States will have even larger imports in the future (e.g., Roberts and Tybout [1997]). This implies that the proposed DiD estimation is biased upward if GSP-eligible importing countries had larger U.S. exports before the GSP introduction. To address this concern, I check whether rollout countries are as good as "randomly assigned" by checking if importing countries that are GSP-eligible systematically differ from non-eligible countries in terms of share of imports from the

United States relative to their GDP, both on eBay and overall. Results in Table 11 in Appendix A show that GSP-eligible importing countries actually have systematically smaller share of imports from the United States relative to their GDP or total consumption on eBay. This suggests that the country-level DiD estimates are lower bounds of the program impact. We also provide evidence of the parallel trend assumption in Figure 3.

Note that country-level DiD analysis is possible in this study because we have data on which countries did sellers export to. In conventional studies of evaluating EPPs, the DiD estimations are performed on total exports at the firm level, which could cause an upward bias because firms who self-select into using the programs are likely to differ from firms who do not in serially correlated unobservable dimensions, such as their managerial ability. Another note is that we use a policy dummy rather than the intensity of the GSP use in eligible countries because the latter involves sellers' decisions of usage, which are unlikely to be random.

5 Overall Program Impacts

5.1 Intent-to-Treat Estimation

To show the validity of the randomization, I test for the existence of any pre-experimental differences between the treatment and control groups. The t-statistics in Appendix D shows that there are no statistically significant differences in the average domestic sales in dollars and quantity, international sales in dollars and quantity, number of destination countries, number of domestic listings, and number of internationally available listings.

Upon seeing baseline balance, we proceed to the analyses of the experiment. The take-up rate is about 6% in the treatment group from October to December 2012, and early adopters are twice larger than later ones. Low take-up rate could be a result of people ignoring ads banner and site messages on eBay in a short period. 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%. The TOT estimate is 45.4%. Consistently, the robust DiD specification in column (2) shows that the average export from the treatment group increases by 2.9% despite no significant difference exists prior to the experiment. The FD specification also gives the same estimate as expected. This increase in export revenue is purely from an increase in export quantity: the difference in average sales price between the treatment and control groups is statistically insignificant at the 15% level.

Table 2: Change in Export Volume, and Extensive and Intensive Margins of Export

	(1) $log(S_{i,post})$	(2) $log(S_{it})$	(3) $\Delta log(S_i)$	(4) $log(\Delta S_i)$	(5) $log(\Delta Ext_i)$	(6) $log(\Delta Int_i)$
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)
R^2	0.010	0.041	0.013	0.011	0.011	0.002
Norm. Obs.	100	200	100	100	100	100
TOT Estimates	0.454***	0.454***	0.454***	0.509***	0.507***	0.020
	(0.047)	(0.054)	(0.048)	(0.064)	(0.063)	(0.040)

Notes: S_{it} refers to seller i's export sales at time $t \in \{Pre, Post\}$. $log(\Delta Ext_i)$ 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.

We should note that the number of impressions (exposures of listings to consumers) should increase after sellers' enrollment in the GSP. Although the increase in impressions could be a result of higher demand, it could partially stems from eBay's opaque "Best Match" search algorithm. Therefore, we check if the export increaes is driven purely by changes in impressions. Column (1) in Table 4 controls 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% and is highly statistically significant. This implies that even if we treat all the increase in listing exposure as a result of the search algorithm, the program still has caused 2.7% increase in exports. We note that controlling for impressions is critical for analyzing different underlying mechanisms of the program in Section 8.

We cannot perform an ITT estimation to study the long-run impact of the GSP, because the experiment is only three-month long. This is a typical shortcoming in empirical evaluations of export promotion programs.[32] Instead, I find that the share of sellers who still used GSP three years after their first use is more than 90%. This suggests that the export promotion effect of the GSP is likely to be long-term.

Next, I study whether the export increase comes from the extensive or intensive margins of export. The distinction between the intensive and the extensive margins is important because it

[32] A notable exception is by Cadot et al. [2013].

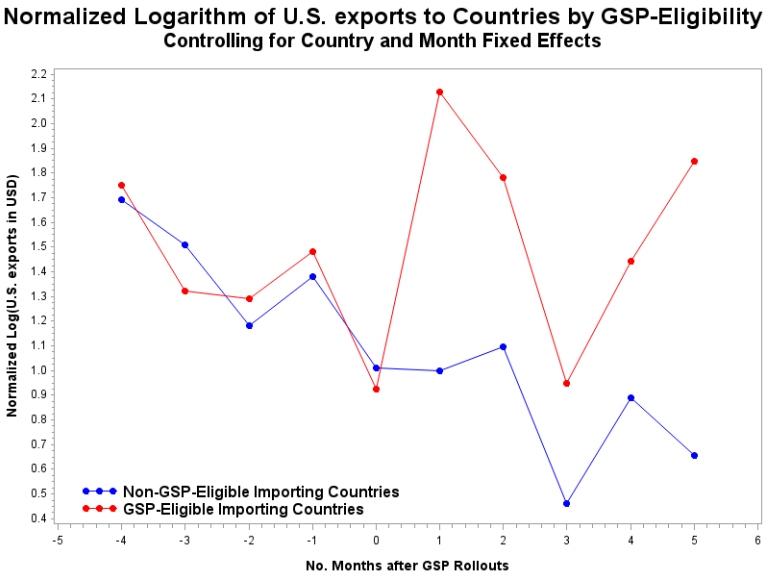
could have different welfare implications for different types of firms (Arkolakis et al. [2012] and Melitz and Redding [2015]); also, it helps disentangling the export entry cost and export variable cost. In this paper, I define these margins on the the country level because sellers need to incur the hassle cost of figuring out customs regulations for different countries.[33]

Under this definition, a change in the intensive margin comes from sellers exporting more to countries that they have exported to previously. 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 $\Delta S_i = \$1,000$, the change in extensive margin is $\Delta Ext_i = \$900$, and the change in intensive margin is $\Delta Int_i = \$100$.

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, column (4) is a benchmark for columns (5) and (6), i.e., $\Delta S_i = \Delta Ext_i + \Delta Int_i$. The reason for taking the inverse hyperbolic sine transformation is that change in export and the two margins could be zero or negative.[34] Comparing columns (4) to (6), the majority of the changes in exports (3.2%) originates from the extensive margin of export, and the change in the intensive margin is negligible (0.1%) and statistically insignificant. The TOT estimates for changes in the extensive and intensive margins are 50.7% and 2%, respectively.

In columns (3) and (5) in Table 4, 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%. We should note that changes in the extensive margin comes existing eBay sellers, as there is no seasonality-adjusted change in the entry of new sellers on eBay after the GSP introduction. Another measure for the change in the extensive margin is the change in number of exporters, which is 2.65% in the experimental period. These results are consistent with a decrease in export entry cost, as will be discussed in Section 8.

Figure 3: U.S. Exports by Importing Countries' GSP Eligibility



Notes: We normalize all values by the logarithm of U.S. exports to non-GSP eligible importing countries in the month before the policy change (blue point at 0).

5.2 Difference-in-Difference Estimation

The ITT estimation yields the causal program effects in the experimental period. As discussed in Section 4, there are three limitations of the experimental approach. We address these concerns by adopting the DiD specification (4) to estimate the program effect after the full launch. In the first five rollouts after the full launch, the take-up rate monotonically increases to more than 80% and the number of eligible importing countries goes up to 42.

Figure 3 shows how U.S. exports change in GSP-eligible and non-eligible importing countries, controlling for country and month fixed effects. We normalize all values by the logarithm of U.S. exports to non-GSP eligible importing countries in the month before the policy change. We see that there was no significant difference in export trend before the GSP introduction, and exports to GSP-eligible importing country increased right after. This is re-assuring for the parallel trends assumption in our DiD specification.

The estimates are reported in Table 3. There are 217 countries on eBay. To estimate the overall

[33]Most heterogeneous firm trade models adopt country-specific entry cost, e.g.,Pavcnik [2002], Trefler [2004], Eaton et al. [2008], and Arkolakis et al. [2008]. McCallum [2013] provides a formal test for this assumption.

[34]I also used a measure of percentage changes, $[S_{i,Post} - S_{i,Pre}]/\overline{S}_i$, where $\overline{S}_i = [S_{i,Post} + S_{i,Pre}]/2$. 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 $\overline{S}_i = 0$, in which case percentage changes are not properly defined.

Table 3: Change in Exports After the Full Launch

Dependent Variable: $log(Y_{ct})$						
	(1)	(2)	(3)	(4)	(5)	(6)
	Overall	Rollout 1	Rollout 2	Rollout 3	Rollout 4	Rollout 5
Policy	0.123***	0.030**	0.075***	0.105***	0.360***	0.088***
	(0.036)	(0.014)	(0.024)	(0.033)	(0.031)	(0.027)
R^2	0.96	0.99	0.99	0.99	0.99	0.99
Observations	5,208	2,170	1,910	1,830	1,810	1,800

Notes: The estimates are β in equation (4). Country fixed effects, month fixed effects, and country-specific linear trends are controlled in all these regressions. There are 217 countries. To estimate the overall effect, we use monthly data from 12 months before and after March 2013. To estimate effects for different rollouts, I use five months before and after each rollout month and exclude countries that were rolled out before.

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

effect, we use monthly data from 12 months before and after March 2013. To estimate effects for different rollouts, I use five months before and after each rollout month, excluding countries that were rolled out before.[35] Note that since the DiD estimation is at the importing country level, it is interpreted as the average program impact for *all* sellers, which is essentially an ITT estimate.

Column (1) shows that the overall program effect on U.S. export is 12.3%, larger than the ITT estimate. This increase comes from larger share of seller enrollments after the experiment, and from inclusions of more eligible importing countries to the program. This increase dominates the effect of larger competition among U.S. exporters. We then report estimated export increases in columns (2)–(6). The estimate for the first rollout is quantitatively similar to the ITT estimate from the experiment due to their adjacency in time. The estimate generally increases for later rollouts because more sellers took up the program. We spot a large spike in exports in rollout 4 because this rollout includes Russia. One explanation is that the export entry cost to Russia used to be very high before the GSP, such as the cost of learning Russia's customs regulations.

6 Heterogeneous Treatment Effects

We explore heterogeneous treatment effects (HTEs) for different market segments. These HTEs could guide us towards discovering the underlying program mechanisms. We find that export increases come from "disadvantaged" groups that were disproportionately affected by export entry cost: Small and medium sellers, more distant countries, and products with smaller profit margins.

[35] Alternatively, I include these countries and have their policy dummies specified according to their rollout date. Essentially, this changes the control group to a combination of countries that have never been eligible and countries that have always been eligible in the ten-month period. This approach yields very similar estimates.

In particular, smaller sellers were less likely to become exporters prior to the GSP because they could not leverage export entry costs with their small scales. More distant markets are harder to break into partially due to increasing costs in learning export rules for these markets. For example, learning customs regulation for Russia is much harder than that for Canada due to drastically different culture and customs systems. Finally, only items with high profit margins could be exported to be able to recoup entry cost. Although not definitive, these evidence are all consistent with a reduction in export entry cost after the GSP introduction.

6.1 Different Sellers

What type of sellers benefited the most from the GSP? For this analysis, I define small, medium, and large sellers to be those with $(\$0, \$10,000]$, $(\$10,000, \$120,000]$, and $(\$120,000, \infty]$ sales in the past year, respectively. These threshold roughly corresponds to eBay's internal seller classifications.[36] eBay considers sellers with at least $10,000 as commercial sellers, because these sellers are more like micro businesses as opposed to casual sellers.[37] Therefore, medium seller could also be thought as small commercial sellers.

For seller-level average treatment effects, column (2) in Table 4 shows export increases by 2.8% and 3.8% for small and medium sellers, respectively. Decomposing the total increase in exports, 71% of the increase comes from small sellers and 28% comes from medium sellers. 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 terms of margins of adjustment, columns (4) and (6) show that export increases comes entirely from the exntesive margin for small sellers (3%) and medium sellers (3.9%). Large sellers do not experience significant change in either margin.[38]

6.2 Different Countries

Which countries have larger export growth because of the GSP? We have seen in Table 3 that the export increase is almost 36% for the forth rollout, where Russia is the only importing country that was affected. We therefore speculate that more distant countries experienced larger export increase. In the international trade literature, geographical distance is a proxy for all kinds of distance-related trade costs, many of which being unobservable (Disdier and Head [2008]).

[36] The results are robust to change in threshold values.

[37] The same definition is seen in Lendle et al. [2012], Lendle and Vézina [2015], and Bar-Gill et al..

[38] We also found that small sellers who have exported before experienced a 7.2% increase in exports, which is 5.1% larger than small domestic sellers. This difference is likely driven by their motivation of becoming larger sellers.

Table 4: Heterogeneous Treatment Effects for Different Seller Sizes

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta log(S_i)$		$log(\Delta Ext_i)$		$log(\Delta Int_i)$	
Treatment Group	**0.027*****		**0.029*****		**4E-4**	
	(0.003)		(0.004)		(0.002)	
Treatment Group*Small Seller		**0.028*****		**0.030*****		**-1E-4**
		(0.003)		(0.004)		(0.002)
Treatment Group*Medium Seller		**0.038*****		**0.039*****		**-0.010**
		(0.013)		(0.015)		(0.007)
Treatment Group*Large Seller		**0.003**		**-0.028**		**0.026**
		(0.043)		(0.050)		(0.023)
$\Delta log(Imp_i)$	0.254***		0.537***		0.148***	
	(0.001)		(0.002)		(0.001)	
Treatment Group*$\Delta log(Imp_i)$	0.011***		0.021***		0.012***	
	(0.003)		(0.004)		(0.002)	
R^2	0.087	0.841	0.081	0.834	0.009	0.076
Norm. Obs.	100	100	100	100	100	100

Notes: In (1), (3), and (5), I also control for intercepts. In (2), (4), and (6), I also control for Seller Size FEs, $\Delta log(Imp_i)$*Seller Size FEs, and $\Delta log(Imp_i)$*Seller Size FE*Treatment Group. $\Delta log(Imp_i)$ is the change in log of the impression that seller i receives. Small, Medium, and Large sellers are defined as sellers who had $(\$0, \$10,000]$, $(\$10,000, \$120,000]$, and $(\$120,000, \infty]$ 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.

To test this hypothesis, we estimate gravity models, which posit that bilateral trade flows should be proportional to the economic size and inversely proportional to the distance of these two countries, analogous to the Newtonian theory of gravitation. We modify the structural gravity model (Anderson and Van Wincoop [2003]) by incorporating a policy dummy and its interactions with other cost variables to capture GSP's impacts on trade elasticities of trade costs.

$$log(X_{ijt}) = \alpha + \beta log(T_{ij}) + \delta Policy_{ijt} * log(T_{ij}) + \tau Policy_{ijt} + \Pi_i + P_j + \eta_t + \epsilon_{ijt}, \tag{7}$$

where $log(T_{ij}) = \gamma_1 log(Dist_{ij}) + \gamma_2 NCLS_{ij} + \gamma_3 NC_{ij} + \gamma_4 NCL_{ij} + \gamma_5 NB_{ij} + \gamma_6 NFTA_{ij}$. In this expression, X_{ijt} is the bilateral trade flow from exporting country i to importing country j in month t; $Policy_{ijt}$ is the policy dummy that equals to 1 between the United States and GSP-eligible importing countries after their corresponding rollouts. In the T_{ij} term, $Dist_{ij}$ is the distance between the exporting and importing countries; $NCLS_{ij}$, NC_{ij}, NCL_{ij}, NB_{ij}, $NFTA_{ij}$ are dummy variables that equal to 1 if country i and j do not share common legal systems, colonial ties, common languages, borders, and regional trade agreements, respectively; Π_i and P_j are importer and exporter fixed effects (GDPs subsumed in these terms); η_t is monthly fixed effects. We obtained

Table 5: Testing Differences in Gravity Coefficients

Dependent Variable: $log(X_{ijt})$						
	log(Dist)	NCLS	NC	NCL	NB	NFTA
Gravity Coeff.	-0.275***	-0.115***	-0.140***	-0.450***	-0.343***	-0.249***
	(0.003)	(0.006)	(0.010)	(0.009)	(0.011)	(0.008)
Interaction w/ Policy	0.049**	-0.034	-0.073	0.123***	-0.412	0.035
	(0.021)	(-0.028)	(0.043)	(0.031)	(0.762)	(0.083)
Other Controls: Exporting Country FEs, Importing Country FEs,Month FEs, Policy, Intercept						

Notes: The first row contains all the estimated β in equation (7) and the second row contains all the estimated γ. *Dist* is the distance between the exporting and importing countries; $NRTA$, NCL, $NCLS$, NCT, NB are dummy variables that equal to 1 if country j does not share a regional trade agreement, a common language, a common legal system, a colonial tie, and a border with the U.S., respectively. R^2 equals 0.845 in this regression.

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

the trade cost data from CEPII, WTO, and IMF.

Estimation of the cost parameters are reported in Table 5. The data we use is from March 2012 to February 2014 as before. We use a DiD specification for this exercise to include all 42 eligible importing countries after GSP's full launch. The first row shows the estimates of the trade cost elasticities. These estimates are less negative than the ones obtained in Lendle et al. [2012] potentially because they used old data from 2004–2009 and cross-border trade has become more common since then. From the second row, we see that the trade elasticity of distance has decreased: before the GSP, a 10% increase in distance would decrease trade volume by 2.75%; after the GSP, this number becomes 2.24%. The gravity results show that the increase in export is larger for more distant countries.

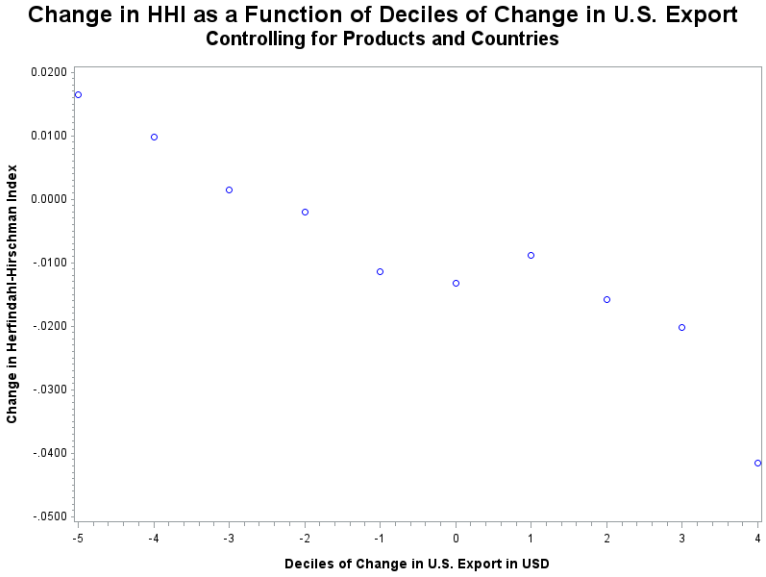
6.3 Different Products

How were exports of different products affected differently by the GSP? Out of 42 importing countries in the sample, the median share of U.S. imports is 21% in 2013. What happened to overall market concentration in these product markets? In our analysis, we define a market to be an importing country-leaf category combination. Leaf categories are the finest product category on eBay that include both homogeneous and differentiated products.[39] I then compute the monthly Herfindahl–Hirschman Index (HHI), which is frequently used as a proxy for market competition, for each market by summing up individual seller's market share squared in a given month.

Figure 4 shows that the estimated changes in HHI negatively correlates with changes in U.S.

[39]Examples of leaf categories are: Boys' Outerwear (Newborn-5T), LED Light Key Chains, and Circuit Breaker & Fuse Boxes.

Figure 4: Correlation between Change in the HHI and Change in Exports



export to markets. Changes in both variables are estimated using the DiD specification (5) for each markets. I then plot average change in the HHI on deciles of changes in exports. This correlation shows that the change in market concentration is a result of the entry of U.S. sellers, rather than from a pre-existing time trend.[40]

Next, we study how changes in U.S. exports and changes in HHIs differ by categories. Both changes give us the same qualitative insights and we only report results on HHI. I expect changes in competition to differ along two dimensions. First, the increase in competition should be larger for products with a lower profitability because of entry costs. Second, increases in 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 larger increase in competition in the former markets comes from consumers' preference for variety. For example, when French buyers shop for porcelain vases, new varieties from U.S. sellers could justify higher shipping cost and longer waiting time. On the other hand, French buyers may buy a brand-new iPhone 6 from domestic sellers due to their logistic advantages despite the presence of U.S. iPhone 6 sellers.

I test this hypothesis by estimating changes in the HHI for each meta category using the DiD specification in equation (6).[41] In Figure 5, a negative change in HHI indicates a decrease in market

[40] There is no obvious pattern between changes in price and changes in export. More results on price in Section 7.

[41] Meta categories are the highest-level category that eBay uses, and there are many leaf categories under each meta category (in the order of tens of thousands).

Figure 5: Changes in the Herfindahl–Hirschman Index Across Product Categories

Notes: For each meta category, the estimates are obtained from the DiD specification in equation (6) at the country-leaf category level. Smaller HHI means smaller market concentration. Red bars indicate that the estimates are statistically significant at the 1% level.

concentration, which is frequently used as a proxy for an increase 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 & Accessaries 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. The regression results analogous to this graph is reported in Appendix F.

7 Welfare of Foreign Consumers, Foreign Sellers, and eBay

The GSP increases cross-border trade between U.S. sellers and foreign buyers that would not have happened otherwise. U.S. sellers are better off due to larger market access. Foreign consumers would be better off if they experience higher transaction quality or lower price, ceteris paribus. We should note that transaction quality from new U.S. exporters is unclear in the short run because their reputation scores are obtained from domestic sales only. Exporting requires new knowledge because foreign consumers have different product taste (Blum and Goldfarb [2006] and Hortaçsu et al. [2009]) and sellers need to overcome language barriers in listing descriptions and communications (Lendle et al. [2012]). If the export increase comes at the expensive of lower price-adjusted transaction quality, such an export growth is unlikely to be sustainable because foreign consumers are worse off.

Potentially lower transaction quality from new exporters is particularly relevant in this study because new exporters are systematically less sophisticated than existing exporters. As shown theoretically in Melitz [2003], heterogeneity in firm quality and the existence of an export entry cost implies that firms with higher quality self-select into exporting. Therefore, new exporters as a result of trade liberalization must have lower quality than existing exporters. To test this, we use the effective percentage positive (EPP), the number of positive feedback divided by the number of total transactions, as the quality measure of sellers.[42] The ITT estimation confirms Melitz's prediction and shows that average EPP of domestic sales from new exporters is 1.2% lower than that from existing exporters in the experiment. However, their quality gap (0.6%) is smaller in international transactions, possibly because new exporters' increased efforts in international sales or lower quality standard from foreign consumers compared to U.S. consumers.

Lower quality of new U.S. exporters could lead to an increase in overall transaction quality if they are better than the average quality of foreign sellers. We adopt the DiD specifications (5), and (6) in Section 4 to test this. In columns (2) and (3) of table 6, we analyze changes in price and EPP at the country-product-month level to control for changes in product mixes. In columns (4) and (5), we perform similar analyses at the country-product-seller-month level to see if the change in price and EPP is due to a change in seller composition (selection) or a within-seller change (effort); in particular, only sellers who are active both before and after the policy change are included.

In both exercises, we focus only on products that are in "new with tags" condition and are

[42] Nosko and Tadelis [2015] shows that EPP is a more precise measure of seller quality than feedback score or percent positive on eBay.

Table 6: Welfare of Foreign Consumers

Dependent Variable:		$log(Y_{ct})$	$log(Y_{cpt})$		$log(Y_{cpst})$	
		(1)	(2)	(3)	(4)	(5)
		Variety	Price	EPP	Price	EPP
U.S.	Policy	0.083***	0.004***	2.6E-04	0.004***	-1.9E-04
Sellers		(0.016)	(0.001)	(0.002)	(0.001)	(0.003)
	R^2	0.99	0.99	0.80	0.99	0.87
	Observations	5,209	9,134,030	9,134,030	11,029,423	11,029,423
Non-U.S.	Policy	-0.021	-0.008***	0.009***	-0.003***	0.012***
Sellers		(0.015)	(0.001)	(0.001)	(0.001)	(0.001)
	R^2	0.99	0.99	0.64	0.99	0.76
	Observations	5,257	9,134,030	9,134,030	11,029,423	11,029,423

Notes: The estimates are β in equation (5) and (6). Country and month fixed effects, and country-specific linear trends are controlled in all these regressions.
*** indicates significance at p = 0.01; ** indicates p = 0.05 ; * indicates p = 0.1.

catalogued with product IDs by eBay. Product IDs is finer than leaf categories in that it uniquely identifies a version of products.[43] The trade-off is that only homogeneous goods categories such as electronics, books, DVDs are assigned product IDs. I choose to analyze new items with product IDs because comparing apples to apples is vital in price and quality analysis.

We see that average sales price for new and incumbent U.S. exporters increased by 0.4%, while the change in quality is not statistically significant. On the other hand, average sales price for non-U.S. sellers dropped by 0.8% in GSP-eligible importing countries, and there is a 0.9% increase in EPP; similar changes are seen in incumbent non-U.S. sellers as well. These patterns show that the overall transaction quality is higher due to an increased quality from non-U.S. sellers, which comes from both larger efforts from incumbents and exits of low-quality foreign sellers.

Besides benefiting from higher transaction quality, buyers in the GSP-eligible importing countries also enjoy 8.3% larger product variety measured by the number of distinct leaf categories on eBay. This represents a channel for a rise in consumer welfare as discussed in Brynjolfsson et al. [2003].

For the welfare of non-U.S. sellers, we find no cannibalization in sales for them to the affected countries on average. This is likely due to the fact that U.S. exports are of new varieties.[44] However, sellers experienced larger competition and hence some drop in sales in heterogeneous goods markets, as discussed earlier in Figure 5.

[43]For example, a 32GB Black iPhone 6 ATT has unique Product ID which is different from an iPhone from a different generation with a different color, internal memory, or carrier. For books or CDs, these Product IDs represent their ISBN codes.

[44]This contradicts the conventional wisdom that imports always cannibalize domestic sales. Another example of little cannibalization is provided in Ghose et al. [2006] in the case of used books.

eBay also profited from the GSP. The initial program integration cost will be spread out in future periods and therefore the average setup cost converges to zero. To estimate the operation profit of running the GSP, we ask the following question: in order to achieve the same amount of export increase, how much would eBay subsidize sellers' price in the absence of the GSP? We use 2.9% as the estimated increase in export to get a conservative estimate of the GSP profitability. We infer the price elasticity of demand on eBay from Einav et al. [2015] to be around 3.2. This implies that a price subsidy of 0.7% is needed to increase export revenue by 2.9%.[45] According to eBay's financial report, the company earns $5.9 billion from the marketplace in 2013, which mainly comes from eBay's final value fees (a share of item's sales prices).[46] Therefore, it would cost eBay $41 million ($5.9 billion times 0.7%) in final value fees to trigger a 2.9% export increase. We do not know the operation cost of the GSP, but the annual salary paid to an average team in a technology firm with one product manager and seven engineers is about $1 million.[47] Therefore, eBay saved about $40 million dollars by running the GSP, compared to directly subsidizing sellers' prices.

Although the focus of this paper is not to structurally estimate the change in total welfare gain, it is illustrative to compute this estimate to compare with previous literature. Under a broad class of general equilibrium trade models, Arkolakis et al. [2012] shows that the change in total welfare is given as $(\lambda'/\lambda)^{(1/\epsilon)}$, where (λ'/λ) is the change in domestic expenditure and ϵ is the elasticity of imports with respect to variable trade costs.[48] Both Lendle et al. [2012] and Fan et al. [2015] uses $\epsilon = -4$ in their welfare calculation, as recommended by Eaton and Kortum (2012). Using this method, the average change in total welfare in the year after the GSP introduction is 2.8%. In comparison, Lendle et al. [2012] estimates the welfare gain of reducing offline frictions to the online level is 29%; Fan et al. [2015] estimates the gain from larger variety offered by e-commerce is 1.6% on average in China.

[45] We solve for dP with these equations: $dQ + dP = 2.9\%$ and $\frac{dQ}{dP} = -3.2$

[46] The marketplace revenue is obtained from eBay's 2015 annual report at investors.ebayinc.com.

[47] This is based on team size at Google. On average, this ratio is 1:7 and goes up to 1:20, based on a former Google employee. Source: http://tomtunguz.com/span-of-control/

[48] They show that welfare changes in a large class of trade models, e.g. Ricardian, Eaton and Kortum(2002), Krugman(1980) and Melitz (2003), are the same under the assumptions that trade is balanced, that profit-income ratio is constant, and that demand is consistent with gravity specifications. The formula remains the same regardless of its micro foundations, such as gain from lower price and larger variety.

8 Disentangle Different Mechanisms

In previous sections, we have established GSP's impacts of the marketplace. 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, which are listed in Table 1, 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?

8.1 Supply or Demand?

The increased export level is an equilibrium outcome, which could originate from both supply and demand. GSP may increase demand through the two channels: 1) buyers see all export-related costs upfront in GSP listings and pay for everything during checkout; 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. We should note that the simultaneity problem is present in almost all empirical studies of supply-side interventions.

8.1.1 Intention to Export

The above simultaneity problem occurs because of the nature of trade data. Fortunately, I also observe data on sellers' entire listings, sold and unsold, which are roughly seller-level supply curves. I therefore study how sellers' intention to export has changed by analyzing changes in numbers of internationally available listings between the treatment and control groups in the experiment.

In column (1) and (2) in Table 7, estimations results from specification (1) and (2) show a 4% increase in the number of listings that sellers intend to export. 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%, which is very similar to the estimate in Table 2. These analyses show that seller-level supply curves shift outwards, indicating a decrease in export costs.

Note that this analysis hinges on the following assumption on sellers' expectation: It is impossible for sellers (especially the small ones) to anticipate whether consumers will like the the

Table 7: Change in Number of Internationally Available Listings

	(1) $log(IL_{i,post})$	(2) $\Delta log(IL_i)$	(3) $\Delta log(IL_i)$
Treatment Group	0.040***	0.040***	0.029***
	(0.001)	(0.001)	(0.001)
$\Delta log(TL_i)$			0.171***
			(2.2E-04)
Treatment Group*$\Delta log(TL_i)$			0.009***
			(5.0E-04)
Intercept	0.528***	0.007***	-0.027***
	(0.001)	(4.8E-04)	(4.5E-04)
R^2	0.020	0.029	0.148
Norm. Obs.	100	100	100

Notes: $\Delta log(IL_i)$ is the change in the *log* of numbers of internationally available listings. $\Delta log(TL_i)$ 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

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 appeallingness 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.

8.1.2 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 a feature 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 suspect that some sellers will experiment with different shipping options to discover consumers' preference, reminiscent of *matched listings* in Einav et al. [2015]. This feature thus provides an excellent opportunity to evaluate consumers' preference towards GSP.

First seen in Elfenbein et al. [2012], matched listings are contemporaneous listings where sellers experiment with shipping options for otherwise identical listings. These listings are matched by seller identity, item listing title, item listing subtitle, and item category. The second requirement is to have variations in whether the GSP service is used within these matched listings. I then exploit cross-sectional variation in sales probability between the GSP and non-GSP listings within matched

Table 8: Demand Channel: Evidence from Seller Experiments

	(1)	(2)
	Success	Success
GSP	0.001***	0.003***
	(1.5E-04)	(2.5E-04)
eTRS		0.031***
		(0.001)
GSP*eTRS		-0.003***
		(3.1E-04)
Relative Price	-0.066***	-0.053***
	(3.8E-04)	(6.0E-04)
Relative Price*eTRS		-0.022***
		(0.001)
Impression Count	9.4E-07***	9.4E-07***
	(1.0E-08)	(1.0E-08)
Experiment Fixed Effects	✓	✓
R^2	0.482	0.480
Observations	23,495,182	23,495,182

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, conditional on their relative price, and estimate the difference in intercepts of listing-level demand curves.

The data used in this exercise is from Buy It Now listings in the year after the full launch of GSP. The basic estimation equation is

$$Success_{ij} = \alpha P_{ij} + \beta GSP_{ij} + \gamma Impression_{ij} + \mu_i + \epsilon_{ij}, \tag{8}$$

where $Success_{ij}$ is an indicator for whether listing j within matched listing group 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. $Impression_{ij}$ is the number of impressions that listing j receives.

Table 8 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.[49] In column (2), I study

[49] I checked robustness by controlling for monthly dummies and the estimate is smaller than the ones in the table.

whether consumers' preference towards the GSP differs by sellers' eBay Top Rated Seller (eTRS) status.[50] 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 sellers with lower reputation. 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.

Like in Einav et al. [2015], we perform multiple robustness checks the address the price endogeneity issue. We control for monthly dummies in the regressions, using different time window, and look at overlapping versus non-overlapping listings. The coefficients on GSP get even smaller in these robustness checks. In summary, 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.

8.2 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. Therefore, 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. I provide further evidence that the increase in exports is mainly due to a reduction in entry costs.

8.2.1 Data Sparsity and Change in Export Competition

The theoretical framework in Section **??** implies that a reduction in entry costs can only increase the extensive margin of export: Changes in fixed costs affect sellers' decisions of entering foreign markets, but does not affect sellers' optimal outputs conditional on operation. On the other hand, a reduction in marginal/variable costs also affects the intensive margin by altering sellers' optimal levels of output.

Therefore, my previous finding of no change in the intensive margin and negligible demand effect 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

[50] eBay Top Rated Seller is an eBay-certified badge that is awarded to high-quality sellers that meet several quality requirements established by eBay.

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. However, if the number of listings is sparse relative to the number of countries, the change in the extensive margin may happen *by chance* and does not necessarily reflect sellers' intention to export to more countries (Armenter and Koren [2014] and Lendle and Vézina [2015]. Another concern is that the increase in sellers' intended exports is offset by larger export competition.

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 our previous results on changes in overall export in columns (1) and (2) of Table 9. 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 part of changes in the intensive margin under the new definition.

More interestingly, columns (5) and (6) of Table 9 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 export increase is not driven by the intensive margin, as the new definition of margins make the program's effect on intensive margin more salient.

To measure the extent of changes in export competition, we analyze listing data to study whether sellers *list* larger share of internationally available listings, which is net of the competition effect. Table 14 in Appendix G shows that although the increase in the extensive margin is comparable to when we use transaction data, we also see a 0.3% increase in the intensive margin. This provides evidence that the GSP possibly reduces export marginal cost, although its magnitude is small compared to its reduction in export entry cost.

Table 9: The Extensive Margin Defined on U.S. and Non-U.S. Levels

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta log(S_i)$		$log(\Delta Ext_i)$		$log(\Delta Int_i)$	
Treatment Group	0.029***	0.027***	0.027***	0.027***	0.001*	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
$log(\Delta Imp_i)$		0.254***		0.123***		0.132***
		(0.001)		(0.001)		(2.4E-04)
Treatment*$log(\Delta Imp_i)$		0.011***		0.007*		0.004***
		(0.003)		(0.003)		(0.001)
Intercept	0.088***	0.083***	0.080***	0.077***	0.008***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(2.3E-04)	(2.2E-04)
R^2	0.013	0.087	0.013	0.057	0.001	0.026
Norm. Obs	100	100	100	100	100	100

Notes: The margins are defined on the U.S. and non-U.S. levels. $log(\Delta Int_i)$ 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. $log(\Delta Ext_i)$ 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. $\Delta log(Imp_i)$ 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.

8.2.2 "Muting" the Marginal Cost Mechanism

An alternative approach to analyze the relative prevalence of the entry and marginal cost mechanisms is to find a subset of sellers that unlikely benefited from the latter mechanism, and check whether the increase in export and extensive margin persists for this group of sellers.

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.[51] 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. The results are reported in Table 10. 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 4 when controlling for impressions. 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)

[51] Buyers rate sellers in four categories: item as described, communication, shipping time, and shipping charges.

Table 10: A Subset of Sellers: "Muting" the Marginal Cost Mechanism

	$log(\Delta S_i)$	$log(\Delta Ext_i)$	$log(\Delta Int_i)$
Treatment Group	0.025***	0.029***	0.005
	(0.005)	(0.007)	(0.004)
$log(\Delta Imp_i)$	0.388***	0.833***	0.258***
	(0.002)	(0.003)	(0.002)
Treatment*$log(\Delta Imp_i)$	0.006***	0.019***	0.023***
	(0.005)	(0.007)	(0.004)
Intercept	-0.114***	-0.082***	0.053***
	(0.002)	(0.003)	(0.002)
R^2	0.124	0.161	0.081
Norm. Obs.	31.7	31.7	31.7

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. $\Delta log(Imp_i)$ 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.

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, both exercises suggest that the majority of the increase in exports results from a reduction in export entry costs. For a back-of-the-envelope analysis, assume 2.525% is the program effect net the variable cost mechanism and 2.741% (Column (1) in Table 4 without rounding) is the overall program effect, the share of the export increase due to the entry cost and demand mechanisms is 2.525/2.741 = 92.12%. Since the demand mechanism increases conversion rate by 0.1% and average sales price barely changed, the export increase due to reductions in entry costs is roughly 92%.[52] This simple calculation assumes additive form of different mechanisms.

9 Conclusion

In this paper, I exploit a randomized field experiment to study the impacts of integrating the export logistic service on a leading e-commerce platform. The results show that, once the "hassle" cost of figuring out the process of exporting (an export entry cost) is removed, cross-border trade on eBay increases by 2.9% – 12.3% through the extensive margin of export. The increase comes from groups where export entry costs are prohibitive: Small and medium sellers, more distant countries, and products with smaller price-to-shipping ratios. Foreign consumers benefited from higher

[52]Note that this is a conservative estimate since an average seller is smaller than the ones analyzed in this section, and should benefit by more than 2.525% from the entry cost and demand channels.

marketplace quality and a 8.3% increase in product variety. Foreign sellers experienced no sales cannibalization on average but experienced higher competition from U.S. sellers in differentiated goods categories. eBay also greatly profits from this integration.

To my knowledge, this is the first large-scale randomized field experiment to estimate the impact of an export promotion program. The results have managerial and policy implications. Managerially, the results suggest that integrating logistic intermediaries complements e-commerce platforms to profitably promote export, and its "distributional" impact is likely dependent on the type of services offered. We should note that GSP is a simple intervention in that it merely "nudges" sellers to export through the integration of an existing technology, which sellers could have used before the integration. However, this integration is powerful enough to increase export at a high profit margin, and it is more cost-effective than many trade policies that target existing exporters.

The results also shed light on the increasing policy attention of promoting exports from small and medium-sized enterprises (SMEs) and suggest that governments that try to promote SMEs' exports should target their entry costs, such as encouraging firms to adopt IT to export. Note that a quantitative extrapolation of my results beyond eBay is implausible because seller sizes and export costs are smaller on eBay. However, I believe it is reasonable to use eBay as a prototype to study the *distributional impacts* of the *export entry cost mechanism* for two reasons. First, eBay is a competitive marketplace and sellers and buyers behave strategically in response to changes in market conditions.[53] In fact, the distribution of seller sizes on eBay is similar to that in conventional markets (Figure 1b) and export trends on eBay is similar to those offline (Figure 1a). Second, eBay is a massive marketplace with 157 million users and 800 million live listings at any point in time; the value of export on eBay was $15 billion in 2014.[54] These facts suggest that the external validity of the qualitative distributional impact of a reduction in export entry cost is likely to hold.

We should note that the effect of GSP is almost immediate on eBay but it takes months before typical EPPs cause any impact. This is likely due to small transaction costs online, such more efficient matching between buyers and sellers, and effective distributional channels. A final note is that the export entry cost on eBay is much smaller than that in offline marketplaces for reasons listed above. Yet further reducing the hassle cost of exporting by having an intermediary handle sellers' exports is still powerful enough to generate at least a 2.9% increase in exports, which would be too small (albeit economically large) to be detected with 100-500 firms as in conventional studies

[53] E.g., Elfenbein et al. [2012], Einav et al. [2014], Einav et al. [2015], Saeedi [2014], and Hui et al. [2015]

[54] 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.

on supply-side interventions. It is conceivable that outside e-commerce, the impact of this type of policies might be even larger due to larger trade costs offline. Therefore, it may be worthwhile to conduct larger-scale experimentation on these interventions since a small percentage increase could lead to billions of dollars gain, as also recommended by McKenzie and Woodruff [2013].

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A GSP Roadmap

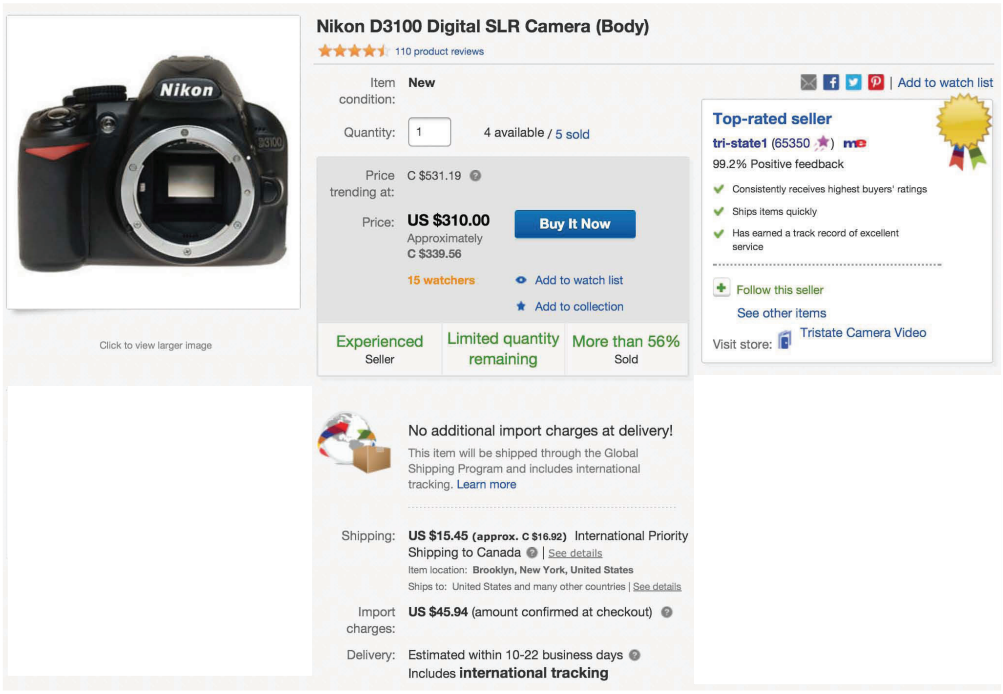
- Field experiment, 20% sellers, October 2012: Australia, Bulgaria, Canada, Cyprus, Czech Republic, Denmark, Spain, Finland, United Kingdom, Greece, Hungary, Lithuania, Latvia, Malta, Portugal, Romania, Slovakia, and Slovenia.
- First rollout, full launch, March 2013,: Japan, China, Thailand, South Korea, Taiwan, Indonesia, Sweden, and South Africa.
- Second rollout, full launch, June 2013: Belgium, France, Hong Kong, Ireland, Italy, Netherlands, Poland, and Spain.
- Third rollout, full launch, July 2013: Germany and Austria.
- Fourth rollout, full launch, September 2013: Russia.
- Fifth rollout, full launch, November 2013: Singapore, Mexico, New Zealand, Israel, and the Philippines.

Table 11: Pre-GSP Imports for GSP-Eligible and Non-Eligible Countries

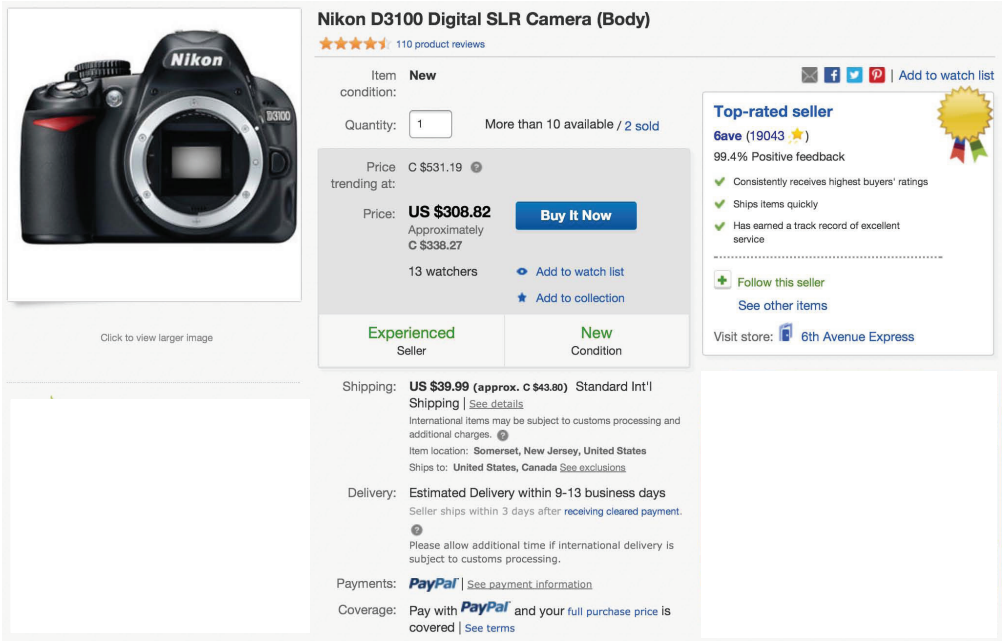
Dependent Var: Imports from the United States relative to GDP				
	All Imports		Imports on eBay	
Policy	-0.017*		-0.280***	
	(0.010)		(0.038)	
First Rollout		-0.019		-0.277***
		(0.022)		(0.046)
Second Rollout		0.001		-0.380***
		(0.020)		(0.079)
Third Rollout		-0.023		-0.520***
		(0.039)		(0.155)
Fourth Rollout		-0.031		-0.090***
		(0.056)		(0.218)
Fifth Rollout		0.032		-0.075
		(0.025)		(0.099)
Intercept	0.043***	0.039***	0.548***	0.548***
	(0.005)	(0.005)	(0.016)	(0.016)
R^2	0.02	0.02	0.2	0.2

Notes: This table tests systematic differences in imports from the United States relative to GDP or consumption between GSP-eligible importing countries and non-eligible importing countries on eBay in 2013.

B Examples of a GSP and a non-GSP listing



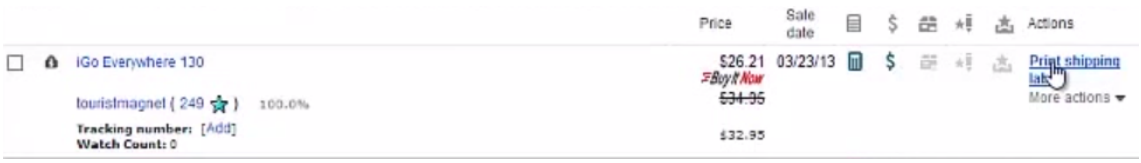
(a) A GSP Listing



(b) A Non-GSP Listing

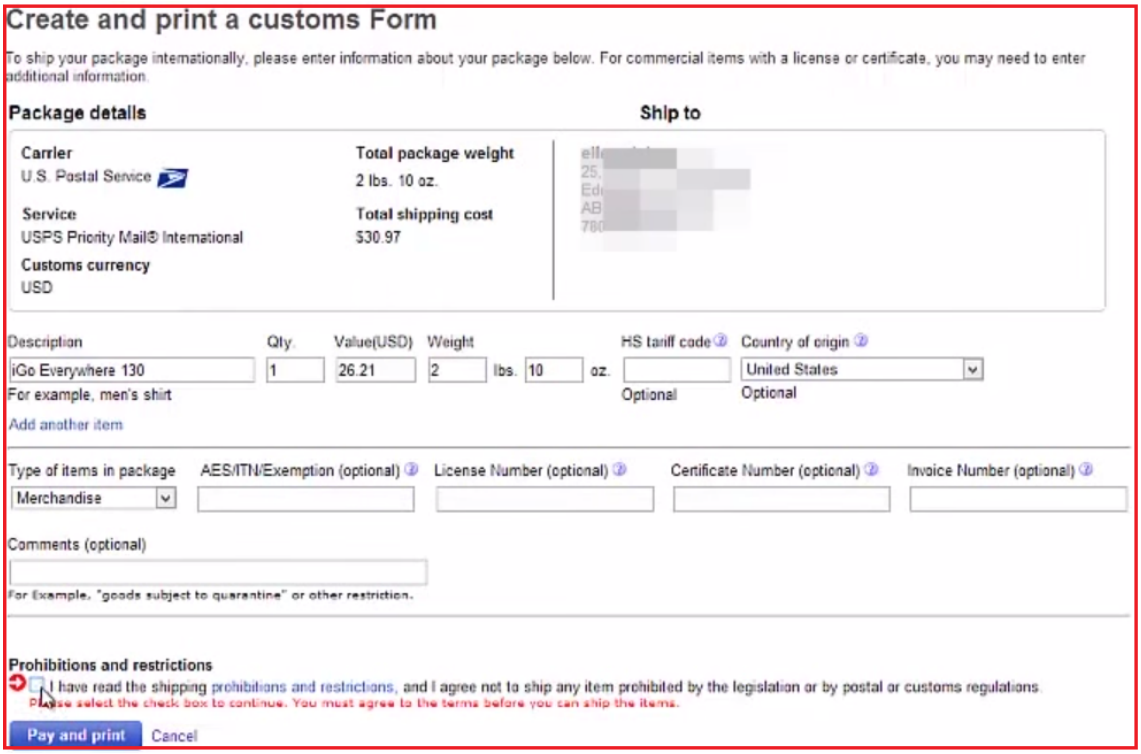
Notes: These screen shots are captured from the eBay Canada Site. Sellers in both listings are in the U.S.

C Steps for Selling Internationally on eBay

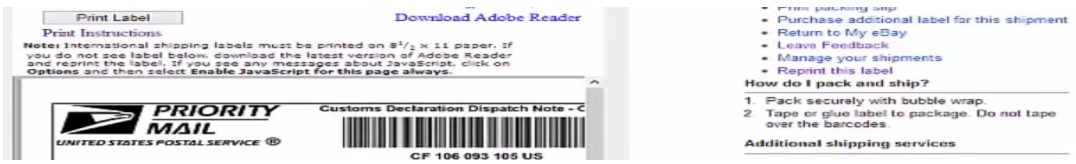


(a) **S**tep 1: Receiving a Payment Notification (Domestic and International Sales)

(b) **S**tep 2: Purchasing a Shipping Postage (Domestic and International Sales)



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



(d) **S**tep 4: Printing the Shipping Label/Customs Form (Domestic and International Sales)

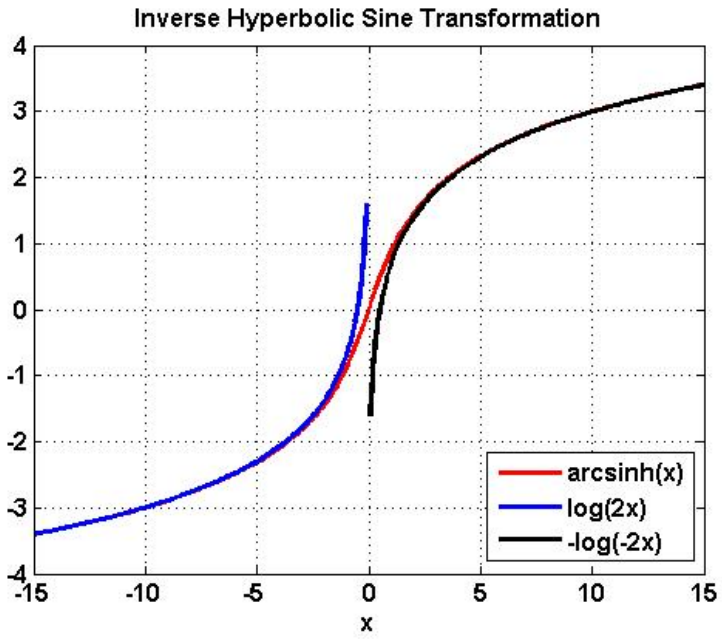
D Testing Baseline Balance

Table 12: Baseline Balance

t-tests Between Group Means				
	Domestic Sales	Domestic Quantity	Export Sales	Export Quantity
Control − Treatment	-7.80	-0.15	-1.41	-0.07
t-statistics	-0.43	-0.10	-0.35	-0.45
	No. Countries	No. Domestic Listings	No. Intl Listings	
Control − Treatment	0.07	0.29	-0.94	
t-statistics	0.03	0.21	-0.36	

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.

E Graphical Illustration: Inverse Hyperbolic Sine



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 approximtely $-log(-x)$ 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]

F Resolving Data Sparsity Using Listing Data

In this section, I formalize the results in Figure 5 with regression analyses. For each meta category, I find the percentage of items that are cataloged by eBay. I then define a product category to be homogeneous if this percentage is above the median percentage across all categories. I also proxy the profitability of a category by a few variables: average listing prices of Buy It Now items, average shipping fee, average shipping weight in pounds, average price-shipping fee ratio, and average price-shipping weight ratio for each categories. The signs of the estimates are consistent with our hypotheses that change in market concentration is larger for heterogeneous goods with low profitability.

Table 13: Investigating Heterogeneity in HHI Changes

Dependent Variable: Estimated Change in HHI						
	(1)	(2)	(3)	(4)	(5)	(6)
Homog Goods	0.063*	0.076***	0.075**	0.076**	0.064*	0.070**
	(0.034)	(0.028)	(0.029)	(0.029)	(0.033)	(0.034)
Avg Price		8.3E-05***	8.3E-05***	8.3E-05***		
		(2.0E-05)	(2.1E-05)	(2.1E-05)		
Avg Shipping Fee			-0.001			
			(0.002)			
Avg Weight				5.2E-05		
				(3.2E-04)		
Avg Price/Shipping					0.001*	
					(5.6E-04)	
Avg Price/Weight						0.001
						(0.001)
Intercept	-0.022	-0.047***	-0.043**	-0.048***	-0.042**	-0.034**
	(0.014)	(0.013)	(0.020)	(0.014)	(0.018)	(0.016)
R^2	0.100	0.422	0.423	0.422	0.189	0.165
Observations	33	33	33	33	33	33

Notes: The regressions are at the meta category level. Homog Goods is a dummy variable for whether the share of catalogued products in a meta category is above the median. Avg Price and Avg Shipping Fee are average price and shipping fee in a meta category. Average weight is measured in pounds. Avg Price/Shipping and Avg Price/Weight are average price-shipping fee ratio and average price-shipping weight ratio, respectively.

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

G 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 8.2.1. For easy comparison, I report the previous results in Table 7 on the change in number of internationally available listings in columns (1) and (2) of Table 14. 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. This table also suggests that the GSP may decrease marginal export cost but the potential increase in export along the intensive magin is offset by increase in exports competition.

Table 14: The Extensive Margin Defined on U.S. and Non-U.S. Levels: Listings Data

	(1)	(2)	(3)	(4)	(5)	(6)
	$log(\Delta IL_i)$		$log(\Delta ExtIL_i)$		$log(\Delta IntIL_i)$	
Treatment Group	0.040***	0.029***	0.035***	0.026***	0.005***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(4.7E-04)	(4.7E-04)
$log(\Delta TL_i)$		0.171***		0.145***		0.026***
		(2.2E-04)		(2.0E-04)		(1.0E-04)
Treatment*$log(\Delta TL_i)$		0.009***		0.008***		0.001***
		(5.0E-04)		(4.5E-04)		(2.3E-04)
Intercept	0.007***	-0.027***	0.004***	-0.024***	0.003***	-0.003***
	(4.8E-04)	(4.5E-04)	(4.4E-04)	(4.1E-04)	(2.1E-04)	(2.1E-04)
R^2	0.029	0.028	0.002	0.148	0.130	0.018
Norm. Obs	100	100	100	100	100	100

Notes: The margins are defined on the U.S. and non-U.S. levels. $\Delta log(IL_i)$ 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.

H Comparing ITT Estimator with Non-Experimental Estimators

I compare the intent-to-treat (ITT) estimator with non-experimental estimators used in the literature, namely seller-level DiD and matching DiD estimators. Column (1) is copied from column (1) in Table 2. In column (2), I perform a seller-level DiD analysis, which compares inter-temporal changes in exports from enrolled sellers against those from non-enrolled ones. In column (3), I perform a DiD analysis with controls of 100 equal stratas based on propensity scores (PS). 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. 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 an weighted least square estimation, where the weights are given by the inverse probability of treatment weights (IPTW). 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. We see that the DiD estimator with PS strata gives the closest estimate to the experimental estimate and is biased upward by 18.7%.

Table 15: Comparing the ITT Estimator with Non-Experimental Estimators

	(1)	(2)	(3)	(4)
Dependent Variable: $log(S_{it})$				
	ITT	DiD	DiD with PS Strata	IPTW
	$log(S_{it})$	$log(S_{it})$	$\Delta log(S_i)$	$\Delta log(S_i)$
Interaction	0.454***	0.798***	0.539***	0.576***
	(0.047)	(0.040)	(0.029)	(0.004)
Treatment/Enrolled		1.674***	0.504***	0.288***
		(0.029)	(0.021)	(0.003)
Post		-0.094***	0.446***	0.518***
		(0.003)	(0.002)	(0.003)
Intercept	-0.076***	1.833***		
	(0.008)	(0.002)		
PS Strata FE			✓	✓
R^2	0.013	0.309	0.469	0.508
Norm. Obs.	100	100	100	100

Notes: S_{it} refers to seller i's export sales in period $t \in \{Pre, Post\}$.
log is approximated by the inverse hyperbolic sine transformation.
*** indicates significance at p = 0.01.