Breaking in New Markets: Relying on Networks or Spillovers? *

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Abstract

Exporting firms have been shown to use various channels—spillovers, networks, and sequential entry—of alleviating risk and uncertainty when breaking into new markets. Previous literature studied these channels in isolation and did not examine the importance of the supplier network (SN) channel. Using several firm-level datasets on exporting and importing, we construct novel, highly disaggregated, measures of (i) spillover combined with sequential entry (Spillover/SE), (ii) consumer exports network (CEN), (iii) SN, and jointly estimate their effects on breaking in new markets. We show that the SN is the most important channel for the exporters with one export destination. Thus, any trade barriers affecting the extensive margin of imports have an adverse effect on the extensive margin of exports, especially by smaller exporters. Overall, the SN is as important as Spillover/SE channel with the CEN having a somewhat smaller effect. Importantly, omitting any of these channels biases (upwards) the marginal effects of other channels by up to 150%. For a subset of our data, we are able to construct an even more granular, firm-to-firm, measure of the CEN. It has a three times higher effect (on breaking in new markets) than a more aggregate, firm-to-country, measure, which confirms the importance of direct contacts emphasized by the networks literature.

Keywords: Firm-level, Spillover, Networks, Trade.

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1 Introduction

Breaking in new markets is critical for export diversification and economic growth since it enhances country's 'self-discovery' (Hausmann and Rodrik, 2003),[1] and a substantial fraction of aggregate exports is generated by new exports (Eaton et al., 2014; Bernard et al., 2009; Lawless, 2009; Albornoz et al., 2016). Entering new markets, however, is subject to sizable information uncertainty and risk. To alleviate these obstacles, firms employ various channels. For example, they study the exports of other domestic firms—*domestic spillovers* (Greenaway et al., 2004; Silvente and Giménez, 2007; Koenig et al., 2010); leverage their own experiences—*sequential exporting* (Bernard and Jensen, 2004; Eaton et al., 2009; Albornoz et al., 2012; Nguyen, 2012); and search remotely from their customer's locations—*network remote search* (Chaney, 2014; He, 2018).

While this is literature is growing, some important questions are still unanswered. First, there is no consensus on whether spillovers have an effect on breaking in new markets. While some researchers find the effect to be substantial (Silvente and Giménez, 2007; Koenig, 2009; Koenig et al., 2010; Choquette and Meinen, 2015),[2] others claim it to be negligible (Bernard and Jensen, 2004). Second, the related network literature focused mainly on the consumer exports networks (CENs) (e.g., Chaney, 2014), while the effect of supplier networks (SNs) is yet to be explored (as pointed out by Bernard and Moxnes, 2018). Third, the effects of spillovers, sequential entry, and networks have been studied in isolation. Their relative importance is unknown and the existing estimates might be subject to the omitted variables bias. This paper attempts to fill these gaps.

To this goal, we use matched Colombian exports and imports firm-level datasets, along with Chilean imports and exports data, and several other datasets. The exact network of informational flows leading to a certain exporting outcome can be complex and, with exception of controlled settings of field experiments (e.g., Atkin et al., 2017), is impossible to trace since the data on information gathering and decision making by managers is hardly available. Every network, however, simple or complex, consists of links. Our approach is built on tracing the most granular observable informational links and examining which of them increase the probability of exporting to new and existing destinations. First, for each Colombian exporting firm and potential export destination, we check whether other Colombian firms export

[1] Under information uncertainty a country's comparative advantage is not evident and has to be discovered through trial and error. Hausmann and Rodrik (2003) rank the country's self-discovery through exporting as the most important factor for economic growth—even above reducing corruption and getting access to foreign technology.

[2] It also includes examples of how practitioners facilitate information exchange between current and potential exporters at various conferences and gatherings (e.g., Koenig et al., 2010).

to this destinations products which this firm has shown a potential to export. We label this type of links as the spillover combined with sequential entry (henceforth, Spillover/SE) link. Second, inspired by Chaney (2014) and Bernard and Moxnes (2018), we focus on two types of links related to the firm-to-country networks: consumer exports network (CEN) and supplier network (SN).[3] The CEN link identifies countries to which firms from my current export destinations export their products. The SN link identifies the countries of my suppliers.

Using these constructed links, we are the first to jointly estimate the effects of Spillover/SE, CEN, and SN links on the probability of firm's breaking in a new market. We find that (i) the SN links are at least as important as the CEN links, (ii) the SN and CEN links combined are at least as important as the Spillover/SE links, and (iii) the omission of either CEN, SN, or Spillover/SE links generates a pronounced (up to 120%) upward bias for other links. By matching Colombian exporters with their partnering Chilean importers, we are also able to construct a more granular, firm-to-firm, measure of the CEN links, which traces the exports of the Colombian trading partners (rather than of all firms as in firm-to-country CEN) in Chile. We find that these firm-to-firm links have an up to three times stronger effect (on breaking in new markets) than a more aggregate, firm-to-country, measure of CEN links.

For our first empirical exercise, we use Colombian Exports and Imports transaction-level data and United Nations Comtrade worldwide trade data, for years 2007-2016. Our dependent variable is defined from the perspective of Colombian exporting firms and it has three dimensions: firm, export destination (country), and year. It is one if Colombian firm i exports to country c in year t, and zero otherwise. Similarly to Chaney (2014), we employ a dynamic Probit model to examine factors affecting firm's export destinations. Our main variables of interest are: Spillover/SE dummy, firm-to-country CEN dummy, and SN dummy.

We propose novel ways of constructing these variables, which allow us to utilize data at firm-product-destination-year level, but to maintain the manageable size of the dataset. The Spillover/SE for firm i country c year t is set to one if, in year $t-1$, any other Colombian firm exported at least one of the products (defined at Harmonized System 6-digit level) exported by i to any country in year t and zero otherwise. Thus, Spillover/SE dummy summarizes information about products exported by firm i in year $t-1$ and about wether any of these products were exported by other Colombian firms to a given country in year $t-1$.[4]

[3]While our construction of the CEN measure is different from that of Chaney (2014), it is in line with his idea of export networks. Bernard and Moxnes (2018) indicated that the analysis of supplier networks is missing in this literature.

[4]Its coefficient as well as coefficients of other dummy variables can be interpreted as the effect of this variable on the expansion to new destinations, since as in Chaney (2014), all specifications include a dummy variable of exporting to a given destination in the previous year, which controls for the continuing exports to

Previous studies defined spillovers at more aggregate level—often a single-dimensional one (e.g., Bernard and Jensen, 2004). Combining Spillovers and SE into one variable allows us to have only one observation per firm-destination-year instead of one observation per firm-destination-year-product, which decreases the required number of observations to only 16.9 mln instead of 85 bln.

To construct the firm-to-country CEN dummy variable for each Colombian firm, we first identify the set of export destinations (countries) for each firm i. For firm i and country c, the CEN dummy is equal to one if i's export destinations export to country c within the same industry as they import from i.[5] Finally, the SN dummy is introduced to examine whether firms may find new customers in the countries of their foreign suppliers. We also complemented the constructed set of dummies with the standard control variables used by Chaney (2014), i.e., geographic proximity measures, import and export growth rates, and market size.

We find the coefficients for all three variables to be both statistically and and economically significant and of the right sign. The marginal effect of the Spillovers/SE, CEN, and SN are more important than the marginal effects of all control variables, such as geographic proximity measures, import and export growth rates, and market size, combined.[6] Importantly, we can rank the marginal effects of the Spillover/SE, CEN, and SN, and to demonstrate that omitting either of the channels generates pronounced upward bias for other effects. These findings are important, since they show that evidence based on the micro data provide strong support for spillover and networks—including foreign supplier networks—effects in exporting to new markets.

For our next step, we combine three transaction-level datasets for years 2007-2016: Colombian Exports, Chilean Imports, and Chilean Exports. We utilize the fact that Colombian Exports dataset includes the identity of both exporting and (foreign) importing firms. This enables us to match Colombian exporting firms with their Chilean importing counterparts in each year between 2007 and 2015. To control for the sequential exporting and potential networks through other export destinations, we restrict our sample to the Colombian firms which originally export only to Chile. For firm i and country c, the firm-to-firm CEN dummy is equal to one if i's trading partners (i.e., Chilean importing firms) export to country c within

a given destination.

[5]To construct this variable, we employ the worldwide bilateral trade at product level from the United Nations Comtrade dataset.

[6]The choice of our control variables was motivated by the specifications of Chaney (2014) plus we added an adjacency dummy variable to control for the similarity between an exporting firm's home country and the possible export destination as suggested by Rauch (2001). We do not have production data for Colombia, and thus we cannot use data on plant size, employment and wages as in Bernard and Jensen (2004).

the same industry as they import from i.[7] All other variables are constructed in the same fashion as in the previous exercise.

Our main result is that, within the same sample, the marginal effect of the firm-to-firm CEN is two to three times greater than that of the firm-to-country CEN. That is, Colombian firms are much more likely to utilize the information obtained from their trading partners in Chile than from observing where other Chilean firms export. Put differently, the more granular is the observed information channel, the greater is the predictive power of this information. Importantly, both Spillovers/SE and the CEN effects are statistically and economically significant even for the less advanced exporters—recall that we focus on firms which originally export to only one country (Chile) and tend to have very few, on average 1.5, trading partners in Chile.[8] Our evidence thus present an even stronger support for the importance of spillovers and networks for firm's expansion path.

Furthermore, focusing on firms with a single trade partner allowed to downplay additional, more complex effects present in larger networks, such as reputation effects, homophile[9], segregation, etc.[10] For example, a firm with multiple trading partners is potentially likely to have a stronger reputation in the eyes of the potential new partners, as multiple trading partners project higher quality and reliability than a firm with only few partners. Thus, even if a firm meets a new partner without direct involvement of the existing partner, being a part of the larger network might have facilitated the match. Focusing on firms with a minimal network allowed us to isolate these effects.

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 provides a detailed data description. Section 4 presents empirical models and the estimation results. Section 5 provides robustness checks. Section 6 concludes.

2 Related Literature

This paper contributes to several strands of literature. Most directly, it adds to a large literature on firms' expansion in international markets. The existing literature has identified three strategies that firms use to expand into new markets: domestic information spillover,

[7] To construct this variable, we matched firms and industries in Chilean Imports and Chilean Exports datasets.

[8] As demonstrated by Chaney (2014), these firms are least likely to expand, as their networks are minimal.

[9] The widely known analog of homophily effect in trade is Linder effect—firms are more likely to export to countries with the similar income per capita as the one in their own country.

[10] See, for example, Currarini et al. (2009) and Jackson and Zenou (2015) for a more detailed description of these and other additional effects in larger social networks.

foreign networks, and sequential exporting.

The literature on domestic spillovers is the largest among the three. It emphasizes the pool of existing exporters as an important source of information for other firms (Koenig et al., 2010). Firms tend to learn about profits, requirements, and challenges in the overseas markets by observing other firms' exporting experience, and they tend to imitate the export behavior of the more successful, more experienced leaders. Clerides et al. (1998), Silvente and Giménez (2007), Koenig (2009), Koenig et al. (2010), and Choquette and Meinen (2015) used firm-level data from different countries to show that a firm's export decision and/or the volume exported by the firm are positively affected by their neighboring firms[11]. Aitken et al. (1997), Greenaway et al. (2004), and Kneller and Pisu (2007) identified multinationals as one of the most important sources of information spillover. Iacovone and Javorcik (2010) used Mexican export data to show that once a firm begins exporting a new product, other firms will soon export the same products. Wagner and Zahler (2015) explored detailed data on new exporters in Chile and found that followers are 40% more likely to enter a product if a pioneer survives more than one year of exporting that product. Bernard and Jensen (2004), on the other hand finds the effects of domestic spillovers on export entry by other firms negligible.

Our contribution to this literature is twofold. First, when examining the spillover effects, we control for other important effects, including network and sequential-export effects. Second, we were able to rank the magnitude of the spillover effect versus other effects. Overall, the Spillover/SE effect has the same marginal effect on the probability of entering anew market as the SN effect with both effects dominating the CEN effect. When experimenting with subsamples of firms with different number of export destinations, we found that SN is more important than the Spillover/SE for Colombian firms exporting to only one destination, while the opposite is true for firms exporting to between two and five and to more than five destinations. Finally, omitting the spillover effect in the empirical specification leads to very pronounced upward biases of other effects, while omitting network effects and common language substantially biases the Spillover/SE effect.

The literature on networks and trade dates back to Rauch (1999), who introduced the idea that informational frictions dampen trade, and that social networks between buyers and sellers help reducing these frictions and promote trade[12]. While a more recent strand of the

[11]There is also theoretical and empirical literature on the negative effect of spillovers on firms' export decisions. For example, Ciliberto and Jäkel (2017) documented the negative effects of present competitors on foreign market entry, but they only focus on the superstar exporters. Barrios et al. (2003) and Bernard and Jensen (2004) found no evidence of spillover effects on firms' decisions to export, but they didn't address the expansion to new markets for firms that already export.

[12]See also Rauch (2001), Chaney (2016), and Bernard and Moxnes (2018) for excellent surveys on networks

literature empirically estimates the trade-creating effect of networks using country-specific case studies,[13] it is relatively silent on the expansion path at the firm level.

Do exporting firms rely on their networks of existing trade partners to search for new trade partners? This question was answered positively by Chaney (2014, 2018). Theoretically, both papers modeled the remote search for new partners through existing trading partners. Empirically, Chaney (2014) provided the reduced-form evidence of the effect of firm-to-country networks on the export expansion path of French firms. Building on Chaney(2014)'s work, we provide an additional test of the effect of the consumer export networks on trade expansion by using a finer firm-to-firm measure of networks of Colombian and Chilean firms. We show that firm-to-firm CENs do have a positive effect on the choice of new export destinations even after controlling for the spillover and sequential-exporting effects. Quantitatively, we show that a Colombian firm's probability of choosing a new export destination would increase by 55% (from 0.0022 to 0.0034) if its Chilean trade partners exported the same HS 2-digit product to that country in the previous period.

We also shed some light on the role of the foreign supplier networks on finding new export destinations. While the literature on foreign supplier networks is quite extensive, it tends to focus on other aspects of networks, such as propagation of shocks (Barrot and Sauvagnat, 2016; Lim, 2018), firm performance (Bernard et al., 2018b), firm's exposure to trade through its domestic network (Tintelnot et al., 2018), etc. We show that SN is one of the two most important channels for breaking in new markets in the entire sample, whereas has by far the greatest marginal effect among the firms with only one export destination. Furthermore, not including SN in the estimation equation generates a substantial upward bias for other effects.

Our paper is also related to a new but flourishing literature that focuses on the firm-to-firm connections in international trade. The vast majority of world trade flow is between firms. However, many empirical studies are restricted to aggregated trade, due to the scarcity of the detailed trade transaction data between firms. Recently, with the increasing availability of firm-to-firm trade data, the literature has started to explore the role of the connections between individual exporters and importers. For example, Rauch and Watson (2004), Antras and Costinot (2011), Petropoulou (2008), and Chaney (2014) modeled intermediaries as agents that facilitate matching between exporters and foreign buyers. Benguria (2015) proposed a model to analyze the sorting and matching between exporting and importing firms

and trade.

[13] Rauch and Trindade (2002), Combes et al. (2005), Greaney (2009), Garmendia et al. (2012), and Aleksynska and Peri (2014) while using different methodologies and/or datasets, arrive at the same conclusion that the cultural, social, and business networks can largely facilitate international trade.

and provides empirical evidence in support of this theory. Other papers have examined the cross-section and/or evolution of firm-to-firm connections in trade (Eaton et al., 2009; Blum et al., 2010, 2012; Bernard et al., 2014, 2018a; Dragusanu, 2014; Monarch, 2014). We show that these connections are critical for a firm's choice of new export destinations.

Our paper also contributes to the Hausmann and Rodrik (2003)'s influential hypothesis of suboptimal exporting due to missing export pioneers. In sectors with latent comparative advantage, pioneering activity is both risky and costly, while benefits are dispersed also among the followers, which benefits from observing the performance of pioneers. In fact, as shown by Wagner and Zahler (2015), followers tend to overtake export flows from pioneers within a relatively short period of time. This externality feature of pioneering results in the suboptimal pioneering, especially, for smaller countries (Wei et al., 2017). We classify Colombian export pioneers into global—those which are the first to export a product from Colombia—and market-specific—those which are the first to export a product to a certain market. Since we explicitly control for export followers by Spillover/SE, the marginal effects of CEN and SN can be interpreted as the increase in probability of market-specific pioneering. We are the first to show, that among the two, the SN has a more pronounced effect, especially among the firms with only one export destinations. Importantly, among all considered channels, the CEN and SN seem to be the major channels enhancing market-specific pioneering.

3 Data

Our primary data source is the customs records of Colombian and Chilean import and export transactions between 2007 and 2016.[14] A transaction record includes the firm's national tax ID number, the product code at Harmonized System (HS) 10-digit level,[15] the value of the transaction in US dollars, the country of destination for export data, and the country of origin for import data. For our first set of regressions, we will use the entire sample, which we will denote as *Full Sample.*

For our second set of regressions, with the the firm-to-firm measure of networks, we will use the *Restricted Sample.* In this set of regressions, we utilize an important feature of the Colombian export data: for each export transaction, we also observe the names of foreign importing firms. This allows us to identify Chilean firms that import from Colombia, and to focus on Colombian exporters which initially export only to Chile.[16] This allows us to trace

[14]The data is obtained from Datamyne, a company that specializes in documenting import and export transactions in Americas. For more detail please see www.datamyne.com.

[15]In our paper we need the product dimension only for the Colombian part of the data, which is at HS10.

[16]The names of these Chilean firms are not standardized in the Colombian exports data. There are instances in which the name of the same firm and its address are recorded differently (e.g., using abbreviations,

the export destinations of the direct Chilean partners of Colombian firms. In what follows, we explain and motivate the construction of variables used in our analysis.

3.1 Dependent Variable: Entry

Following Chaney (2014), our dependent variable, $Entry_{i,c,t+1}$, is set to one if, conditional on being an exporter in year t, firm i exports to country c in year $t+1$, and zero otherwise. In what follows we will explain sample dimensions for Full and Restricted samples.

Full Sample. Exploring Colombian transaction-level export data, we identified 91,891 firm-year combinations of Colombian exporting firms between 2007 and 2015. To construct $Entry_{i,c,t+1}$, we considered 184 countries that we have information on distance and size as potential exporting destinations for each firm, which gave us a total of 16,907,944 $(= (91,891 \text{ firm-year obs.}) \times (184 \text{ countries}))$ possible firm-year-destination combinations.

Restricted Sample. To examine the effects of the firm-to-firm measure of networks, we restrict our sample to the Colombian firms that initially export only to Chile and within this sample define the Entry variable the same as above. Using Colombian and Chilean transaction-level export and import data, we successfully matched 577 Colombian firms (163 expanding firms, 119 non-expanding firms, and 295 disappearing firms) to their Chilean importing counterparts. For each of these matched Colombian firms, we define the Entry dummy, $Entry_{i,c,t+1}$, to be equal to one if, conditional on exporting only to Chile in year t, it exported to country c in year $t+1$, and zero otherwise. We considered 183 countries (184 countries minus Chile) as potential new export destinations for matched Colombian firms, which gave us a total of 105,591 (=(577 firm-year obs.) $\times$ (183 countries)) possible firm-year-destination combinations. As shown in the first column of Table C.1, we found that Entry dummy equals one for 237 of these combinations, suggesting that conditional on expanding, a firm that previously exported only to Chile will export, on average, to 237/163=1.5 new destinations.

3.2 Independent Variables

Spillover/Sequential Exporting Dummy. We constructed a Spillover/Sequential Exporting dummy variable, $Spillover/SE_{i,c,t}$, to examine how the choice of new export destination is affected by both spillovers and sequential exporting effects. For each exporting firm i, we first identified which HS 6-digit products were exported by the firm at time t.

dots, dashes, extra spaces, etc.). We deal with this problem by standardizing the spelling of the names and by comparing these names to the standardized names of firms in the Chilean imports data. The detailed description of cleaning the exporters' names is provided in the Appendix A.

We then explored the Colombian transaction-level export data to see if there was any other Colombian firm j exporting at least one of these products at time t to country c. If yes, $Spillover/SE_{i,c,t}$, was set to one for c and if no, it was set to zero.

Note that our Spillover/SE is constructed at product-country level, whereas previous literature defines it at industry-country or even industry-'export status' levels. This potentially could have increased the sample size by several orders of magnitude since we are considering over 5000 HS6 products. If we were to consider for spillovers separately from sequential entry (i.e., whether any Colombian firm exported this product to a given country) the sample would have increased from 16.9 mln to over 100 bln. Thus, combining both effects together makes the sample size more manageable.[17]

Consumer Export Network: Firm-to-Country and Firm-to-Firm Measures. We constructed a firm-to-country measure of Consumer Export Network dummy variable $ExpNetwork_{i,c,t}$, to examine whether Colombian exporting firms rely on their current exporting destinations to remotely search for new destinations. Consider a Colombian firm i exporting product(s) within industry Z[18] in year t to a certain set of countries X. The Consumer Export Network dummy, $ExpNetwork_{i,c,t}$, equals one for all destination c to which any of these countries in X exports products within the same industry Z in year t, and zero otherwise. In our exercise with Colombian exports to Chile only (Restricted Sample), the set X contains a single country Chile. Thus, the firm-to-country measure of $ExpNetwork_{i,c,t}$, equals one for all destinations to which Chile exports products within the same industry Z at time t, and zero otherwise.

For a more granular, firm-to-firm measure of the CEN, we matched Colombian exporting and Chilean importing firms, along with the additional transaction dataset on Chilean exports. For each of the 577 matched Colombian firms, the firm-to-firm network dummy, $ExpNetwork_{i,c,t}$, equals one for each destination c to which any of its matched Chilean importing firms exports (within the same industry) and zero otherwise.

Supplier Import Network Dummy. Firms may learn about new export destinations through their foreign suppliers. To examine this possibility, we matched firms in Colombian exports and imports datasets and constructed a Supplier Import Network dummy variable, $ImpNetwork_{i,c,t}$. For each Colombian exporting firm, $ImpNetwork_{i,c,t}$ is set to one for each country c from which the firm imports and to zero otherwise.

[17] Importantly, firms tend to expand with products which they previously exported. For example, in our Restricted Sample, more than 83% of Colombian expanding firms expanded with HS 6-digit product(s) that they previously exported to Chile, suggesting a strong consistency in the products exported by Colombian firms over time.

[18] Consumer Export Network Dummy variable is HS 2-digit specific.

Adjacency Dummies. Muendler and Rauch (2018) pointed out that the literature on export spillover and network search is subject to the problem of correlated unobservables. That is, a firm may enter a new market not necessarily because it learnt about it through spillover or network channels, but because that market is similar to the firms' previous export destinations or its home country. The use of firm-to-firm measure of networks helps us resolve this problem when estimating the network effect, since all firms initially export to only one market (Chile) and network search can be attributed only to export destinations of firm's trading partners in Chile.

The problem still potentially exists for the spillover channel. Firms entering the same market as other firms in the same industry might not be caused by the information spillover, but rather by the market's similarities or adjacency to the home country. To address this concern, we included an adjacency dummy variable to our empirical specifications to control for the similarity between Colombia and the potential new exporting destination. Following Morales et al. (2014) and Muendler and Rauch (2018), adjacency is defined in four different ways: $Language_c$, $Contiguity_c$, $Continent_c$, and $IncomeGroup_c$. These variables are defined as indicators taking the value of one when Colombia shares a border, an official language, a continent, and the same income group (World Bank's classification for calender year 2007), respectively, with a firm's potential new export destination c. We include the adjacency dummy $Language_c$ in our baseline estimation, the other three adjacency variables are discussed in the robustness check section.

Other Variables. Following Chaney (2014), we also used eight additional variables to control for geographic proximity, import sources, market size, export and import growth, and previous export status.

(i) $Ncontacts_{i,t}$ controls for the number of countries to which firm i currently exports, i.e. the number of current exporting destinations.

(ii) A dummy variable $ExpGrowth_{i,c,t}$ [19] measures the export growth from firm i's current

[19] Instead of defining a dummy variable, Chaney (2014) computes export growth as $\sum_{c'} \frac{Export_{c',c,t+1}-Export_{c',c,t}}{Export_{c',c,t}}$. In our paper, the export growth is HS 2-digit specific. That is, we focus on the export of the same HS 2-digit product from firm i to its current exporting destination c', and from c' to country c. We have many zero export value in this case and therefore would lose many observations if we define the export growth in the same way as Chaney (2014). To avoid this problem, we created a dummy variable to indicate positive export growth. We later report the results with both ours' and Chaney (2014)'s definitions of Export Growth.

exporting destination c' to country c between years t and $t+1$.

$$ExpGrowth_{i,c,t} = \begin{cases} 1, & \text{if } \sum_{c' \in X_{it}} Export_{c',c,t+1} - \sum_{c' \in X_{it}} Export_{c',c,t} > 0; \\ 0, & \text{otherwise,} \end{cases}$$

where X_{it} is the set of countries to which Colombian firm i exports at time t[20], and $Export_{c',c,t}$ is the export value from country c' to country c at time t.
(iii) $ImpGrowth_{c,t}$ measures country c's import growth from all other countries in the world between years t and $t+1$.

$$ImpGrowth_{c,t} = \begin{cases} 1, & \text{if } \sum_{c'} Export_{c',c,t+1} - \sum_{c'} Export_{c',c,t} > 0; \\ 0, & \text{otherwise,} \end{cases}$$

where $Export_{c',c,t}$ is the export value from country c' to country c at time t. The bilateral trade data was obtained from the United Nations Comtrade Database.
(iv)-(vi) Using the bilateral distance data, we computed the proximities between Colombia and other countries:

$$COL\_proximity_c \equiv \frac{1}{Dist_{COL,c}};$$

between firm i's current exporting destinations and country c:

$$Ave\_proximity_c \equiv \frac{1}{n} \sum_{c' \in X_{it}} \frac{1}{Dist_{c',c}},$$

where X_{it} is the set of firm i's current exporting destinations[21], and n is the number of these current exporting destinations; and the average proximity of each country from the rest of the world:

$$Overall\_proximity_c \equiv \frac{1}{N-1} \sum_{c'} \frac{1}{Dist_{c',c}},$$

where $N = 184$ is the total number of countries in our sample. The data on bilateral distances ($Dist_{COL,c}, Dist_{c',c},$) is obtained from CEPII. It is calculated as the population-weighted average of the distances between the main cities of two countries.
(vii) Firm i's export status in the previous period is controlled by the lagged Entry dummy, i.e. $Entry_{i,c,t}$, which equals one if firm i exported to country c at time t, and zero otherwise.
(viii) The country size of country c in year t, $GDP_{c,t}$, is measured by its nominal GDP (in millions of US dollars), obtained from the Penn World Tables.

[20] In the exercise with Colombian exports to Chile only, X_{it} contains a single country Chile for all firms, and $ExpGrowth_{i,c,t}$ is simply the export growth from Chile to country c between time t and $t+1$.

[21] In the exercise with Colombian exports to Chile only, X_{it} contains a single country Chile for all firms, and $Ave\_proximity_c$ is simply the proximity between Chile and country c.

Table 1 presents the summary statistics for each variable we use in the empirical specifications and Table 2 presents the correlation coefficients between these variables[22]. Table 2 shows that the correlations between any two independent variables are rather low: the highest correlation coefficient is around 0.59 between *Language* and *COL_proximity*, and most of them are less than 0.1. The correlations between the dependent and independent variables are also rather low, the highest one is with the export status in the previous period, i.e. the lagged dependent variable: 0.67, and most of them are around 0.1-0.2.

When zooming in on Colombian firms that originally export to Chile only, we find a somewhat large overlap between their new export destinations and the export destinations of their peer firms and Chilean trading partners. We graphically illustrate this pattern in Figure 3 in the Appendix D, in which we provide geographic maps of the new destinations that the Colombian firms expand to, as well as the export destinations of their peer firms and their matched Chilean trading partners.

4 Empirical Model and Estimation Results

In this section, we present the empirical model and explore to what extent firms rely on foreign networks and domestic spillovers combined with sequential entry (Spillover/SE) when choosing a new export destination. Building on Chaney (2014), we use a dynamic Probit model to examine how these factors affect the choice of Colombian firm i to expand its exports to country c rather than any other country or not to expand to any country. We apply the dynamic Probit to both Full Sample (all Colombian exports) and Restricted Sample (Colombian firms that initially export only to Chile). In the Restricted Sample we also compare the strength of the firm-to-firm and firm-to-country networks.

[22]Table 1 and Table 2 present summary statistics and correlation coefficients for all Colombian exporting firms. Summary statistics and correlation coefficients for the smaller sample of Colombian firms that initially export to Chile only are available in the Appendix C.

Table 1: Summary Statistics

	Entry	Spillover/SE	ExpNetwork	ImpNetwork	Language	Ncontacts	COL_ proximity	Ave_ proximity	Overall_ proximity	ExpGrowth	ImpGrowth	Lagged_ Entry	GDP
Mean	0.0118	0.2334	0.4824	0.0153	0.1033	2.65	0.1747	0.2026	0.2319	0.272	0.5756	0.0144	3.37×10^{10}
Median	0	0	0	0	0	1	0.0993	0.105	0.2278	0	1	0	26052.34
Std. Dev.	0.108	0.423	0.4997	0.1226	0.3043	3.9076	0.2059	0.6061	0.0816	0.445	0.4942	0.1191	1.42×10^{11}
Min	0	0	0	0	0	1	0.0516	0.0509	0.0876	0	0	0	130.4654
Max	1	1	1	1	1	66	1.3633	118.3479	0.4307	1	1	1	1.18×10^{12}
No. of ones	199,750	3,946,056	8,156,465	258,158	1,745,929					4,598,317	9,732,991	243,533	
Percent of ones	1.18%	23.34%	48.24%	1.53%	10.33%					27.2%	57.56%	1.44%	

Table 2: Correlation Coefficients Between Variables

	Entry	Spillover/SE	ExpNetwork	ImpNetwork	Language	Ncontacts	COL_ proximity	Ave_ proximity	Overall_ proximity	ExpGrowth	ImpGrowth	Lagged_ Entry	GDP
Entry	1												
Spillover/SE	0.1807	1											
ExpNetwork	0.0882	0.1964	1										
ImpNetwork	0.139	0.1163	0.1041	1									
Language	0.1747	0.3785	0.1634	0.0387	1								
Ncontacts	0.1942	0.0958	0.2994	0.1086	<0.0001	1							
COL_proximity	0.175	0.3384	0.1647	0.0029	0.5864	<0.0001	1						
Ave_proximity	0.2389	0.1539	0.0614	0.0248	0.1876	0.0214	0.2718	1					
Overall_proximity	-0.0568	-0.0461	0.0259	-0.0181	-0.237	<-0.0001	-0.0928	0.0184	1				
ExpGrowth	0.0541	0.1101	0.4552	0.0603	0.1023	0.1824	0.0977	0.0364	0.0098	1			
ImpGrowth	0.0017	-0.014	-0.0034	0.001	-0.0131	0.0013	-0.0424	-0.0096	0.0001	0.1058	1		
Lagged_Entry	0.6693	0.1999	0.0647	0.1389	0.1921	0.1782	0.1978	0.4207	-0.0667	0.038	0.0007	1	
GDP	0.1387	0.2313	0.1089	0.2546	-0.0378	0.0003	-00349	0.0025	-0.0964	0.0616	-0.0046	0.1873	1

4.1 Full Sample: Colombian Exports to All Countries

By extending the empirical model of Chaney (2014), we employ the following specification:

$$
\begin{aligned}
&Prob(Entry_{i,c,t+1} = 1 \mid observables) \\
&= \Phi\Big(\alpha Spillover/SE_{i,c,t} + \alpha' Spillover/SE_{i,c,t} * Entry_{i,c,t} \\
&+ \beta_1 ExpNetwork_{i,c,t} + \beta_1' ExpNetwork_{i,c,t} * Entry_{i,c,t} \\
&+ \beta_2 ImpNetwork_{i,c,t} + \beta_2' ImpNetwork_{i,c,t} * Entry_{i,c,t} + \lambda_1 ExpGrowth_{i,c,t} \\
&+ \xi Language_c + \rho Ncontacts\_i, t + \lambda_2 ImpGrowth_{c,t} + \eta Entry_{i,c,t} \\
&+ \gamma_1 COL\_proximity_c + \gamma_2 Ave\_proximity_c + \gamma_3 Overall\_proximity_c + \delta GDP_{c,t} \Big),
\end{aligned}
\tag{1}
$$

where subscripts i, c, and t denote firm, country, and year, respectively;

$Entry_{i,c,t+1}$ is 1 if firm i enters country c at time $t+1$ and 0 if not;

$Spillover/SE_{i,c,t}$ is Spillover/Sequential Entry dummy;

$ExpNetwork_{i,c,t}$ is Consumer Export Network dummy;

$ImpNetwork_{i,c,t}$ is foreign Supplier Network dummy;

$Language_c$ is the same language (Spanish) dummy variable;

$Ncontacts\_i, t$ is the number of countries to which firm i exports in year t;

$COL\_proximity_c$ is the proximity between Colombia and country c;

$Ave\_proximity_c$ is the proximity between i's current exporting destinations and c;

$Overall\_proximity_c$ is the proximity between country c from the rest of the world;

$ExpGrowth_{i,c,t}$ is i's export growth to country c between years t and t+1;

$ImpGrowth_{c,t}$ is c's overall import growth between years t and $t+1$;

$Entry_{i,c,t}$ is firm i's export status to country c in year t;[23]

$Spillover/SE_{i,c,t}$, $ExpNetwork_{i,c,t}$, and $ImpNetwork_{i,c,t}$ are interacted with $Entry_{i,c,t}$ to capture their effects on exporting to the same destination as in the previous year;

$GDP_{c,t}$ is c's GDP in year t.

Main Conjectures. Our main focus is on the Spillover/SE and Networks coefficients: α, β_1, and β_2. We expect all three coefficients to be significantly positive. The positive Spillover/SE effect will be in line with Greenaway et al. (2004), Silvente and Giménez (2007), Koenig et al. (2010), and Albornoz et al. (2012), among others. The positive Consumer Exports Network effect will be in line with the remote search idea of Chaney (2014), while examining the foreign Supplier Network effect was claimed to be missing in this literature by Bernard and Moxnes (2018). Note, that in our specification we distinguish between the effects of these

[23] This variable controls for the continuing to the same destinations exporters.

channels on breaking in new markets versus continuing exporting to the same destination to which a firm was exporting in a previous year. As stated above, coefficients α, β_1, and β_2 will reflect the effect of these channels on entering new markets, while the summations of coefficients $\alpha + \alpha'$, $\beta_1 + \beta_1'$, and $\beta_2 + \beta_2'$ will indicate the effect of these channels on the probability of continuing exports to their existing export destinations. For existing export destinations, risk and uncertainty should be of much smaller concern, as firms had the possibility to learn about these markets through their own experience. Thus, we expect α', β_1', and β_2' to be negative.

We expect $\xi > 0$ as firms are more likely to export to a country that speaks the same language as Colombia. ρ is expected to be positive as a firm that currently exports to more destinations are typically more productive and thereby more likely to export to any foreign country in the next period. All proximity variables were also used in Chaney (2014)'s original specification. We expect the coefficients γ_1 and γ_2 to be positive and statistically significant, as firms are expected to be more likely to enter the markets closer to the exporting country and to the firm's previous exporting destinations. Coefficient γ_3, on the other hand, is expected to be negative, as we would expect the level of competition to be higher in countries that are closer to other countries, making it more difficult to break into those markets.

The effect of the export growth dummy is expected to be positive, i.e. $\lambda_1 > 0$. As explained in Chaney (2014), the trade flows between a firm's current exporting destinations and country c can be used as a proxy for the intensity of their communication. If there is a positive export growth from current exporting destinations to country c, t implies that the communication between them increases, and we would expect firm i to be more likely to enter country c as its current exporting destinations have a stronger connection with it. Finally, we expect both λ_2 and δ to be positive, as firms are mechanically more likely to export to countries with faster import growth and greater economic size.

Results. Table 3 and Table 4 summarize our estimation results. To aid interpretation, we present the estimated marginal effects rather than the coefficients. Since our paper builds on Chaney (2014), for comparison, Table 3 present our replication of Chaney's results using Colombian export data. Column (1) lists the results of Chaney, who used French firm export data between 1986 and 1992. In Column (2), we estimated exactly the same empirical model as Chaney (2014), but with Colombian firm export data between 2007 and 2016. Qualitatively, we confirm Chanye's results, as all of the coefficients between Columns (1) and (2) are of the same sign. The magnitudes tend to be smaller (in some cases, much smaller) for

Colombian exports than for French exports[24]. This is not surprising, since France is a more developed economy with an average French exporter exporting to more destinations than a Colombian exporter. Thus, to make a visible relative impact compared to a benchmark case, the absolute marginal effect in the Colombian sample does not have to be as large as in the French sample. In Column (3), we preserved the same set of variables as in Column (2), but re-defined the export and import growth as dummy variables to avoid losing observations as discussed in section 3.2. This change does not have any major impact on our estimation results except that the effect of import growth becomes negative and insignificant. In Table 4, however, when we add spillover, networks, and language dummies, the effect of import growth become significantly positive, which is consistent with Chaney's finding.

In Columns (1)-(3) of Table 4 we included combinations of Spillover/Sequential Exporting and Network dummy variables, but omit adjacency measures. In Columns (4)-(6), we added *Language* to specifications (1)-(3) to control for the similar characteristics of export destinations. Column (6) presents the results based on the full set of variables in estimation equation (1). To have a relative benchmark for evaluating the marginal effects in Table 4, recall that the average unconditional probability of a Colombian firm entering a new, not targeted in the previous year, foreign country c in year t is 0.00305. It is calculated by first removing from the sample all observations with the positive Lagged Entry dummy indicator and then calculating the fraction of ones of the Entry variable in the total number of observations (51,182/16,759,376=0.00305).

The results presented in Table 4 confirm our main conjectures. First, in all specifications the Spillover/SE and both the Consumer and Supplier Network effects are positive and statistically significant. They are also economically significant. From Column (6) of Table 4, a Colombian firm's probability of breaking in a new foreign market is 49% higher (i.e., greater by 0.0014) compared to the unconditional probability in the presence of either the Spillover/SE or SN and 13% higher (i.e., greater by 0.0004) in the presence of CEN. The only other factor which has a comparable effect on the probability of entry is the common language, which increases the probability by 26% (i.e., by 0.0008) compared to the unconditional probability. As expected, the interaction terms of the Lagged Entry with both Spillover/SE and SN have significantly negative coefficient, indicating a lesser importance of these channels for continuing exports compared to exports to new destinations. The opposite is true for the CEN effect, though.

[24]For instance, the marginal effect of $Ncontacts_{i,t}$ is 0.0016 for French firms, implying that the probability of a French firm entering a foreign market in the next period would increase by 0.0016 if the firm exports to one more country at time t. However, this effect is about eight times smaller for a Colombian firm with the probability increasing by only 0.0002.

Table 3: Replicated Results of Chaney (2014)

Dependent Variable:	French firms	Colombian firms	
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)
Ncontacts	0.0016	0.0002	0.0001
	(0.00001)	(0.00001)	(0.00001)
COL_proximity	0.131	0.0052	0.0027
	(0.0007)	(0.0002)	(0.0001)
Ave_proximity	0.0281	0.0001	0.00001
	(0.0007)	(0.00001)	(0.00001)
Overall_proximity	-0.0752	-0.0056	-0.0026
	(0.0037)	(0.0003)	(0.0002)
ExpGrowth	0.0028	0.00001^a	0.0007
	(0.0001)	(0.00001)	(0.00004)
ImpGrowth	0.0033	0.0002	$< -0.00001^a$
	(0.0002)	(0.00004)	(0.00001)
Lagged_Entry	0.422	0.3317	0.2423
	(0.0014)	(0.0056)	(0.0054)
GDP	0.009	<0.0001	<0.0001
	(0.00004)	(<0.0001)	(<0.0001)
Years	1986-1992	2007-2015	2007-2015
# Obs.	20,857,435	13,441,274	16,907,944
R-square	0.5499	0.5917	0.6021

Notes: This table shows the marginal effects for the Probit estimation of equation (1) in Chaney (2014). Columns (1) presents Thomas Chaney's results with French firms. Columns (2) and (3) present the results with Colombian firms. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. ^{a} indicates not statistically significant. ^{b} indicates statistically significant at 5% level. ^{c} indicates statistically significant at 10% level. All other variables are significant at 1% level.

In terms of ranking, the Spillover/SE and SN are the most important channels of breaking in new markets. The CEN has a 3.5 times smaller effect than either of them. From comparing Columns (4) and (5) to Column (6), omitting either Spillover/SE or Networks effects results in substantial, up to 150%, upward biases for the remaining effects. This confirms our initial concern that the estimation of these effects in isolation is likely to be subject to the (pronounced) omitted variables bias. Finally, by comparing the results in Columns ((3) and (6), omitting the adjacency measure—common language—biases the marginal effects of Spillover/SE, CEN, and SN by between 14 and 36 percent. This result confirms that criticism of the literature by Muendler and Rauch (2018) about the importance of including adjacency

Table 4: Estimated Marginal Effects of Spillovers and Networks

(Full Sample)

Dependent Variable: $Pr(Entry_{i,c,t+1} = 1)$	Spillover/SE	Network	Spillover/SE Network	Spillover/SE Language	Network Language	Spillover/SE Network Language
	(1)	(2)	(3)	(4)	(5)	(6)
Spillover/SE	0.0034		0.0019	0.0024		0.0014
	(0.0002)		(0.0001)	(0.0001)		(0.0001)
SpilloverSE*lagEntry	-0.0003		-0.0002	-0.0003		-0.0002
	(0.00002)		(0.00001)	(0.00001)		(0.00001)
ExpNetwork		0.0014	0.0005		0.001	0.0004
		(0.0001)	(0.00003)		(0.00005)	(0.00002)
ExpNetwork*lagEntry		-0.0001	0.0001		$< -0.00001^a$	0.0001
		(0.00002)	(0.00002)		(0.00002)	(0.00002)
ImpNetwork		0.0042	0.0016		0.0029	0.0014
		(0.0002)	(0.0001)		(0.0002)	(0.0001)
ImpNetwork*lagEntry		-0.0004	-0.0002		-0.0003	-0.0002
		(0.00002)	(0.00001)		(0.00002)	(0.00001)
Language				0.0012	0.0022	0.0008
				(0.0001)	(0.0001)	(0.00005)
Ncontacts	0.0001	0.0001	0.00003	0.0001	0.0001	0.00003
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
COL_proximity	0.0008	0.0015	0.0006	0.0004	0.0006	0.0003
	(0.00004)	(0.0001)	(0.00003)	(0.00002)	(0.00004)	(0.00002)
Ave_proximity	$< 0.00001^a$	0.00002	0.00001	$< 0.00001^b$	0.00002	0.00001
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
Overall_proximity	-0.0013	-0.0017	-0.001	-0.0001^b	0.0001^a	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.00004)	(0.00005)	(0.00003)
ExpGrowth	0.0002	0.0001	0.00004	0.0002	0.0001	0.00003
	(0.00001)	(0.00001)	(<0.00001)	(0.00001)	(0.00001)	(<0.00001)
ImpGrowth	0.00002	0.00005	0.00003	0.00001	0.00003	0.00003
	(<0.00001)	(0.00001)	(<0.00001)	(<0.00001)	(0.00001)	(<0.00001)
Lagged_Entry	0.2429	0.2299	0.2085	0.2027	0.1743	0.1722
	(0.0074)	(0.0042)	(0.0062)	(0.0068)	(0.0037)	(0.0056)
GDP	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944
R-square	0.6282	0.6187	0.6369	0.6336	0.6279	0.6415

Notes: This table shows the marginal effects for the Probit estimation of equation (1). The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. ^{a} indicates not statistically significant. ^{b} indicates statistically significant at 5% level. ^{c} indicates statistically significant at 10% level. All other variables are significant at 1% level.

measures when examining export expansion paths. In the robustness checks, we show the results with three other adjacency measures—omitting any of those generates a much smaller or no bias.

In line with Chaney (2014)'s results, all proximity variables are statistically significant and have the expected signs. Coefficients γ_1 and γ_2 are positive, indicating that firms are more likely to enter the markets closer to the exporting country and to the firm's previous export destinations. Coefficient γ_3 is negative, suggesting that firms are more likely to enter a country that is remote from all other countries as the level of competition is milder there. The export growth and overall import growth dummy variables have significantly positive effects. Coefficient $\lambda_1 > 0$ suggests that if there is an export growth between firm i's current exporting destinations and country c, it is subsequently more likely to enter that country. Coefficient $\lambda_2 > 0$ means that the faster a country's import grow, the more likely it is that any firm enters that country. Finally, the estimation results show that firms are more likely to export to a large country and, export to the same destinations with much higher probability than to the new ones.

Next, we calculated the marginal effects of these channels separately for each industry and each channel. Table 5 presents the results for the top 10 export destinations and top 10 industries for each channel. We also present the percentage of Colombian export that goes to each country and industry in 2015. The magnitudes of the marginal effects are highly heterogenous both across destinations and industries. All channels seem to have the greatest effect (much stronger than the average) for breaking in the U.S.A and Panama as destination countries. These are Colombia's main export destinations with export shares of 29% and 7%, respectively. The industries which benefit the most from these channels tend to be less contract intensive according to Nunn (2007)'s classification (i.e., industries with relatively low share of differentiated inputs). The few exceptions are Chemicals, Glass, Machinery/Electrical, and Wood Products.

4.2 Restricted Sample: Colombian Firms Initially Exporting Only to Chile.

In this subsection, we experiment with a more granular, firm-to-firm measure of the Consumer Export Network. To this goal, we restrict our sample to Colombian firms that originally export only to Chile. We then utilize the connections between Colombian exporting firms and their Chilean importing counterparts to examine the effects of firm-to-firm measure of CEN on a firm's choices of new exporting destinations. Building on and extending the

Table 5: The strongest Marginal Effects Across Destinations and Industries

Rank	ISO3	Spillover/SE Effects	% of Export	Industry	Spillover/SE Effects	% of export
1	USA	0.0337	28.72%	Vegetable Products	0.0063	15.49%
2	PAN	0.0265	7.15%	Mineral Products	0.0052	51.11%
3	VEN	0.0208	3.17%	**Chemical** and Allied Industry	0.0044	6.49%
4	ECU	0.0207	4.28%	Metals	0.0041	3.55%
5	CRI	0.0181	0.74%	Foodstuffs	0.004	3.9%
6	MEX	0.0166	2.73%	Stone/**Glass**	0.004	4.78%
7	PER	0.0149	3.43%	Plastics/Rubbers	0.0038	4.26%
8	DOM	0.0146	0.77%	Raw Hides, Skins, Leather, Fur	0.0038	0.73%
9	NIC	0.014	0.03%	**Machinery/Electrical**	0.0037	2.61%
10	ESP	0.0134	4.72%	Textile	0.0034	2.35%
Rank	ISO3	CEN Effects	% of export	Industry	CEN Effects	% of export
1	USA	0.0266	28.72%	Vegetable Products	0.003	15.49%
2	PAN	0.0203	7.15%	**Chemical** and Allied Industry	0.0023	6.49%
3	ECU	0.0166	4.28%	Mineral Products	0.0023	51.11%
4	VEN	0.0152	3.17%	Plastics/Rubbers	0.0021	4.26%
5	CRI	0.0126	0.74%	Foodstuffs	0.0021	3.9%
6	MEX	0.0118	2.73%	Textile	0.002	2.35%
7	PER	0.0105	3.43%	Metals	0.002	3.55%
8	DOM	0.0102	0.77%	Raw Hides, Skins, Leather, Fur	0.0019	0.73%
9	ESP	0.0088	4.72%	Stone/**Glass**	0.0018	4.78%
10	GTM	0.0085	0.65%	Wood/**Wood Products**	0.0018	1.14%
Rank	ISO3	SN Effects	% of export	Industry	SN Effects	% of export
1	PAN	0.0562	7.15%	Vegetable Products	0.0102	15.49%
2	USA	0.05	28.72%	Foodstuffs	0.0069	3.9%
3	ECU	0.0453	4.28%	Textile	0.0069	2.35%
4	VEN	0.0436	3.17%	**Chemical** and Allied Industry	0.0067	6.49%
5	CRI	0.0393	0.74%	Plastics/Rubbers	0.0067	4.26%
6	DOM	0.0336	0.77%	Mineral Products	0.0066	51.11%
7	PER	0.0319	3.43%	Raw Hides, Skins, Leather, Fur	0.0063	0.73%
8	MEX	0.0305	2.73%	Metals	0.006	3.55%
9	GTM	0.0288	0.65%	Stone/**Glass**	0.006	4.78%
10	SLV	0.028	0.24%	Wood/**Wood Products**	0.0059	1.14%

Notes: This table shows the top 10 destinations and industries that are most affected by the spillover and network effects for Colombian exports between 2007 and 2015. The contract-intensive industries are marked in bold. These are the industries with the relatively high (greater than the median) share of the differentiated inputs according to Nunn (2007)'s classification.

empirical model of Chaney (2014), we employ the following specification:

$$
\begin{aligned}
&Prob(Entry_{i,c,t+1} = 1 \mid observables) \\
&= \Phi\Big(\alpha Spillover/SE_{i,c,t} + \beta_1 ExpNetwork_{i,c,t} + \beta_2 ImpNetwork_{i,c,t} + \xi Language_c \\
&+ \gamma_1 COL\_proximity_c + \gamma_2 Ave\_proximity_c + \gamma_3 Overall\_proximity_c \\
&+ \lambda_1 ExpGrowth_{i,c,t} + \lambda_2 ImpGrowth_{c,t} + \delta GDP_{c,t} \Big).
\end{aligned} \tag{2}
$$

All variables are defined in the same way as in equation (1). We exclude the Lagged Entry dummy and its interactions with Spillover/SE, ExpNetwork, and ImpNetwork since we only consider Colombian firms that originally export only to Chile and study their entry only to new markets. Thus, by construction, we only estimate the probability of breaking in new markets. We also exclude the variables $Ncontacts_{i,t}$ and $Lagged\_Entry_{i,c,t}$ from the specification as the majority of Colombian firms have only one Chilean trading partner and they all only export to Chile in the previous period. The variables $Ave\_proximity_c$ and $ExpGrowth_{i,c,t}$ thus simply capture the proximity and export growth from Chile to country c, respectively.

We estimate equation (2) separately for the firm-to-firm measure of export networks and the firm-to-country measure of export networks. Our prior is that simply being present in Chile in not very helpful in terms of gaining information about other destinations. It is the firm-to-firm communication and interaction between Colombian exporting firms and their Chilean importing counterparts that serves as the main source to obtain information about the new foreign market. Therefore, we expect firm-to-firm networks to have a stronger impact on a firm's choice of new export destinations than the firm-to-country networks.

Table 6 summarizes the estimation results of equations (2). We present the estimated marginal effects rather than the coefficients, to aid interpretation. Columns (1)-(4) present the results for a smaller sample that consists of only expanding and non-expanding Colombian firms. Columns (5)-(8) present the results for a larger sample that consists of all Colombian firms that initially only exporting to Chile, including expanding, non-expanding, and disappearing firms. Column (4) and (8) use firm-to-country export networks, wheras all other columns use firm-to-firm export networks. As shown in Appendix C, the average probability of entering a new destination is 0.0022 for Colombian firms that initially only export to Chile. We take this value as the baseline probability of entering new destinations.

The estimation results suggest that both Spillover/SE and Export Network have statistically significant positive effects on a firm's choice of new export destinations. The results

Table 6: Estimated Marginal Effects of Spillovers and Networks

(Restricted Sample)

Dependent Variable:	Expanding and Non-expanding Firms				All Firms			
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spillover/SE	0.0034***		0.0032***	0.0019***	0.0016***		0.0016***	0.0009***
	(0.001)		(0.001)	(0.0007)	(0.0005)		(0.0005)	(0.0003)
ExpNetwork		0.0054*	0.0033*	0.0011***		0.0018*	0.0012*	0.0006***
		(0.0028)	(0.0018)	(0.0004)		(0.0009)	(0.0006)	(0.0002)
ImpNetwork		0.0023*	0.0017	0.0011		0.0015*	0.0011	0.0007
		(0.0013)	(0.0011)	(0.0007)		(0.0009)	(0.0007)	(0.0004)
Language	0.0027***	0.0067***	0.0025***	0.001**	0.0012***	0.0032***	0.0011***	0.0004**
	(0.001)	(0.0018)	(0.0009)	(0.0005)	(0.0004)	(0.0008)	(0.0004)	(0.0002)
COL_proxmity	0.0014***	0.0026***	0.0014***	0.001***	0.0006***	0.0012***	0.0006***	0.0004***
	(0.0004)	(0.0005)	(0.0004)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
Ave_proximity	0.0006	0.0006	0.0004	0.0003	0.0003	0.0003	0.0002	0.0001
	(0.0005)	(0.0006)	(0.0005)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0001)
Overall_proximity	-0.0018**	-0.0023**	-0.0016**	-0.001*	-0.0008**	-0.0011**	-0.0007**	-0.0004*
	(0.0007)	(0.0011)	(0.0007)	(0.0006)	(0.0003)	(0.0005)	(0.0003)	(0.0002)
ExpGrowth	0.0032	0.0004	0.0004	0.0015	0.0011	0.0001	0.0001	0.0004
	(0.0027)	(0.0008)	(0.0007)	(0.0012)	(0.001)	(0.0004)	(0.0003)	(0.0004)
ImpGrowth	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GDP	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	51,606	51,606	51,606	51,606	105,591	105,591	105,591	105,591
R-square	0.3028	0.2841	0.3122	0.3162	0.2765	0.2595	0.2865	0.2936

Notes: This table shows the marginal effects for the Probit estimation of equation (2). The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. * indicates statistically significant at 10% level. ** indicates statistically significant at 5% level. *** indicates statistically significant at 1% level.

in Column (7) suggest that, on average, a Colombian firm's probability of exporting to a new destination would increase by 0.0016 if at least one other Colombian firm exported the same HS 6-digit product to that country in the previous period. That is a 73% increase from the baseline entry probability of 0.0022. Moreover, a firm's probability of entering a new destination would increase by 0.0012 (a 55% increase from baseline entry probability) if its Chilean trading partners exported the same HS 2-digit product to that destination in the previous period. The SN has a positive but insignificant effect on a firm's choice of new exporting destinations. This is mainly due to the fact that these firms have on average a very limited number of foreign suppliers outside of Chile.

By comparing Column (4) to Column (3), and Column (8) to Column (7), the magnitude of the CEN effect is 2-3 times greater in the firm-to-firm than in the firm-to-country specifications. This result confirms our prior conjecture that firms rely more on their firm-to-firm connections with foreign trading partners to decide which new country to expand in the future. The effects of all other variables are of the expected signs and statistically significant, except for $Ave\_proxmity$, $ExpGrowth$, and $ImpGrowth$, suggesting that for Colombian firms that initially export only to Chile, their choices of new exporting destination are not affected by the geographical distance or the export growth from Chile to the new destination, or the overall import growth of the new destination.

4.3 Economic Significance of Export Networks

How important are the firm-to-country and firm-to-firm Export Networks for breaking in new markets. The marginal effects reported above provide only a partial answer to this question since, with non-linear estimation, the actual effects are highly heterogenous across export destinations. In order to provide a more complete answer, we calculated three predicted probabilities of breaking in a new market for each destination. We label the first probability as "Other effects." It includes the effects of proximity, export and import growth, language and market size factors, but sets the Spillover/SE and CEN dummies to zero. They are calculated at the average value of these variables for each destination multiplied by the corresponding coefficient. The coefficients are taken from Column (7) of Table 6 for the firm-to-firm probabilities and from Column (8) of Table 6 for the firm-to-country probabilities. The statistically insignificant coefficients (e.g, ImpNetwork coefficient) are set to zero. The second probability includes "Other Effects" and Spillover/SE. Finally, the third probability includes "Other Effects" and CEN.

We present these country-specific probabilities by regions. Probabilities for countries in North America are presented in Table . Probabilities for all other countries are presented in

Figure 1. Several results are worth noting. First, for the vast majority of countries, both the Spillover/SE and CEN effects are stronger than the effect of all other factors combined. Second, the effects of both the Spillover/SE and CEN all factors are significantly greater based on the firm-to-firm (Subfigures a, c, e) than on firm-to-country (Subfigures b, d, f) results.[25] Third, the magnitudes of the effects are highly heterogeneous both across and within country groups.

Table 7: Predicted Probability of Entering a North American Country

	Firm-to-firm ExNetwork			Firm-to-country ExNetwork		
	US	Mexico	Canada	US	Mexico	Canada
Other effects only	0.0168	0.0021	0.0004	0.0049	0.0005	0.0001
Other+ExNetwork effects	0.0481	0.0083	0.0018	0.0194	0.0028	0.0008
Other+Spillover/SE effects	0.0666	0.0128	0.003	0.0218	0.0032	0.001

Notes: This table shows the predicted probability of entering a new North American country for Colombian firms that initially only export to Chile. The predicted probabilities are calculated based on the estimation results in Columns (7) and (8) of Table 6.

[25]Note that the scales of the figures for a given group of countries are different. For example, for Latin American countries, the same vertical distance is scaled to be between 0 and 0.04 for firm-to-firm results but only 0 to 0.015 for the firm-to-country results.

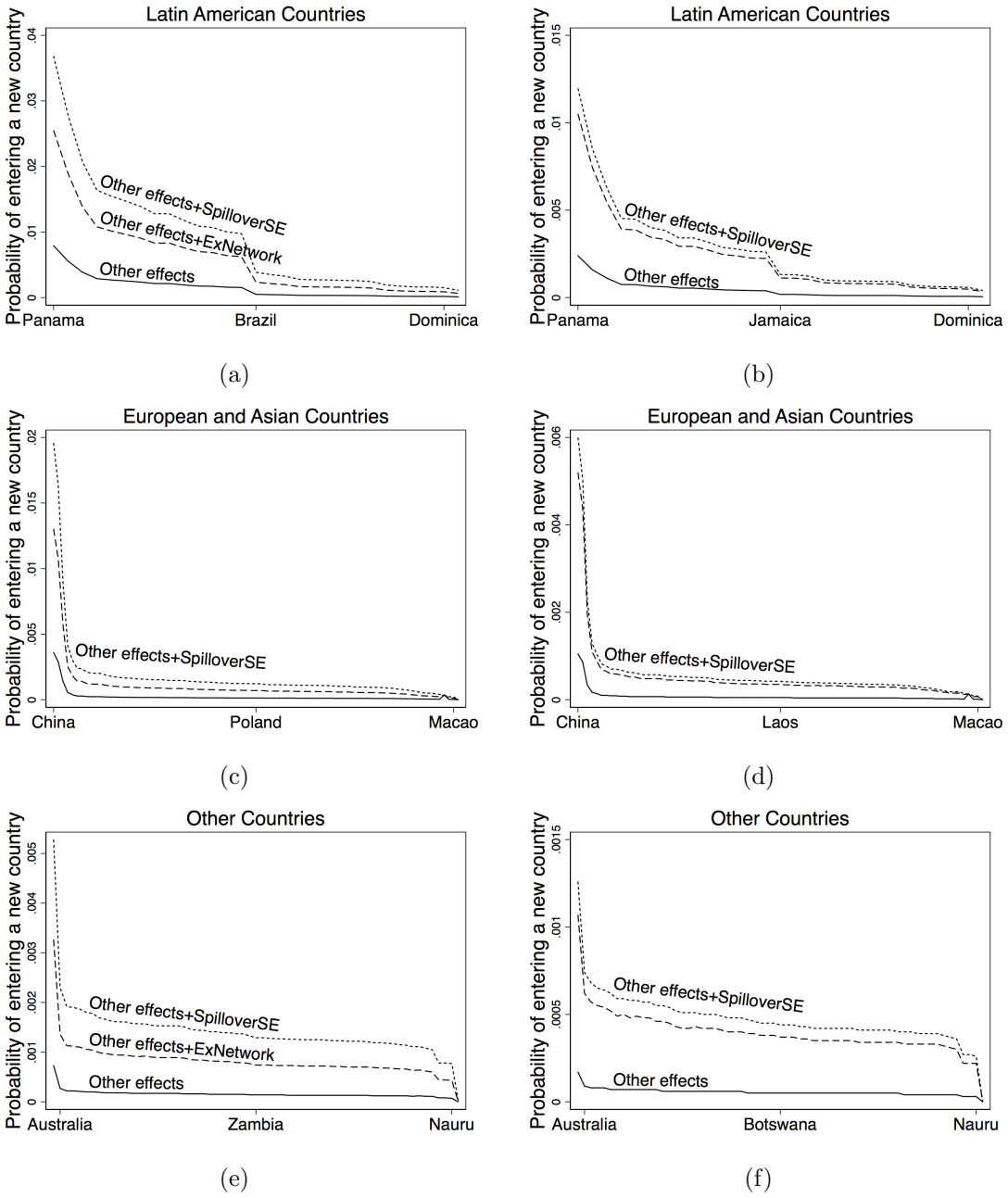

Figure 1: Predicted Probability of Entering a New Export Destination

Notes: This figure shows the predicted probability of entering a new export destination for Colombian firms that initially only export to Chile. The predicted probabilities are calculated based on the estimation results in Columns (7) and (8) of Table 6. Figures (a), (c), and (e) show the effect of firm-to-firm export networks. Figures (b), (d), (f) show the effect of firm-to-country export networks. The order of the lines in the above graphs are the same. Form the top to the bottom: with spillover/SE and other effects, with export network and other effects, and with other effects only.

4.4 How Representative Are the Restricted-Sample Results

In the previous subsection, we have shown that, within the same sample, the marginal effect of the firm-to-firm CEN is two to three times greater than that of the firm-to-country CEN. That is, the more granular is the observed information channel, the greater is the predictive power of this information. Due to data constraints, this comparison was performed on a particular subsample of firms—on firms which have consumers only in one foreign country (in our case, in Chile). This approach has some advantages as it allows to eliminate other, more complex effects present in larger networks, such as reputation effects, homophile[26], segregation, etc.[27] For example, a firm with multiple trading partners is potentially likely to have a stronger reputation in the eyes of the potential new partners, as multiple trading partners project higher quality and reliability than a firm with only few partners. Thus, even if a firm meets a new partner without direct involvement of the existing partner, being a part of the larger network might have facilitated the match. Focusing on firms with a minimal network allowed us to isolate these effects.

Focusing only on the one-destination firm, however, raises a selection-bias concern. Thus the question is: How representative are our one-destination results for the whole population of Colombian firms? Due to data constraints, we cannot answer this question for the firm-to-firm specification. We can, however, try to answer it for the firm-to-country specification. To this goal, we split our entire sample into three groups: firms exporting to only 1 destination, firms exporting to between 2 and 5 destinations, and firms exporting to more than 5 destinations. We then applied our base-line firm-to-country specification 1 to each subsample. The corresponding results are presented in columns (3), (6), and (9) of Table 8. To check the strength of the omitted variables bias, we also included specifications without Spillover/SE effects (Columns 1, 4, and 7) and without Networks effects (Columns 2, 5, and 8).

Based on the results, presented in Table 8, we conclude the following. First, our main qualitative results are robust across all three samples. Spillover/SE, CEN, and SN, have a significantly positive effect on breaking in new markets; the magnitudes of these effects are somewhat smaller for continuing exports to the same market; and omitting any of these channels in the specification generates an upward bias for the remaining channels. Second, the effects are of much stronger magnitude for firms with larger number of export destinations. In fact, when moving from $N = 1$ to $2 < N < 5$, all marginal effects increase by roughly an order of magnitude, and then they increase again by roughly an order of magnitude when moving

[26]The widely known analog of homophile effect in trade is Linder effect—firms are more likely to export to countries with the similar income per capita as the one in their own country.

[27]See, for example, Currarini et al. (2009) and Jackson and Zenou (2015) for a more detailed description of these and other additional effects in larger social networks.

from $2 < N < 5$ to $N > 5$. Thus, our the magnitudes reported for our one-destination specifications are likely to present a lower bound for the entire population of Colombian exporters. Third, in terms of ranking, SN dominates two other channels for firms with $N = 1$, but for firms with more than one connection, the Spillover/SE dominates both of the networks effects.

Table 8: Estimated Marginal Effects of Spillovers and Networks

(Full Sample)

Dependent Variable:	Ncontacts=1			2≤ Ncontacts≤ 5			Ncontacts>5		
$\mathbf{1}[Export_{i,c,t+1} > 0]$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Spillover/SE		0.0003	0.0002		0.0066	0.0039		0.0288	0.0231
		(0.00002)	(0.00001)		(0.0001)	(0.0001)		(0.0006)	(0.0006)
Spillover/SE*lagEntry		-0.00005	-0.00003		-0.001	-0.0006		-0.0065	-0.0055
		(<0.00001)	(<0.00001)		(0.0003)	(0.00003)		(0.0002)	(0.0002)
ExpNetwork	0.0001		0.0001	0.0027		0.0012	0.0119		0.0056
	(0.00001)		(<0.00001)	(0.0001)		(0.00004)	(0.0002)		(0.0003)
ExpNetwork *lagEntry	-0.00005		-0.00004	-0.0012		-0.0006	-0.0093		-0.0036
	(0.00001)		(0.00001)	(0.00003)		(0.00003)	(0.0008)		(0.001)
ImpNetwork	0.0009		0.0007	0.0052		0.0028	0.033		0.0132
	(0.0001)		(0.0001)	(0.0003)		(0.0002)	(0.0012)		(0.0007)
ImpNetwork*lagEntry	-0.0001		-0.00005	-0.0011		-0.0006	-0.008		-0.004
	(<0.00001)		(<0.00001)	(0.00004)		(0.00003)	(0.0002)		(0.0002)
Language	0.0004	0.0003	0.0002	0.0071	0.0041	0.0027	0.0348	0.0193	0.0159
	(0.00003)	(0.00002)	(0.00001)	(0.0002)	(0.0002)	(0.0001)	(0.0009)	(0.0007)	(0.0006)
Ncontacts				0.0005	0.0004	0.0003	0.0007	0.0005	0.0005
				(0.00002)	(0.00002)	(0.00001)	(0.00002)	(0.00002)	(0.00002)
COL_proximity	0.0001	0.0001	0.0001	0.0021	0.0015	0.0011	0.0128	0.0061	0.0062
	(0.00001)	(0.00001)	(0.00001)	(0.0001)	(0.0001)	(0.00005)	(0.0005)	(0.0004)	(0.0003)
Ave_proximity	<0.00001	0.00001	<0.00001	0.0001	0.0001	0.00005	0.0022	0.0013	0.0011
	(<0.00001)	(<0.00001)	(<0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.0002)	(0.0001)	(0.0001)
overall_proximity	-0.00005	-0.0001	-0.0001	-0.0007	-0.001	-0.0009	0.0034	-0.0012^{a}	-0.0029
	(0.00002)	(0.00002)	(0.00001)	(0.0002)	(0.0002)	(0.0001)	(0.0015)	(0.001)	(0.0009)
ExpGrowth	0.00001	0.00003	0.00001	0.0001	0.0002	0.0001	0.0011	0.0008	0.0005
	(<0.00001)	(<0.00001)	(<0.00001)	(0.00002)	(0.00002)	(0.00002)	(0.0002)	(0.0001)	(0.0001)
ImpGrowth	0.00001	0.00001	0.00001	0.0001	0.0001	0.0001	0.0004	0.0006	0.0005
	(<0.00001)	(<0.00001)	(<0.00001)	(0.00003)	(0.00002)	(0.00002)	(0.0002)	(0.0001)	(0.0001)
Lagged_Entry	0.0765	0.058	0.0772	0.3821	0.283	0.3725	0.6895	0.5499	0.627
	(0.0026)	(0.0035)	(0.0044)	(0.0127)	(0.0093)	(0.0152)	(0.0333)	(0.0126)	(0.0383)
GDP	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	<0.0001	<0.0001
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	10,564,544	10,564,544	10,564,544	4,446,728	4,446,728	4,446,728	1,896,672	1,896,672	1,896,672
R-square	0.5365	0.5372	0.5461	0.5518	0.5616	0.5666	0.6191	0.6332	0.6362

Notes: This table shows the marginal effects for the Probit estimation of Equation 1 for three groups of Colombian exporters between 2007 and 2015. Columns (1)–(3) present the results for Colombian firms that export to a single country. Columns (4)–(6) present results for Colombian firms that export to two to five countries. Columns (7)-(9) summarize results for Colombian firms that export to more than five countries. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Standard errors are clustered at the firm level. [a] indicates not statistically significant. [b] indicates statistically significant at 5% level. [c] indicates statistically significant at 10% level. All other variables are significant at 1% level.

5 Robustness Checks

As discussed in Section 3, this paper potentially suffers from the problem of correlated unobservables. That is, an exporting firm entering a new market might not necessarily because it learned about that market through information spillover or network search, but because that market is similar to the firms' previous export destinations or its home country. The use of firm-to-firm measure of networks help us resolve this problem when estimating the network effect, since network search will be attributed only to those new markets to which only firm's trading partners export.

However, the problem still potentially exists for the spillover/SE effect. To address this concern, we modified our empirical specifications by adding an adjacency dummy variable which controls for the similarity between the new export destination and Colombia. Following Morales et al. (2014) and Muendler and Rauch (2018), we consider the following variables: $Language_c$, $Contiguity_c$, $Continent_c$, and $IncomeGroup_c$. These variables are defined as indicators taking the value of one when country c shares a border, language or income group, respectively, with Colombia. The effect of variable $Language_c$ has been discussed in the baseline estimation, thus in this section we focus on the effects of the other three dummies.

We re-estimated equation (1) and (2) using various adjacency variables. The estimation results of Colombian export to all other countries are presented in Table 9. The estimation results using the sample of Colombian firms that initially only exporting to Chile are summarized in Table 10. Moreover, Column (1)-(4) of Table 10 presents the results using firm-to-firm measure of export networks while Column (5)-(8) using firm-to-country measure of networks. Including $Contiguity$, $Continent$, and $IncomeGroup$ does not change our estimation results significantly. The spillover/SE and network effects are robust both in terms of significance and the magnitudes, suggesting that firms rely on both domestic spillover and foreign networks when choosing a new export destination, even after controlling for the similarities between the new export destination and Colombia.

Table 9: Estimated Spillover and Network Effects with Adjacnecy Variables

(Full Sample)

Dependent variable:		Contiguity	Continent	Income Group
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)	(4)
Spillover/SE	0.0018	0.0018	0.0016	0.0018
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ExpNetwork	0.0006	0.0006	0.0006	0.0006
	(0.00003)	(0.00003)	(0.00003)	(0.00003)
ImpNetwork	0.0009	0.0008	0.0009	0.0009
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Adjacency		0.0002	0.0002	0.0001
		(0.00002)	(0.00001)	(0.00001)
Ncontacts	0.0004	0.00004	0.00004	0.00004
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
COL_proximity	0.0007	0.0005	0.0005	0.0006
	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Ave_proximity	0.00002	0.00002	0.00002	0.00002
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
Overall_proximity	-0.0011	-0.0009	-0.0007	-0.0009
	(0.0001)	(0.0001)	(0.00005)	(0.0001)
ExpGrowth	0.0001	0.0001	0.00005	0.00005
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
ImpGrowth	0.00004	0.00004	0.00003	0.00003
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
Lagged_Entry	0.1196	0.1164	0.1161	0.1194
	(0.003)	(0.003)	(0.003)	(0.003)
GDP	<0.0001	<0.0001	<0.0001	<0.0001
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	16,907,944	16,907,944	16,907,944	16,907,944
R-square	0.6352	0.6357	0.6357	0.6354

Notes: This table shows the marginal effects for the Probit estimation of Equation 1 with various adjacency variables. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. All estimated marginal effects are statistically significant at 1% level.

Table 10: Estimated Spillover and Network Effects with Adjacnecy Variables

(Restricted Sample)

Dependent Variable:	Firm-to-firm networks				Firm-to-country networks			
		Contiguity	Continent	Income Group		Contiguity	Continent	Income Group
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spillover/SE	0.002***	0.0022***	0.0021***	0.002***	0.001***	0.0011***	0.001***	0.001***
	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0003)	(0.0004)	(0.0004)	(0.0003)
ExpNetwork	0.0013*	0.0012*	0.0013*	0.0013*	0.0007***	0.0008***	0.0007***	0.0007***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
ImpNetwork	0.0012	0.0012	0.0012	0.0012	0.0007	0.0006	0.0007	0.0007
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Adjacency		0.0013**	-0.0001	0.0001		0.0008**	-0.00004	0.00005
		(0.0006)	(0.0001)	(0.0001)		(0.0004)	(0.0001)	(0.00004)
COL_proximity	0.001***	0.0007***	0.001***	0.001***	0.0005***	0.0003***	0.0006***	0.0005***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)
Ave_proximity	0.0008***	0.0009***	0.0008**	0.0007***	0.0004**	0.0004**	0.0004*	0.0003**
	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Overall_proximity	-0.0012***	-0.0007*	-0.0013***	-0.0011***	-0.0006**	-0.0002	-0.0006***	-0.0005**
	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
ExpGrowth	0.0001	0.0001	0.0001	0.0001	0.0004	0.0004	0.0004	0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
ImpGrowth	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GDP	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	105,591	105,591	105,591	105,591	105,591	105,591	105,591	105,591
R-square	0.2783	0.2855	0.2783	0.2788	0.2899	0.2972	0.29	0.2904

Notes: This table shows the marginal effects for the Probit estimation of equation (2) with various adjacency variables. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. * indicates statistically significant at 10% level. ** indicates statistically significant at 5% level. *** indicates statistically significant at 1% level.

6 Conclusion

This paper explores the effects of domestic spillovers and foreign networks on an exporting firm's expansion into new foreign markets. While there is a large literature focusing on how spillover and network effects impact a firm's expansion to new foreign markets, our paper is the first to jointly estimate the following three effects: Spillover/Sequential Entry, Consumer Exporting Network, and Supplier Network effects. It allowed us to rank the magnitudes of the effects and to demonstrate that omitting any of these channels in the estimation specification results in a pronounced upward bias of the remaining channels. We also show that each of these effects has a substantial economic significance, more important than several other factors (including proximity, import and export growth rates, language, and market size) combined.

Additionally, by matching Colombian exporting firms and Chilean importing and exporting firms between 2007 and 2016, we are able to construct a firm-to-firm measure of the Consumer Exporting Network. We showed that the finer, firm-to-firm measures of networks is more accurate and informative than the more widely used firm-to-country measures of networks.

Although this paper provides empirical evidence for the spillover and network effects in a firm's expansion to new foreign markets, it is still imperative to formulate a theoretical model that substantiates these effects. Moreover, this paper only analyzes the network and spillover effects on the extensive margin of trade (i.e., the expansion to new markets) but remains silent on their effects on the intensive margins (i.e. how much the firm sells to each market). A model for network and spillover effects on the intensive margin of trade would thus also be interesting. Finally, with the increasing availability of firm-level trade data, it is possible to check whether the results of this paper can be generalized to trade between other countries. These questions are left for future research.

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Appendix

A Technical notes on firm-to-firm matching

Matching Colombian exporting firms to their Chilean trade partners plays a critical role in estimating foreign network effects in our paper. We managed to do this, as the Colombian firm-level export data record the name and address of the foreign importing firm for each transaction. However, the foreign firm name data are very noisy. There are instances in which the same firm is recorded differently by using various abbreviations, extra spaces, dashes, dots, and other special signs. To clean and match the importing firm names, we used the following procedure:

1. We dropped all observations with the missing importing firm names.
2. We eliminated the typical prefixes, suffixes, and abbreviations (e.g., "LTDA", "LLC","CO.", "INC").
3. We eliminated the non alpha numeric characters (e.g., . / ; () @ &).
4. We compared the importing firm names with the standardized firm names recorded in the Chilean imports data. If the firm names were the same, we accomplished a match.
5. There are cases where the firm names have slightly different spellings than the standardized firm names. In these cases, we performed a further match by address. Specifically, we searched the address of the standardized firm through Internet, and compared it with the address recorded in Colombian export data. If the addresses were the same, we matched the two firms. Otherwise we failed to match.

B Alternative Specifications: Logit and Linear Probability Model

Table B.1 and Table B.2 present the marginal effects for the Logit estimation of equation (1) and (2), respectively. Table B.3 and Table B.4 present the estimation results using a Linear Probability Model (LPM). These results are quantitatively and qualitatively similar to our baseline results using Probit model.

Table B.1: Estimated Spillover and Network Effects: Logit Model
(Full Sample)

	Chaney's Specification		Modified Specifications (Colombian Firms)						
Dependent Variable: $Pr(Entry_{i,c,t+1} = 1)$	French firms	Colombian firms		Spillover/SE	Network	Spillover/SE Network	Spillover/SE Language	Network Language	Spillover/SE Network Language
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Spillover/SE				0.0039		0.0026	0.0029		0.002
				(0.0001)		(0.0001)	(0.0001)		(0.0001)
ExpNetwork					0.0017	0.0008		0.0014	0.0007
					(0.0001)	(0.00003)		(0.00005)	(0.00003)
ImpNetwork					0.0018	0.0008		0.0013	0.0007
					(0.0001)	(0.00004)		(0.0001)	(0.00004)
Language							0.0013	0.0026	0.001
							(0.0001)	(0.0001)	(0.00004)
Ncontacts	0.0016	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	(0.0001)	(0.00001)	(0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
COL_proximity	0.131	0.0041	0.0028	0.001	0.0021	0.0009	0.0004	0.0009	0.0005
	(0.0007)	(0.0002)	(0.0001)	(0.00003)	(0.0001)	(0.00003)	(0.00002)	(0.00003)	(0.00002)
Ave_proximity	0.0281	0.0001	0.00002	0.00001	0.0001	0.00003	0.00001	0.00005	0.00003
	(0.0007)	(0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
Overall_proximity	-0.0752	-0.0052	-0.0035	-0.002	-0.0029	-0.0017	-0.0002	-0.0001^{a}	-0.0003
	(0.0037)	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ExpGrowth	0.0028	$< -0.000001^{a}$	0.0008	0.0003	0.0001	0.0001	0.0002	0.0001	0.0001
	(0.0001)	(¡0.00001)	(0.00003)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
ImpGrowth	0.0033	0.0002	-0.00003	0.00002	0.0001	0.0001	0.00001^{b}	0.0001	0.00005
	(0.0002)	(0.00003)	(0.0002)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Lagged_Entry	0.422	0.2103	0.1622	0.0546	0.1159	0.0476	0.0442	0.0809	0.0391
	(0.0014)	(0.0076)	(0.0048)	(0.0021)	(0.0033)	(0.0017)	(0.0018)	(0.0026)	(0.0014)
GDP	0.009	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	(0.00004)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	1986-1992	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	20,857,435	13,441,274	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944
R-square	0.5499	0.5848	0.595	0.622	0.6095	0.6295	0.6247	0.6189	0.6342

Notes: This table shows the marginal effects for the Logit estimation of equation (1). Columns (1) presents Thomas Chaney's results with French firms. Columns (2)-(9) present the results with Colombian firms. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. ^{a} indicates not statistically significant. ^{b} indicates statistically significant at 5% level. All other variables are significant at 1% level.

Table B.2: Estimated Spillover and Network Effects: Logit Model

(Restricted Sample)

Dependent Variable:	Expanding and Non-expanding Firms				All Firms			
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spillover/SE	0.0031***		0.003***	0.0016**	0.0015***		0.0015***	0.0008**
	(0.0012)		(0.0011)	(0.0007)	(0.0006)		(0.0006)	(0.0003)
ExpNetwork		0.0031*	0.002**	0.0014***		0.001**	0.0007**	0.0007***
		(0.0015)	(0.0009)	(0.0005)		(0.0005)	(0.0003)	(0.0002)
ImpNetwork		0.0011	0.0008	0.0006		0.0006	0.0005	0.0003
		(0.0007)	(0.0006)	(0.0004)		(0.0004)	(0.0004)	(0.0002)
Language	0.0023***	0.0064***	0.0023***	0.0009**	0.001**	0.0031***	0.001**	0.0004**
	(0.0008)	(0.0017)	(0.0008)	(0.0004)	(0.0004)	(0.0008)	(0.0004)	(0.0002)
COL_proximity	0.0012***	0.0021***	0.0012***	0.0008***	0.0005***	0.001***	0.0005***	0.0004***
	(0.0003)	(0.0005)	(0.0003)	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Ave_proximity	0.0004	0.0004	0.0003	0.0002	0.0002	0.0002	0.0002	0.0001
	(0.0004)	(0.0005)	(0.0004)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
Overall_proximity	-0.0024***	-0.0029***	-0.0021***	-0.0013*	-0.0011***	-0.0014***	-0.001***	-0.0005*
	(0.0008)	(0.0011)	(0.0008)	(0.0007)	(0.0004)	(0.0005)	(0.0004)	(0.0003)
ExpGrowth	0.0014	0.0001	0.0002	0.0008	0.0005	0.00004	0.00003	0.0002
	(0.0011)	(0.0004)	(0.0004)	(0.0006)	(0.0004)	(0.0002)	(0.0002)	(0.0002)
ImpGrowth	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.00004
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.00005)
GDP	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)	(<0.00001)
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	51,606	51,606	51,606	51,606	105,591	105,591	105,591	105,591
R-square	0.2972	0.2767	0.305	0.3103	0.2729	0.2517	0.2806	0.2891

Notes: This table shows the marginal effects for the Logit estimation of equation (2). Column (4) and (8) present the results with firm-to-country export networks, while all other columns present results using firm-to-firm networks. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. * indicates statistically significant at 10% level. ** indicates statistically significant at 5% level. *** indicates statistically significant at 1% level.

Table B.3: Estimated Spillover and Network Effects: LPM

(Full Sample)

	Chaney's Specification		Modified Specifications (Colombian Firms)						
Dependent Variable: $Pr(Entry_{i,c,t+1}=1)$	French firms	Colombian firms		Spillover/SE	Network	Spillover/SE Network	Spillover/SE Language	Network Language	Spillover/SE Network Language
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Spillover/SE				0.0088		0.008	0.0071		0.0066
				(0.0002)		(0.0002)	(0.0002)		(0.0002)
ExpNetwork					0.0024	0.0012		0.0017	0.0009
					(0.0001)	(0.0001)		(0.0001)	(0.0001)
ImpNetwork					0.0335	0.0323		0.0324	0.0317
					(0.001)	(0.0009)		(0.0009)	(0.0009)
Language							0.01	0.0118	0.0093
							(0.0003)	(0.0003)	(0.0003)
Ncontacts	0.0016	0.0016	0.002	0.0019	0.0019	0.0018	0.002	0.0019	0.0019
	(0.00001)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)	(0.00002)
COL_proximity	0.131	0.0298	0.0308	0.0251	0.0301	0.0253	0.0182	0.0208	0.0189
	(0.0007)	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0005)
Ave_proximity	0.0281	-0.0072	-0.0105	-0.0107	-0.0105	-0.0107	-0.0107	-0.0105	-0.0106
	(0.0007)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Overall_proximity	-0.0752	-0.0076	-0.0059	-0.0062	-0.007	-0.007	0.0008[b]	0.0014	-0.0003
	(0.0037)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0004)
ExpGrowth	0.0028	0.00003	0.002	0.0013	0.0009	0.0007	0.001	0.0007	0.0006
	(0.0001)	(0.00001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ImpGrowth	0.0033	0.0012	0.0005	0.0005	0.0006	0.0006	0.0005	0.0005	0.0005
	(0.0002)	(0.0001)	(0.00005)	(0.00005)	(0.00005)	(0.00005)	(0.00005)	(0.00005)	(0.00005)
Lagged_Entry	0.422	0.6748	0.6036	0.6016	0.6012	0.5992	0.5999	0.5987	0.5976
	(0.0014)	(0.0032)	(0.0036)	(0.0035)	(0.0035)	(0.0035)	(0.0035)	(0.0035)	(0.0035)
GDP	0.009	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	(0.00004)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	1986-1992	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	20,857,435	13,441,274	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944	16,907,944
R-square	0.5499	0.5009	0.4593	0.4602	0.4607	0.4614	0.4607	0.4614	0.4618

Notes: This table shows the estimation results of equation (1) using Linear Probability Model(LPM). Columns (1) presents Thomas Chaney's results with French firms. Columns (2)-(9) present the results with Colombian firms. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. [a] indicates not statistically significant. [b] indicates statistically significant at 5% level. All other variables are significant at 1% level.

Table B.4: Estimated Spillover and Network Effects: LPM

(Restricted Sample)

Dependent Variable:	Expanding and Non-expanding Firms				All Firms			
$Pr(Entry_{i,c,t+1} = 1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Spillover/SE	0.0075***		0.0074***	0.0077***	0.0036***		0.0036***	0.0036***
	(0.0022)		(0.0022)	(0.0021)	(0.001)		(0.001)	(0.001)
ExpNetwork		0.0685***	0.0681***	-0.0008		0.0365***	0.0365***	0.0002
		(0.024)	(0.0239)	(0.0009)		(0.0114)	(0.0114)	(0.0005)
ImpNetwork		0.009	0.009	0.0112		0.008*	0.0081*	0.0091*
		(0.0071)	(0.0071)	(0.0075)		(0.0045)	(0.0045)	(0.0047)
Language	0.0158***	0.0175***	0.0151***	0.0159***	0.0077***	0.0084***	0.0071***	0.0074***
	(0.0022)	(0.0024)	(0.0022)	(0.0022)	(0.0011)	(0.0012)	(0.0011)	(0.0011)
COL_proximity	0.0233***	0.0268***	0.0235***	0.0235***	0.0115***	0.0132***	0.0116***	0.0117***
	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Ave_proximity	-0.0073	-0.0117	-0.0117	-0.007	-0.0036	-0.0054	-0.0054	-0.0037
	(0.0072)	(0.0075)	(0.0075)	(0.0073)	(0.0035)	(0.0036)	(0.0036)	(0.0036)
Overall_proximity	-0.0005**	-0.0005**	-0.0004*	-0.0005**	-0.0002*	-0.0002*	-0.0002	-0.0002*
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ExpGrowth	0.0375**	0.0014	0.0016	0.0358**	0.0203**	0.0011	0.001	0.0192**
	(0.0176)	(0.015)	(0.0152)	(0.0169)	(0.01)	(0.0089)	(0.0089)	(0.0097)
ImpGrowth	0.0011*	0.0009	0.0009	0.0011	0.0006	0.0005	0.0005	0.0005
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GDP	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***	<0.0001***
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Years	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
# Obs.	51,606	51,606	51,606	51,606	105,591	105,591	105,591	105,591
R-square	0.0371	0.04	0.0412	0.0375	0.0186	0.0205	0.0211	0.0191

Notes: This table shows the estimation results of equation (2) using Linear Probability Model(LPM). Column (4) and (8) present the results with firm-to-country export networks, while all other columns present results using firm-to-firm networks. The marginal effect is calculated as dy/dx at the average value of each x in the sample. dy/dx stands for a discrete change from 0 to 1 when x is a dummy variable. Sector fixed effects are controlled. Standard errors are clustered at the firm level. * indicates statistically significant at 10% level. ** indicates statistically significant at 5% level. *** indicates statistically significant at 1% level.

C Summary Statistics

Table C.1 and Table C.2 present the summary statistics and correlation coefficients between variables for the sample of Colombian firms that originally export to Chile only.

D Maps for Spillover and Export Network Effects

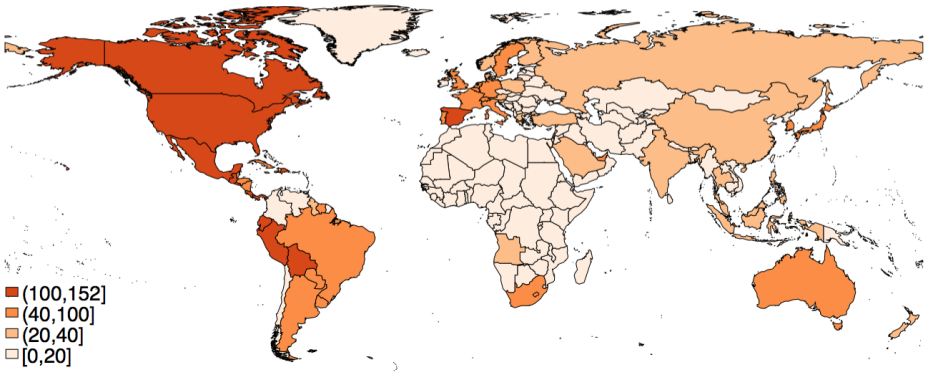
Figure 3 shows the geographic maps for the new destinations that the Colombian firms expand to as well as the export destinations of their peer firms and their matched Chilean trade partners. The intensity of the color represents the frequencies of exports. We can see that there is a large overlap between the Colombian firm's new export destinations and the export destinations of their peer firms and Chilean trade partners, suggesting that exporting firms may rely on both domestic spillovers and foreign networks when choosing a new export destination.

Table C.1: Summary Statistics

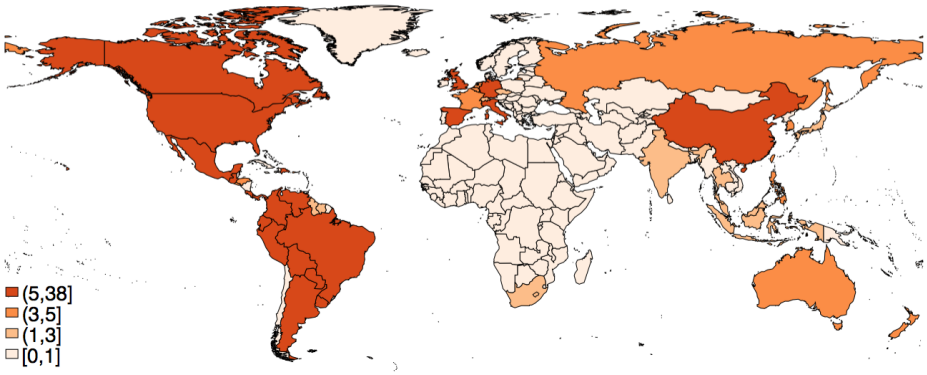
	Entry	Spillover/SE	Firm-to-firm ExpNetwork	Firm-to-country ExpoNetwork	ImpNetwork	Language	COL_ proximity	Ave_ proximity	Overall_ proximity	ExpGrowth	ImpGrowth	GDP
Mean	0.0022	0.1726	0.0042	0.2958	0.0129	0.0984	0.1744	0.1133	0.3347	0.0028	0.5471	3.38×10^{10}
Median	0	0	0	0	0	0	0.099	0.0841	0.2688	0	1	25942.62
Std. Dev.	0.0473	0.3779	0.065	0.4564	0.1126	0.2978	0.2064	0.0983	0.3355	0.0528	0.4978	1.42×10^{11}
Min	0	0	0	0	0	0	0.0516	0.053	0.0976	0	0	130.4654
Max	1	1	1	1	1	1	1.3633	0.8645	3.2844	1	1	1.81×10^{12}
No. of ones	237	18,223	448	31,329	1,357	10,386				295	57,765	
Percent of ones	0.22%	17.26%	0.42%	29.58%	1.29%	9.84%				0.28%	54.71%	

Table C.2: Correlation Coefficients Between Variables

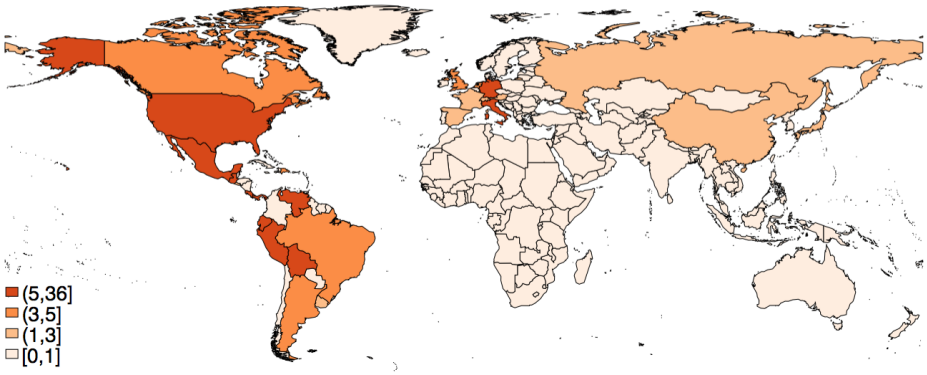
	Entry	Spillover/SE	Firm-to-firm ExpNetwork	Firm-to-country ExpNetwork	ImpNetwork	Language	COL_ proximity	Ave_ proximity	Overall_ proximity	ExpGrowth	ImpGrowth	GDP
Entry	1											
Spillover/SE	0.0827	1										
Firm-to-firm ExpNetwork	0.0677	0.0674	1									
Firm-to-country ExpNetwork	0.0666	0.344	0.1007	1								
ImpNetwork	0.0443	0.0583	0.0922	0.1384	1							
Language	0.0845	0.4086	0.1291	0.4027	0.0267	1						
COL_proximity	0.085	0.3898	0.0799	0.2782	-0.006	0.5967	1					
Ave_proximity	0.0519	0.2676	0.1463	0.2953	0.0141	0.6203	0.4389	1				
Overall_proximity	-0.018	-0.0743	-0.0284	-0.1223	-0.0302	-0.115	-0.0536	-0.1203	1			
ExpGrowth	0.0354	0.0489	0.4244	0.0793	0.072	0.0855	0.0472	0.1058	-0.021	1		
ImpGrowth	0.0021	-0.0251	0.0129	0.009	0.0086	-0.015	-0.0657	-0.0444	0.0036	0.0132	1	
GDP	0.0808	0.2244	0.0579	0.2545	0.2526	-0.0379	-0.0359	-0.0333	-0.0861	0.0566	-0.0037	1



(a) Export destinations of Colombian peer firms



(b) Export destinations of matched Chilean importing firms



(c) New destinations that Colombian firms expand to

Figure 3: Export Maps of Colombian and Chilean Firms