Intermediation and the Nature of Trade Costs: Theory and Evidence

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Abstract

In this paper we use a new data set of matched importer-exporter transactions for Chile and Colombia to document basic characteristics of the ways that trade is intermediated. We find that, in virtually every Chilean exporter-Colombian importer pair, at least one of the parties is a large international trader. Also, more than half of the Chilean exporters sell to only 1 Colombian importer. These exporters sell smaller amounts and fewer HS codes to Colombia and to the world but sell large amounts and more HS codes per importer. Also, they sell to importers that purchase larger amounts and more HS codes. Based on these characteristics, we develop a model of trade in which firms have access to multiple intermediation technologies and choose an intermediation technology as part of the equilibrium. We show that a two-intermediation technology model can capture the basic features of the data. Using this model, we explore the ways that changes in the trading environment, including trade reforms, impact trade costs and trading activity.

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1 Introduction

The answer to the question,"How does an exporting firm get its product into the hands of foreign market customers?" has important implications for assessing the impact of trade policy. For instance, in a case study of exports from the US into Canada, it was found that a set of sheets produced in the US, and sold in both the US and Canada, retailed for a considerably higher price in Canada than in the US. The explanation for the price difference was not tariffs or other trade barriers but the fact that distribution of the sheets involved both a longer supply chain in Canada than in the US and significantly higher markups throughout the supply chain in Canada. The implication is that a reduction in tariffs on imported sheets would have little impact in Canada unless the tariff reduction alters the distribution technology.

Traditionally, models of international trade would have assumed that firms have access to a competitive, constant returns-to-scale distribution sector. Distribution would have been one of many per-unit trade costs incurred in exporting. More recently, trade models have adopted various non-constant returns trading technologies as a means of understanding new, firm-level trade data. Melitz (2003), for instance, assumes that a firm that exports incurs some fixed cost by which it is able to sell to all customers in the foreign market. Each unit of exports incurs a constant, iceberg trade cost.[1] For Melitz, selling abroad is a decreasing cost activity within an export destination and this explains why both a significant fraction of firms in an industry do not export and these non-exporting firms are, on average, small. Hanson and Xiang (2008) shows evidence that selling abroad is also a decreasing cost activity across export destinations. In either case, trade liberalization works to change the distribution of exporting firms. In Arkolakis (2007), exporting firms incur no fixed cost of exporting but incur a variable selling cost that is increasing in the fraction of foreign country consumers to which the firm sells. For Arkolakis, distribution to customers abroad is an increasing cost activity. This opens a new avenue through which trade liberalization works; namely, liberalization increases the fraction of the population that has access to foreign goods.

Underlying these trade cost specifications are some implicit distribution

[1] Eaton, Kortum and Kramaerz (2005) adopt a similar technology assumption but allow the fixed distribution cost to vary across export destinations.

technologies. The Melitz specification, for instance, involves some intermediation technology that requires the exporting firm to incur a quantity invariant cost to get its product out of its country and /or a quantity and country size invariant cost to establish its presence in the destination country. Arkolakis has a discussion about technologies that implicitly generate his distribution cost specification, including the advertising technology assumed in Butters (1977). What these technologies correspond to, in fact, is unclear. In all cases, the distribution technology itself is unaffected by trade policies. As the above example suggests, understanding the distribution technology, and any impact that trade policies might have on it, will be important for our understanding of trade and trade policy.

In this paper, we seek to accomplish two things. First, using a data set of matched importer-exporter transactions, we document some basic characteristics of the ways that trade is intermediated. Second, based on these characteristics, we develop a model of trade in which firms have access to multiple intermediation technologies and choose an intermediation technology as part of the equilibrium. As a result, intermediation activities and associated trade costs vary with the trading environment, including with trade reforms. In this way, we are able to address the issue of how distribution occurs and how it affects trade outcomes. In addition, we are also able to provide micro structure for the trade cost specifications in the literature.

The data set we use matches all Chilean exporters with their Colombian importers over the period 2004-2006. These matched data provide information on all international trade carried out by each importer and each exporter at the transaction level. The data analysis reveals at least three interesting patterns. First, as in many other data sets, there is a large number of small Chilean exporters and a few very large ones. Perhaps more surprisingly, the same pattern holds on the importer side; namely, there is a very large number of small Colombian importers from Chile and a few large ones. As to the latter observation, around 25% of the Colombian importers from Chile buy less than US$13,000 from Chile, although the average Colombian importer buys US$319,000 from Chile per year. Second, in virtually every Chilean exporter-Colombian importer pair, at least one of the parties is a large international trader. The 25th percentile of the distribution of bilateral trade volumes by exporter-importer pair (exporter's sales to Colombia plus importer's purchases from Chile) is almost US$250,000 per year. The 25th percentile of the distribution of worldwide trade by exporter-importer pair (exporter's sales to the world plus importer's purchases from the world) is almost US$3 million

per year. In other words, if the exporter is small the importer is large and vice-versa. Third, on average Chilean exporters sell to 2.3 Colombian importers, but the distribution of importers per exporter is very skewed. More than half of the Chilean exporters sell to only 1 Colombian importer but, at the 99^{th} percentile, exporters sell to around 20 importers. In addition, exporters that sell to few importers sell smaller amounts and fewer HS codes to Colombia and to the world but sell large amounts and more HS codes per importer. Also, they sell to importers that purchase larger amounts and more HS codes.

Since exporter-importer matches are presumably created in a way that minimizes trade / distribution costs, these data suggest that efficient trading involves large volume matches. Given there are both small exporters and small importers, such matches can be created either by a small importer matching with a large exporter or by a small exporter matching with a large importer. Matches of small exporters with small importers do not occur in the data. These matching patterns are not explainable with existing models of trade, which have a homogeneous "importer" sector. In Melitz, for instance, firms sell directly to consumer-importers. Each consumer-importer purchases all imported products, all are the same size and match with the same number of exporters (all of them) so sales per consumer- importer are identical. A similar pattern holds in Arkolakis, although both the size and number of exporters with which importer-consumers match is smaller (since consumers only match with a subset of exporting firms).

In light of these facts we seek to develop a heterogeneous firm trade model that can replicate the matched data. In the model, there are two intermediation technologies for selling to foreign consumers. One technology is a direct-to-market selling technology, the cost of which is decreasing in the size of the exporter. This technology is adopted by large exporting firms who sell, not by finding buyers in the foreign market, but by buyers finding them. In essence, by bearing the costs of being large, these firms do not have to bear the cost of finding customers. This technology generates the large exporter-small importer match. Small firms, finding it costly to sell directly to consumers, instead sell indirectly by pairing-up with large import intermediaries. Under this technology, intermediaries are large and so are easily found by both consumers and exporters. This is the intermediated trade technology and the one that generates the small exporter - large importer match. By being large, the intermediaries are able to spread their costs of intermediation over many exporting firms.

In the equilibrium of the model large and more productive firms choose the first intermediation technology and export directly to the foreign market. The less productive export firms use the intermediation technology to reach foreign customers. The least productive firms do not export at all. Under this equilibrium, there will be a large number of small importers that buy directly from large exporters and a few large importers, the distribution intermediaries. In every trade relationship at least one of the parties will be a large trader, large exporters will deal with multiple importers and small exporters will sell to few intermediaries.

A further implication of this dual distribution system is that, within any given destination country, selling abroad is a decreasing cost activity for firms with a small global presence and a constant cost activity for firms with a large global presence. Across destination countries the situation is reversed. Selling to more destinations is a constant cost activity for firms with a small global presence and a decreasing cost activity for the ones with a large global presence.

The model also provides a number of other insights. First, countries having large numbers of customers demanding small amounts of the export product are more costly to serve than those having small numbers of customers demanding large amounts of the export product: low entry cost countries are those for which the firm can sell large amounts to few importers. As a result, there is a non-linearity in the pattern of intermediation. Specifically, as a country becomes larger, initially the value of exports sold via import intermediaries declines relative to the value sold via direct-to-market selling; once the country becomes sufficiently large, the value of exports sold via import intermediaries increases. Second, a reduction in variable trade costs – either lower unit transportation costs or lower tariffs – induces firms to switch from using intermediaries to direct selling. It also induces entry into exporting using intermediaries to reach foreign consumers. In the end exports sold both via import intermediaries and via direct-to-market selling will be larger but the relative value of exports sold via these two means will be the same. Third, a trade reform in one country can have external benefits for another, non-reforming country by reducing the cost of direct-to-market selling in the non-reforming country. Finally, exporters of more homogeneous products will tend to use less import intermediaries than exporters of less homogeneous products.

The paper is organized in the following way. The next section discusses the data. Section 3 presents the evidence on exporter-importer pairs. Section

4 develops the model while Section 5 analyses the model's implications for trade and intermediation patterns. Section 6 concludes. Additional information about the data set is included in the Appendix.

2 Data Description

The data set used in this paper combines confidential transaction-level export data from Chile and import data from Colombia for the years 2004, 2005, and 2006. The key characteristic of the data set is that it contains information on the importing parties with which each Chilean exporter transacts in foreign markets and the exporting parties from abroad with which each Colombian importer transacts. This information allows us to match Chilean exporters with their Colombian importers to create a data set with bilateral and global trade information for each exporter/importer pair. In the next two subsections, we describe the Chilean transaction-level export database and the Colombian transaction-level import database respectively. The remaining two subsections describe the procedure used to match Chilean exporters and Colombian importers and report summary statistics and consistency checks on the matched data set.

2.1 Chilean Customs Data

The Chilean exports data are obtained from Chile's customs office for the years 2004, 2005 and 2006. For each export transaction, the data set provides information on the identity of the exporting firm (name and tax ID), the 8-digit Harmonized System code of the product exported, the destination country, and characteristics of the shipment such as weigh, quantity, FOB and CIF values, name of the vessel, port of entry, etc. The data set also provides the identity (i.e., name) of the importer in the destination country.

Table 2.1 reports summary statistics of the Chilean transaction-level exports data. In 2004 there were 6,543 Chilean firms that exported, selling a combined US$ 30.5 billion to 180 destination countries. On average, each exporter sold slightly less than US$ 4.7 million and exported to 3.5 destinations. Around 10% of all Chilean exporters sell to Colombia (as discussed in the Appendix, Colombia is the 9th most popular destination for Chilean exporters) although, in terms of value, sales to Colombia represented only slightly more than 1% of all Chilean exports. According to the Chilean cus-

toms data 961 Colombian firms imported products from Chile in 2004. The distribution of exports for Chilean firms confirms that a large fraction of exporting firms sell small amounts both to Colombia and worldwide.

Appendix A shows that Chilean exporters share the same characteristics as American exporters (e.g. Bernard and Jensen 1995), French exporters (e.g. Eaton et al 2004, 2008), and Colombian exporters (Eaton et al 2007). In particular: i) most exporters sell to few destinations while few exporters sell to many destinations; ii) exports are concentrated in a few firms that sell to many destinations; iii) in any given year, a large fraction of exporters are new exporters but new exporters export very little compared to firms that have been exporting for at least one year; iv) a large share of exporters exports small values; v) there is a large fraction of exporters selling very little to any given destination; vi) the number of exporters selling to any given destination and the amount they sell vary with market size; vii) there is no strong hierarchy in export destinations. Blum et al (2008) shows that: (viii) few Chilean firms export; ix) exporters are larger, more productive, and export a small fraction of their output.

2.2 Colombian Customs Data

The Colombian import data are obtained from Colombia's customs office. The data report transaction-level imports of Colombian firms that imported from Chile at least once in the 2004-2006 period. For each transaction with a Chilean entity, the data set provides the name and ID code of the importing firm, the country of origin and country of last departure of the imported product, the 10-digit Harmonized System code classification of the product and characteristics of the shipment such as weight, quantity, and FOB value. The data set also provides the worldwide value of each firm's imports and the name of the exporting entity in the country of origin.

Table 2.2 provides summary statistics, based on the Colombian customs data, for import purchases from Chile by Colombian firms. In the data, 993 Colombian firms imported products from Chile in 2004. On average, these firms purchased US$ 4.9 million from 8.1 different countries, including Chile, and US$ 335 thousand from Chile. The imports distribution of Colombian firms shows a large share of small importers from Chile, with 25% of importers having bought less than US$ 9,786 in 2004. By contrast, the distribution of worldwide purchases for these importers shows many less small importers. Indeed, the 25^{th}percentile in this distribution imported US$ 73,501 from the

world.

2.3 Matching Procedure

Both the Chilean and Colombian data sets contain the identities of Chilean exporters selling to Colombia and the identities Colombian importers buying from Chile. However, only the Chilean data set contains information on the sales of Chilean firms to the rest of the world – how large a Chilean exporter is globally – and only the Colombian data set contains information on the worldwide purchases of Colombian importers – how large a Colombian importer is globally. By merging the two data sets we obtain, for each Chilean exporter – Colombian importer pair, information on both its bilateral trade and its trade with the rest of the world.

In order to match the two data sets, we first clean them to eliminate obvious name misspellings. We use ID numbers in Colombia and Chile to distinguish between firms' legal and trading names and to identify firms that belong to the same multinational corporations. In cases where companies' names are similar but not identical, we compare transaction values, quantities and HS codes to check whether the companies are indeed the same.

Before discussing the matching criteria, we should note that there are several reasons why some transactions might not be matched. First, Colombia's customs office registers all imports coming from Chile regardless of whether the product originated in Chile or not. For example, Bolivian products exported to Colombia through Chile are registered by the Colombian customs as coming from Chile. These products are not registered by Chilean customs as a Chilean export. We deal with this issue by focusing only on import transactions that have Chile as "country of origin". Second, the Chilean customs database does not report shipments from Chile's free trade zones. Firms located in these duty-free areas import and re-export products that are never registered as entering Chile. Therefore, depending on how these transactions are reported to Colombian customs officials by the Colombian importer, they may be recorded as Chilean exports. Based on our examination of a confidential data set with information on exports from Chile's free trade zones, we concluded that virtually none of the unmatched transactions are exports from these free-trade zones. Third, in some cases a Chilean firm exports to a consolidator in a third country that then redirects the products to their final destination. In these cases, the Colombian customs office may report an import having Chile as the country of origin while the Chilean cus-

toms' office may have the consolidator's country as the products' destination. There is nothing we can do deal with this source of measurement error but, as we will discuss later, it should not drive the results we find. Indeed, in all likelihood it will play against our findings. Finally, transactions might not be matched because of recording mistakes by customs officers. For instance, according to customs' officers in Chile, it is not uncommon that a shipment to Colombia is recorded as a shipment to the United States if the majority of the shipment goes to the United States and a small part of it is delivered to Colombia (where the ship makes a stop). Because there are no taxes on exports, customs officials in the exporting country (Chile) have no incentive to verify precisely the destination of the shipment.

We employ three alternative data matching procedures, each of them based on importers' and exporters' names. The first one matches transactions that have the same Chilean exporter as reported by the Colombian and Chilean data sets. The second one matches transactions that have the same Colombian importer as reported by the two data sets. The third one matches transactions that have the same Chilean exporter and Colombian importer according to the Chilean and Colombian customs data. For each of these matches we produce a liberal and a conservative version to deal with the fact that some transactions appear in the Chilean and Colombian data sets in different calendar years. This happens either because export shipments at the end of the calendar year may be recorded as imports in the destination country in the following calendar year or simply because customs officials have a time span of four months to register a transaction. The liberal version assigns a match if the exporter's (importer's) names in the two data sets perfectly match, even if the calendar year of the transaction does not match. The conservative version assigns a match only if names and year match.

Panels A and B in Table 2.3 describe success rates of the matching procedures both in terms of transactions and exporters and importers matched. In terms of transactions, when we use either the exporter's or importer's name we can match well over 90% of all transactions, sometimes over 99% of them. When we use both of them we can match around 90% of all transactions.[2] .In terms of exporter and importer firms matched, we consider a firm matched if there is at least one transaction in which a match is assigned. For instance, as Tables 2.1 and 2.2 showed, the Chilean Customs data indicated that 681 Chilean firms exported to Colombia in 2004, while the Colombian

[2] Appendix B describes the characteristics of unmatched transactions (to be done).

Customs data indicated that 696 Chilean firms exported to Colombia in the same year. When we use Chilean exporters' names, for 570 exporters we are able to find at least one transaction in which the exporter's name is the same in the Chilean and Colombian data. When we use Colombian importers' names as the matching criterion, for 611 Chilean exporters we can find at least one transaction in which the importer's name is the same in the Chilean and Colombian data. When we use both the exporter's and the importer's names this number falls to 540 Chilean exporters.

2.4 Properties of the Matched Firms

Despite the high matching rates presented Table 2.3, it is important to make sure that Chilean exporters and Colombian importers in the matched data retain the main properties of all Chilean exporters to Colombia and all Colombian importers from Chile. Tables 2.4 and 2.5 present summary statistics on matched exporters and importers that can be compared to the information in Tables 2.1 and 2.2. respectively. The bottom part of Table 2.4 shows that, using both importer's and exporter's names as the matching criterion, we match US$ 276 million of the US$ 309 million in Chilean exports to Colombia reported in the Chilean data in 2004 (the Colombian data reported US$ 327 million in Chilean exports to Colombia in the same year). The average Chilean exporter in the matched data set sells to 12.7 destinations and sells slightly over US$ 500,000 to Colombia. According to the Chilean customs data, Chilean exporters to Colombian sell on average to 11.6 destinations and sell slightly more than US$ 450,000 to Colombia. Although these averages are similar, they suggest that, as expected, the unmatched exporters tend to be smaller than the average Chilean exporter to Colombia. The distribution of Colombian sales of Chilean exporters confirms this. The 10^{th} percentile of this distribution in the Chilean customs data with all exporters to Colombia is equal to US$ 3,250 while in the matched data it is equal to US$ 4,491. The distribution of Colombian sales of Chilean exporters is shifted to the right in the matched data but it is still the case that the vast majority of exporters sell small amounts. For instance, 25% of all exporters to Colombia sell US$ 21,000 or less in any given year. The distribution of Chilean purchases of Colombian importers is also somewhat shifted to the right in the matched data set but, again, the main properties of Colombian importers are present in the matched data.

3 Evidence on Exporter-Importer Pairs

Table 3.1 reports summary statistics for the Chilean exporter-Colombian importer pairs.[3] The 540 Chilean exporters in the matched data set traded on average with 2.3 importers to create a total of 1,264 importer-exporter pairs in 2004. However, as Table 3.1 shows the distribution of the number of importers per exporter is skewed to the right and shows significant heterogeneity in the number of importers that exporters deal with. More than half of the exporters sell to only one importer while at the 99^{th} percentile of the distribution exporters sell to19 importers. The distribution of the number of exporters per importer is also skewed to the right and shows heterogeneity, although less so. More than half of the importers deal with only one exporter and at the 99^{th} percentile importers deal with 9 exporters.

The bottom part of Table 3.1 shows the distribution of bilateral trade – the sum of the Chilean exporter's sales to all importers in Colombia and the Colombian importer's purchases from all exporters in Chile – by exporter-importer pair. It also shows the distribution of worldwide trade – the sum of the Chilean exporter's sales to all countries and the Colombian importer's purchases from all countries– by exporter-importer pair. As a basis for comparison, the 25^{th} percentile, by exporter, of the distribution of Chilean export sales to Colombia in the matched data set is US $21,000 and the 25^{th} percentile of the distribution of Colombian purchases from Chile by importer is US$ 17,000. When we look at the distribution of bilateral and worldwide trade at the exporter – importer pair level, the 25^{th} percentile is US$ 245,000 and US$ 2.8 million respectively. This indicates that, even though there are many *small* importers and exporters, there are very few importer-exporter pair where both parties are *small*.

To sum up, two empirical regularities emerge from Table 3.1: i) most exporters deal with one importer only but a few exporters deal with many importers; and ii) small traders match with large traders. Next we take a closer look at these two data regularities.

Table 3.2 provides information on the differences between both exporters that deal with many importers (versus those that deal with few) and importers that deal with many exporters (versus those that deal with few). Panel A shows that, after controlling for year and industry (2-digit HS code)

[3]This section uses the data created by matching both importer and exporter names. All the results hold when alternative matching criteria are used.

fixed effects, exporters that sell to few importers have smaller sales and sell fewer HS8 codes to Colombia and to the world. However, they have significantly higher sales and sell more HS8 codes per importer. They also sell to fewer destination countries and to importers that buy more HS10 codes. The final column in this Panel shows the correlation at the importer-exporter pair-level between the number of trade partners of the importer and of the exporter. This correlation is statistically negative, indicating that exporters that sell to few importers deal with importers that buy from many exporters. In summary, exporters that trade with few importers sell relatively small amounts but sell relatively large amounts per exporter and deal with importers that buy many HS codes from many exporters.

Panel B shows that importers that buy from many Chilean exporters buy larger amounts and more HS8 codes from Chile and the world. They also import significantly smaller amounts and fewer HS8 codes per exporter. Finally they deal with Chilean exporters that sell fewer HS8 codes to Colombia.

Figure 1 examines more closely who Chilean exporters sell to. The series marked with circles shows the share of Chilean exporters to Colombia that sell less than the "Cutoff Value" – shown in the x-axis – in 2004. The vertical lines indicate that almost 20% of the Chilean exporters sold less than US$ 10,000 to Colombia in 2004 while around 35% of them sold less than US$ 30,000 to Colombia in the same year. The series marked with triangles shows the share of Chilean exporters that sold less than the "Cutoff Value" to Colombia *and* traded exclusively with Colombian importers that bought less than the "Cutoff Value" from Chile in 2004. These are the Chilean exporters that are in importer-exporter pairs that are small (i.e., trade less than the cutoff value) in a bilateral sense. For the cutoff point of US$ 30,000, this is the case for 20% of the Chilean exporters. The series marked with squares shows the share of Chilean exporters to Colombia that, in addition to meeting the two previous conditions, sold exclusively to Colombian importers that bought less than the "Cutoff Value" from the World in 2004. For the US$30,000 cutoff point, around 5% of the Chilean exporters fall in this category. Finally, the series marked with diamonds shows the share of Chilean exporters that satisfy the three previous conditions *and* sold less than the "Cutoff Value" to the World. These are the ones where the importer-exporter pair is small in a global sense. As we can see, virtually no Chilean exporter – Colombian importer pair falls into this category, even when the cutoff value is as large as US$ 200,000.

Table 3.3 provides a snapshot of the information in figure 1 for a cutoff

of US$ 30,000. Panel A shows that 195 of the 540 Chilean exporters that traded with Colombia in 2004 sold less than US$ 30,000 to Colombia. Of these exporters, 116 sold only to importers that purchased less than US$ 30,000 from Chile, 73 sold only to importers that purchased more than that, and 6 sold to both. The fact that only 6 exporters sell to both small and large importers suggests that there is sorting going on. Panel B shows that, of the 116 that sold to importers that purchased less than US$ 30,000 from Colombia, only 12 exported less than US$ 30,000 to the world and dealt with Colombian importers that purchased less than that from the world. The other 104 are either large global exporters or deal with large global importers.[4] What this figure shows is that there are virtually no small importer - small exporter pairs.

4 A Model of Trade and Distribution

In what follows, we develop a model of international trade with an explicit distribution sector. To simplify the presentation of the model and analysis, we present first a closed economy model that serves simply to lay out the basic environment and to define some basic concepts. We then provide a model of trade with a single distribution technology. This analysis allows us to draw analogies with existing literature and to provide motivation for our two-technology model. Finally, we present the model with two distribution technologies and draw out the implications of this model for trading behavior.

4.1 The Closed Economy

The basic model is very much in the spirit of the Melitz (2003) model of trade. Specifically, in any country, k, there are 2 final goods sectors, a perfectly competitive sector producing a homogeneous good, X, and a monopolistically competitive sector with a continuum of firms producing differentiated products indexed by ω. There is a single input, labor, used in the production of both goods. The endowment of labor in Country k is denoted by $\overline{L}_k$.

[4] Upon closer inspection we find that the 12 cases mentioned above do not contradict the findings that one of the parties has to be large. For example, one of the cases is that of a Chilean maintenance company that imported a part to fix a broken machine at a plant in Colombia. Another one is boyscouts from Chile shipping folders to boyscouts in Colombia.

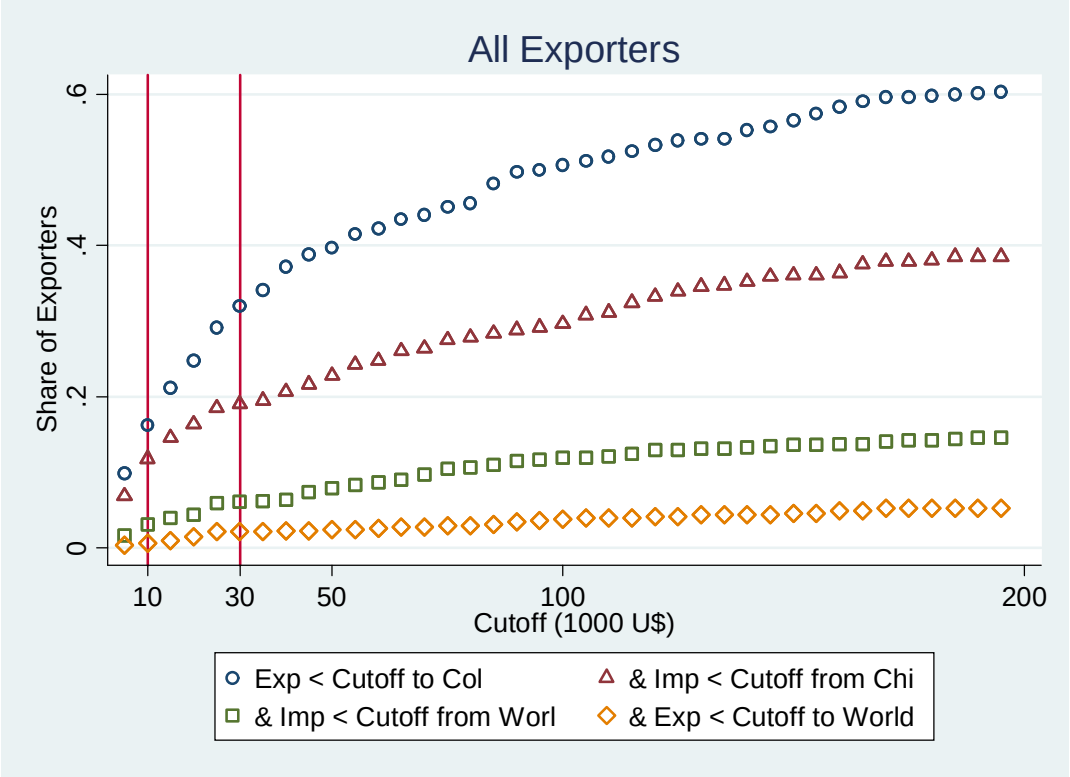


Figure 1: Who Chilean Exporters Sell To (2004)

4.1.1 Production

Good X is produced with a constant returns to scale technology and with units defined so that one unit of labor produces one unit of X. We assume that X is the numeraire good with the price of X normalized to 1. Together, these assumptions imply that the wage rate is also 1.

In the monopolistically competitive sector, a firm that produces a positive amount incurs a fixed cost, measured in units of labor, of f. This cost is identical across firms. Firm's are heterogeneous in labor productivity, with the output of a firm with productivity ϕ given by the production function $y(\phi) = \phi\ell(\phi)$, where $\ell(\phi)$ is the labor utilization in production of a firm with productivity ϕ. For each firm, the productivity parameter is an independent draw from the distribution $G(\phi)$ with support $[\underline{\phi}, \overline{\phi}]$ and density $g(\phi)$. Upon paying a sunk entry cost measured in units of labor, f_e, a firm obtains a productivity draw from $G(\phi)$. Should a firm with productivity draw ϕ choose to produce a positive amount, the firm incurs production costs of $c(\phi) = f + y(\phi)/\phi$. There is free entry into the monopolistically competitive sector so that expected profits in this sector are zero.

4.1.2 Consumer preferences

All consumers in Country k are identical, with preferences given by the utility function $U = Y^{\alpha}X^{(1-\alpha)}$, where Y is a CES aggregator defined as $Y = \left[\int y(\omega)^{\rho}di\right]^{1/\rho}$ and $y(\omega)$ is the quantity consumed of variety ω. We assume that $\alpha \in (0,1)$ and $\rho \in (0,1)$. Given the Cobb-Douglas preference structure, consumption of X in Country k is given by $(1-\alpha)I_k$, where I_k is aggregate income in k.

The remaining αI_k is spent on the differentiated products. Given the CES preference structure for the differentiated product, Y, and given a total measure of producers in Country k of N_k, demand for a variety ω produced by a firm with productivity ϕ is given by the expression $y(\phi) = \alpha I_k p(\phi)^{-\sigma}P^{\sigma-1}$, where $P = \left[\int p(\phi)^{1-\sigma}N_k\nu(\phi)d\phi\right]^{1/1-\sigma}$ is the CES price index, $p(\phi)$ is the price of a variety produced by a firm with productivity parameter ϕ, $\nu(\phi)$ is the distribution of firms selling in Country k, and $\sigma = 1/(1-\rho) > 1$.

4.1.3 The autarky equilibrium

As in Melitz, the profit maximizing price for a firm with productivity ϕ selling domestically is given by $p(\phi) = 1/\rho\phi$. In autarky, this implies that $P = N_k^{1/(1-\sigma)}/\rho\widetilde{\phi} = N_k^{1/(1-\sigma)}p(\widetilde{\phi})$, where $\widetilde{\phi} = \left[\int \phi_i{}^{\sigma-1}\nu_k(\phi)d\phi\right]^{1/\sigma-1}$. Letting R_k be aggregate expenditures in the differentiated products sector in Country k, (i.e., $R_k = \alpha I_k$), firm revenues are given by $R(\phi) = (R_k/N_k)(\phi\,/\,\widetilde{\phi})^{\sigma-1}$ and firm profits by $\pi(\phi) = R(\phi)/\sigma - f$. The firm with productivity parameter ϕ^* such that $\pi(\phi^*) = 0$ will define the marginal producer and so $\nu_k(\phi) = g(\phi)/(1 - G(\phi^*))$. As shown in Melitz, there is a unique ϕ^* that satisfies the free-entry and zero profit conditions. In the equilibrium, the value of I_k is given by $I_k = \overline{L}_k$. The mass of firms, N_k, is given by the equation $N_k = R/R(\widetilde{\phi}) = \alpha\overline{L}_k/\sigma(f + \pi(\widetilde{\phi}))$, where $\pi(\widetilde{\phi}) = f\,[(\widetilde{\phi}/\phi^*)^{\sigma-1} - 1]$.

4.2 The Open Economy: one distribution technology

Consider now an international trade setting. As in Melitz, we suppose that firms in the differentiated products sector incur a variable trade cost for transactions between countries j and k. These costs are of the iceberg variety and are such that a firm requires $\tau_{jk} > 1$ units of production of variety ω to deliver 1 unit from Country k to Country j. These costs are assumed symmetric between country pairs and the same for all varieties. This means that the marginal cost of an export for a producer with productivity parameter ϕ is τ_{jk}/ϕ. We also assume that markets are segmented internationally. Together, these assumptions imply that the profit maximizing export price for a Country k firm with productivity ϕ exporting to Country j is $\tau_{jk}/\rho\phi$. The profit maximizing domestic price for this firm continues to be $1/\rho\phi$.

In Melitz (and others) a producer of any variety must bear a fixed cost of exporting for each country to which it exports. This cost is the same for all varieties and is given exogenously. Unanswered in the model is what activities are responsible for this cost? The answer to this question is important because it affects how one might reasonably model exporting costs. For instance, if the cost of exporting is associated with the processing of all paperwork associated with the movement of products from one country to another, one might imagine that there are (cross-country) scale economies in this activity, as in Hanson and Xiang (2008). If, on the other hand, exporting costs are associated with the direct cost of getting the product across any given country's border – the time and hassle costs of processing the products

through customs – then perhaps a fixed, per-country cost is appropriate. If exporting costs are associated with identifying customers in the foreign country, then a per customer cost, as in Arkolakis, may be appropriate. Whatever the case, a micro model of the exporting activity allows one to structure exporting costs in a way that makes it possible both to confront the transactions level data on exporting and to determine how the distribution system might impact the effectiveness of trade policy.

4.2.1 The distribution technology

Our approach here is to take the stance that the significant, non-transportation cost associated with exporting is a distribution cost associated with matching customers in Country j with firms in Country k. In essence, the ultimate problem that any exporter has is identifying and selling to customers in the foreign country. There are many approaches one might take to modeling this cost. We begin with what we consider the simplest approach and one that delivers an exporting environment very similar to that in Melitz. It is based on a model by Townsend (1983).

Specifically, we assume that a resource cost of $m > 0$ must be incurred in order to match an exporter of variety ω from k to a single consumer in j and sell to that consumer. For simplicity, we assume that this cost is the same for all varieties and for all exporter/consumer pairs. The cost may be borne either by the consumer, by the exporter or shared between the two agents. We assume that there is no cost of matching producers and customers within a country (this is the implicit assumption in Melitz).

Since an exporter only ever captures a fraction of the total surplus generated by the export of its variety, an efficient distribution system in this setting requires the consumer to bear some of the match cost. That is to say, were the exporter to bear the full cost of creating a match with consumers, as is the case in Melitz and others, the exporter that is marginal – the ϕ_x^* exporter of Melitz – generates a surplus that is larger than the match cost. As a result, consumers in Country j will be willing to bear some of the cost of matching in order to obtain certain varieties produced in Country k from firms with productivities less than ϕ_x^*. Thus, the efficient exporting solution involves consumers in Country j sharing some fraction of the matching cost in order to make feasible exports from low productivity producers in Country k.

To define the marginal exporter for this case, we need to define total

surplus – consumer surplus plus profits – for the marginal exporter. For simplicity of presentation, we assume that $\tau_{jk} = \tau$ for all j, k pairs. Since exporters set price equal to $\tau/\rho\phi$, consumer surplus for an individual in Country j purchasing a variety exported by a firm with productivity ϕ is given by

$$\begin{aligned} CS(\phi) &= \alpha P_j^{\sigma-1} \int_{\tau/\rho\phi}^{\infty} p(\phi)^{-\sigma} dp \\ &= \frac{\alpha}{\sigma - 1} P_j^{\sigma-1} (\tau/\rho\phi)^{1-\sigma}. \end{aligned}$$

Profit for the exporter to Country j with productivity ϕ from the match is given by

$$\pi_x(\phi) = \alpha P_j^{\sigma-1}(1-\rho)(\tau/\rho\phi)^{1-\sigma}.$$

Total surplus generated by the match is then

$$\begin{aligned} TS_x(\phi) &= \alpha P^{\sigma-1}(\tau/\rho\phi)^{1-\sigma} \frac{2\sigma - 1}{\sigma(\sigma-1)} \\ &= \frac{r_x(\phi)}{\sigma \overline{L}_j} \frac{2\sigma - 1}{(\sigma - 1)} \end{aligned}$$

where $r_x(\phi)$ is revenues from exporting and is defined as in Melitz. The marginal exporter will be the firm with productivity ϕ'_x such that $r_x(\phi'_x)/\sigma = \overline{L}_j m \times (\sigma - 1)/(2\sigma - 1)$. Note that, were the exporter to bear the full cost of exporting, the marginal exporter would be defined by the condition $r_x(\phi^*_x)/\sigma = \overline{L}_j m$. Thus, we have that $\phi'_x < \phi^*_x$; that is, the marginal exporter under sharing will have lower productivity, higher prices and smaller export sales. Welfare of the importing country increases.

As is likely clear from this analysis, this distribution technology shares various features of the Melitz exporting model: exporting firms either sell to all customers in Country j or none and the cost of exporting to Country j is $f_{ex} = \overline{L}_j m \times (\sigma - 1)/(2\sigma - 1)$. As such, the trading equilibrium will be defined as in Melitz. Note, however, that unlike the Melitz exporting technology, export costs here vary with the size of the foreign country market and the elasticity of substitution among varieties. These features of the distribution technology will be explored subsequently.

Perhaps unsurprisingly, this simple distribution technology is not consistent with the data on exporting and importing. Under the technology, all "importers" are the same size, all exporters match with the same number of "importers" and all "importers" match with the same number of exporters (as in Melitz and others). As noted earlier, the data are strikingly at odds with this prediction. Specifically, the data show that the vast majority of Chilean export firms match with a small number of importers (many just 1) while a small fraction of exporters match with many importers. Further, those that match with a small number of importers export relatively small amounts to Colombia and to the rest of the world but export relatively large amounts per Colombian importer. Those that match with many Colombian importers sell relatively large amounts to Colombia and to the rest of the world but export relatively small amounts per Colombia importer. Finally, there are virtually no small importer-small exporter matches: small exporters match with large importers and small importers match with large (typically global) exporters. These facts suggest that there are likely multiple technologies for exporting, that the cost of market entry in any particular country may affected by global export sales and that small exporters may be able to share market entry costs by using a large intermediary. Below we flesh out a 2 technology model of trade to try to deal with these facts.

4.3 A two-technology model of intermediation

We consider here a model in which there are two possible modes of market entry into a foreign country. One is similar to the above in that selling occurs directly between an exporting firm and a foreign market consumer. We call this technology the "direct-to-market selling technology". The other involves intermediated trade in the sense that the exporting firm sells to an importing intermediary, who is not the final consumer, and the foreign customer buys from the importing intermediary. We call this technology the "intermediated trade technology". We describe each technology in detail below.

4.3.1 The direct-to-market selling technology

This technology is similar to the one in the previous section in that selling occurs directly between an exporting firm and a foreign market consumer. Unlike the above technology, however, the cost of creating a firm-customer match under the direct-to-market technology depends on the size of the ex-

porting firm. Specifically, under this technology a foreign market customer can expend resources finding an exporting firm in Country k. The resource cost of creating the match in this case depends on the Country k firm's global export sales, $s_k^x = \sum_j s_{jk}$, where $s_{jk} = p_{kj}y_{kj}$ gives export sales by a Country k firm to each Country j. The match cost relationship is given by $m_D(s_k^x) \geq 0$, with $m_D(\cdot)$ weakly decreasing in s_k^x and such that $m_D(s_k^x) = \overline{m}$ for $s_k^x \leq \underline{s}$ and $m_D(s_k^x) = \underline{m} < \overline{m}$ for $s_k^x \geq \overline{s}$. As before, the exporting firm, alternatively, can expend resources identifying individual foreign market consumers. The resource cost of creating a match is then $\overline{m}$ per customer (customers are small). Note that, since costs are weakly smaller in the former case, the efficient solution involves foreign market customers identifying exporting firms, resulting in resource cost of $m_D(s_k^x)$ under the direct-to-market technology.

The basic idea behind this structure is that, if firms are large enough global players, they are so well known that foreign customers need expend few if any resources to identify them. As a result, the resource cost of selling is small in this case. If an export firm is small globally, then this firm is not well known and so is hard for the consumer to find. In this case, the cost of creating the match is high both for the firm and the consumer. An alternative interpretation of this technology is that there are scale economies in market entry. This is effectively the global marketing cost assumption of Hanson and Xiang.

4.3.2 The intermediated trade technology

The second technology involves intermediated trade. Under this technology, the export firm sells to an intermediary who then sells to the final consumer. With the intermediated trade technology, the export firm matches with an intermediary and the intermediary matches with a final consumer. The benefit of this technology is that, if the export firm is small but the intermediary relatively large, then it will be relatively cheap both for the export firm to match with the intermediary and for the final consumer to match with the intermediary. As long the cost of intermediation is not too large, this technology may be efficient relative to the direct-to-market selling technology. The question is how the intermediary achieves size in a way that the exporter does not and what the cost is of doing so.

To model this sort of intermediation, we assume that a consumer in the foreign country j can pay a fixed fee, f_I, that gives the consumer access to an

efficient technology for identifying certain exporting firms. One might think of this as the cost of establishing an intermediation firm, buying a data base of producers in some industry, investments in industry contacts and the like. The technology allows the intermediation firm to identify exporting firms at some variable cost that depends on the number of firms that the intermediary seeks to identify. Specifically, if we let n_{jk} be the measure of varieties/firms from Country k identified by an intermediary in Country j, then the cost of identifying these firms is given by $m_I(n_{jk}) > 0$, with $m_I'(n_{jk}) > 0$. The idea here is that the more firms/varieties that the intermediary seeks to identify, the more trade shows the intermediary must attend, the more data bases the intermediary must acquire, etc. so that the intermediary's costs are higher. We also assume that $m_I''(n_{jk}) > 0$, so that the marginal cost of adding varieties is increasing in varieties. This could be because of overlap in attendees at trade shows, reduced values of connections, increasing time costs and the like. Together, these assumption imply that average cost of variety acquisition is U-shaped. We let the average cost minimizing number of varieties for any intermediary be given by $\widehat{n}$ defined such that $\widehat{n}m_I'(\widehat{n}) = f_I + m_I(\widehat{n})$.

In addition to these costs, foreign consumers incur some cost to match with an intermediary and so must exporting firms. To maintain consistency, we model these cost as being identical to the direct-to-market costs above. Specifically, we assume that the resource cost for a consumer to match with an intermediary of size s_I is $m_D(s_I)$; similarly, the resource cost for an exporting firm to match with the same intermediary is $m_D(s_I)$.

What is the size of an intermediary? Note first that, if $m_D(\cdot)$ is convex, then the efficient organization of intermediaries has all intermediaries being the same size. One outcome that achieves this is the symmetric case in which the distribution of exporting firm outputs and prices is the same across all intermediaries. We examine this case. Note also that, since all costs are fixed costs, the efficient contract is for the intermediary to buy output from exporting firms of productivity ϕ that use the intermediary for a price $\tau/\rho\phi$ and to sell to consumers at the same price. The intermediary charges a fixed fee to cover costs. We have therefore that, if N_I^j is the measure of intermediaries in Country j and $[\underline{\phi}_{Ij}, \overline{\phi}_{Ij}]$ the support of firm productivity types that use an intermediary in j to export, then N_I^j is defined

by $\int_{\underline{\phi}_{Ij}}^{\overline{\phi}_{Ij}} N_k \nu_k(\phi) d\phi = N_I^j n_{jk}$. The size of the intermediary is then given by total sales: $s_I = \int_{\underline{\phi}_{Ij}}^{\overline{\phi}_{Ij}} (\tau/\rho\phi) y_{kj}(\phi)(N_k/N_I^j)\nu_k(\phi) d\phi$, where $y_{kj}(\phi)$ are export sales to Country j of a firm of productivity ϕ in Country k.

How does intermediation work? A measure n_{jk} of exporting firms from Country k with productivities on the interval $[\underline{\phi}_{Ij}, \overline{\phi}_{Ij}]$ match with an intermediary in Country j. Each exporting firm match results in a resource cost of $m_D(s_I)$. There are N_I^j intermediaries, each identical to the other. The establishment of each intermediary requires a resource cost of $f_I + m_I(n_{jk})$. Consumers in Country j match with each intermediary, resulting in a resource cost of $m_D(s_I)$ per consumer, per intermediary match. Each consumer buys all n_{jk} varieties from each intermediary and pays price $\tau/\rho\phi$ for the variety produced by an exporting firm with productivity ϕ. There is also a fixed fee that is allocated between exporting firms and consumers to cover the fixed costs of $f_I + m_I(n_{jk})$. The total, per consumer surplus, gross of the fixed resource costs, generated from the transaction with a given intermediary is $TS_I^j = \int_{\underline{\phi}_{Ij}}^{\overline{\phi}_{Ij}} TS_x(\phi_i)(N_k/N_I^j)\nu_k(\phi) d\phi$.

4.3.3 The distribution equilibrium

To keep the analysis of the distribution system simple, we assume here that the structure of distribution is determined to maximize total surplus net of distribution costs; that is, we assume that the efficient distribution system is implemented, subject to export firm pricing decisions. In this situation, and as discussed above, intermediaries will charge the price $\tau/\rho\phi$ for a variety from an export firm of productivity ϕ. A fixed fee will be allocated between consumers and exporters to cover the fixed costs of intermediation.

In this case, a necessary condition for intermediation to take place is that total surplus per customer from intermediation exceeds total cost; that is, that $TS_I^j \geq m_D(s_I) + (f_I + m_I(n_{jk}) + m_D(s_I))/\overline{L}_j$. In addition, since total surplus and export sales for any individual firm are increasing in ϕ while

$m_D(\cdot)$ is decreasing in sales, it must be that the marginal exporter uses the intermediation technology, if it is used at all. Thus, if the intermediation technology is used, $\underline{\phi}_{Ij}$ must be such that

$$\overline{L}_j TS_I^j(\underline{\phi}_{Ij}) = m_D(s_I) + (f_I + m_I(n_{jk}) + \overline{L}_j m_D(s_I))/n_{jk}. \tag{1}$$

Further, since s_k^x is increasing in ϕ and $m_D(s_k^x)$ is decreasing in s_k^x, $\overline{\phi}_{Ij}$ must be such that

$$m_D(s_I) + (f_I + m_I(n_{jk}) + \overline{L}_j m_D(s_I))/n_{jk} = \overline{L}_j m_D(s_k^x(\overline{\phi}_{Ij})). \tag{2}$$

The former condition (the $\underline{\phi}_{Ij}$ condition) guarantees that the gain in total surplus from adding the least productive exporters is just equal to the added cost of intermediation. The latter condition (the $\overline{\phi}_{Ij}$ condition) is an intermediation cost minimization condition: the intermediation cost of the direct technology and of the intermediated trade technology are equal for the $\overline{\phi}_{Ij}$ type.

If both of these equality conditions are satisfied, then $[\underline{\phi}_{Ij}, \overline{\phi}_{Ij}]$ is non empty. In this case, we have that large export firms use the direct-to-market technology while smaller export firms use the intermediated trade technology. The smallest (least productive firms) – those with productivity indices $\phi < \underline{\phi}_{Ij}$ don't export. Further, for $[\underline{\phi}_{Ij}, \overline{\phi}_{Ij}]$ fixed, $N_I^j TS_I^j$ is independent of N_I^j (and so n_{jk}) so that the number of varieties that any intermediary carries (and so the number of intermediaries) is defined such that the cost of intermediation is minimized; that is, such that $m_D(s_I) + (f_I + m_I(n_{jk}))/n_{jk}$ is minimized. Since both N_I^j and $m_D(s_I)$ are (weakly) decreasing in n_{jk}, the number of varieties carried by any intermediary, n_{jk}, is (weakly) larger than $\widehat{n}$, the cost minimizing measure of varieties for an intermediary.

What can we say about exporting and importing firms in the two technology world? First, as long as $m_D(s_I) + (f_I + m_I(n_{jk}))/n_{jk} < \overline{L}_j \overline{m}$, the intermediated trade technology allows (small) firms to export that would not be able to export under the single technology option. This occurs for two reasons: 1) the larger size of the intermediary makes matching cheaper – $m_D(s_I) < \overline{L}\overline{m}$ – and 2) intermediation and matching costs can be spread over a collection of exporters and customers thus reducing the cost that any single exporter or customer bears. Next note that an exporter that uses the direct trade technology sells to each of the $\overline{L}_j$ consumers in the destination country j. An exporter that uses the intermediated trade technology ex-

ports to a single intermediary who then sells to consumers. Thus, firms that export large amounts to Country j (and globally) will have more exporting partners than firms that export small amounts to Country j (and globally). In addition, there are no small importer - small exporter matches. Small exporters match with large intermediaries and large exporters match with (small) consumers. This is as the data suggest.

5 Patterns of Trade and Intermediation

In this section, we investigate how trade and intermediation are affected by transportation costs, country size and the extent of product differentiation. To simplify the analysis, we impose some additional structure on the function $m_D(\cdot)$. Specifically, we assume that this function is a step function defined as:

$$m_D(\cdot) = \begin{cases} \overline{m} & \text{if} \quad 0 \leq s_k^x \leq \widehat{s} \\ \underline{m} & \text{if} \quad s_k^x > \widehat{s} \end{cases}$$

We also assume that $\widehat{s}$ is sufficiently small that there exists some productivity level for which the direct-to-market technology generates costs of $\underline{m}$.

This structure implies that distribution must follow certain simple patterns. If both technologies are employed in equilibrium, then from (2), it must be that

$$m_D(s_I)+(f_I+m_I(n_{jk})+\overline{L}_j m_D(s_I))/n_{jk} \leq \overline{L}_j m_D(s_k^x(\phi_{Ij})) \quad \forall \quad \underline{\phi}_{Ij} \leq \phi_I \leq \overline{\phi}_{Ij},$$

while

$$m_D(s_I) + (f_I + m_I(n_{jk}) + \overline{L}_j m_D(s_I))/n_{jk} > \overline{L}_j m_D(s_k^x(\phi_I)) \quad \forall \quad \phi_I > \overline{\phi}_{Ij}.$$

Given our matching cost structure, these two conditions can only be satisfied (i.e., both technologies can only be operative) if i) $s_k^x(\phi_I) \leq \widehat{s}$ ($m_D(s_k^x(\phi_I)) = \overline{m}$) while $s_I > \widehat{s}$ ($m_D(s_I) = \underline{m}$) for all $\underline{\phi}_{Ij} \leq \phi_I \leq \overline{\phi}_{Ij}$ and ii) $s_k^x(\phi_I) > \widehat{y}$ for $\phi_I > \overline{\phi}_{Ij}$. As a result, the productivity cut-off for direct-to-market selling versus intermediated trade is given by the value $\overline{\phi}_{Ij}$ such that $s_k^x(\overline{\phi}_{Ij}) = \widehat{s}$. In addition, it must be that $\overline{L}_j \underline{m} < \underline{m} + (f_I + m_I(n_{jk}) + \overline{L}_j \underline{m})/n_{jk} \leq \overline{L}_j \overline{m}$,

so that intermediated trade is preferred to direct-to-market selling for $\underline{\phi}_{Ij} \leq \phi_I \leq \overline{\phi}_{Ij}$ while the opposite is true for $\phi_I > \overline{\phi}_{Ij}$. The productivity cut-off for exporting at all (condition (1) above) is then given by the condition $\overline{L}_j TS_I^j(\underline{\phi}_{Ij}) = \underline{m} + (f_I + m_I(n_{jk}) + \overline{L}_j \underline{m})/n_{jk}$. Finally, since the value of $\underline{m}$ is independent of s for all $s > \widehat{s}$, the measure of varieties carried by the representative intermediary, should this technology be operative, is given by $\widehat{n}$ as long as $s_I > \widehat{s}$ when each intermediary carries $\widehat{n}$ varieties. In what follows, we assume that this condition is satisfied.

To analyze the patterns of trade and intermediation, note that all costs of exporting to Country j, other than the transportation cost, are fixed costs. Thus, the trading equilibrium will be defined as in Melitz, with the cost borne by the $\underline{\phi}_{Ij}$ type defining the fixed cost of exporting. For the lowest productivity type that exports to Country j, $\underline{\phi}_{Ij}$, we know from above that $r_x(\underline{\phi}_{Ij})/\sigma = \pi_x(\underline{\phi}_{Ij}) = [(\sigma-1)/(2\sigma-1)] \times [\underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_j \underline{m})/\widehat{n}]$; that is, the share of total intermediation costs, $F_{int} = [\underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_j \underline{m})/\widehat{n}]$, borne by the producer is $(\sigma-1)/(2\sigma-1)$. The remaining share is borne by the consumer and just exhausts consumer surplus. The lowest productivity producer that is active, ϕ^*, is defined such that $\pi_d(\phi^*) = r_d(\phi^*)/\sigma - f = 0$, where $r_d(\phi^*)$ is revenues from domestic sales for the ϕ^* type. Finally, as in Melitz, the profit from exporting to Country j for the $\underline{\phi}_{Ij}$ type can be written as $\pi_x(\underline{\phi}_{Ij}) = [r_x(\underline{\phi}_{Ij})/r_d(\phi^*)] \times r_d(\phi^*) - [(\sigma-1)/(2\sigma-1)]F_{int}$ so that $[\underline{\phi}_{Ij}/\phi^*\tau]^{\sigma-1} \times \sigma f = [(\sigma-1)/(2\sigma-1)]F_{int}$. This implies that

$$\underline{\phi}_{Ij} = \phi^*\tau \left[\frac{\sigma-1}{\sigma(2\sigma-1)} \frac{F_{int}}{f} \right]^{1/(\sigma-1)}. \tag{3}$$

We proceed by analyzing two settings: an initially symmetric, two-country setting and an asymmetric three-country setting. In both cases we assume, as in other studies, that the distribution of ϕ is Pareto on the interval $[1, \infty)$ and so is given by $G(\phi) = 1 - \phi^{-\theta}$. In the two-country, symmetric case, the $\overline{\phi}_I$ type is defined such that $r_x(\overline{\phi}_I) = \widehat{s}$, implying that the value of $\overline{\phi}_I$ is given by

$$\overline{\phi}_I = \phi^*\tau \left[\frac{\widehat{s}}{\sigma f} \right]^{1/(\sigma-1)}. \tag{4}$$

5.1 The symmetric, two-country case

For the two-country case, consider first a symmetric decrease in the variable trade costs, τ. As in Melitz, a reduction in variable trade costs will increase ϕ^* and lower $\underline{\phi}_I$. The impact on the structure of intermediation can be seen by noting that, from (3) and (4),

$$\frac{\overline{\phi}_I}{\underline{\phi}_I} = \left[\frac{\widehat{s}(2\sigma-1)}{(\sigma-1)F_{int}}\right]^{1/(\sigma-1)}. \tag{5}$$

Thus changes in τ have no impact on the relative measure of firms using the two technologies. If we define relative market shares for the two technologies as

$$RS_x = \frac{\int_{\underline{\phi}_I}^{\overline{\phi}_I} r_x(\phi)g(\phi)d\phi}{\int_{\overline{\phi}_I}^{\infty} r_x(\phi)g(\phi)d\phi},$$

then given the Pareto assumption and assuming that $\sigma < \theta + 1$, we have

$$RS_x = \left[\frac{\underline{\phi}_I}{\overline{\phi}_I}\right]^{\sigma-\theta-1} - 1. \tag{6}$$

Thus we have that changes in τ also leave the relative market share of intermediated trade unchanged. These results are summarized below:

Result 1 *In a symmetric trading equilibrium, a reduction in variable trade costs results in a reduction in both $\underline{\phi}_I$ and $\overline{\phi}_I$. As a result, some firms that initially employed intermediaries switch to direct-to-market selling. The reduction in variable trade costs also results in i) a larger fraction of firms exporting ii) the relative share of trade undertaken by intermediaries being unchanged iii) a larger absolute amount of exports being undertaken via intermediaries.*

What happens in this case is that, with lower variable trade costs, global sales of the large exporters expand. As a result, some firms that were previously too small to use the direct-to-market technology effectively expand enough to switch. The lower variable trade costs also allow firms that previously did not export to export. Because these firms are small, they employ intermediaries and so this sector expands in absolute size.

A similar analysis can applied to the impact of changes in σ – the degree of product differentiation – and in $\overline{L}$. For σ, its impact on ϕ^*, and so on export activity, is unclear. However, one can determine the impact of changes in σ on intermediation patterns. Specifically, as long as $\widehat{s} > F_{int}$, then, from (5) a symmetric increase in σ decreases the value of $\overline{\phi}_I/\underline{\phi}_I$. Further, from (6), this change decreases the relative share of exports that are sold via intermediaries. Thus, as goods become closer substitutes, direct-to-market selling gains market share relative to sale via intermediaries.

Result 2 *In a symmetric trading equilibrium, as goods become closer substitutes in consumption, the share of trade undertaken via intermediaries declines.*

Roughly what happens in this case is that an increase in the degree of substitutability increases the advantage that productive firms have over less productive firms. As a result, the large firms expand at the expense of the smaller firms. This causes the intermediation sector to shrink relative to the direct-to-market trade sector. The prediction is that more homogeneous sectors should see less intermediated trade and more direct-to-market selling.

For $\overline{L}$, a symmetric increase in $\overline{L}$ raises F_{int} and so, as in Melitz, leads to a decrease in ϕ^* and an increase in $\underline{\phi}_I$. From (5) and (6), an increase in $\overline{L}$ lowers $\overline{\phi}_I/\underline{\phi}_I$ and so reduces RS_x; that is, an increase in $\overline{L}$ increases the share of exporting done via direct-to-market selling as long as both technologies are viable. The reason is that an increase in $\overline{L}$ raises the cost of exporting by increasing the matching costs that are incurred in exporting. This results in the least productive exporters, who export via intermediated trade, exiting. As a result, $\underline{\phi}_I$ rises. The exit of these exporters also results in entry by less efficient domestic firms – ϕ^* falls. The substitution of less efficient domestic firms for more efficient exporters results in the inframarginal exporters increasing export sales, causing $\overline{\phi}_I$ to fall. This result holds, however, only if both export technologies are utilized. Since utilization of both requires that $\overline{L}\underline{m} < \underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}\underline{m})/\widehat{n} \leq \overline{L}\overline{m}$, if $\overline{L}$ increases enough, then $\overline{L}\underline{m}$ will become greater than $\underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}\underline{m})/\widehat{n}$ and so only the intermediation technology will be used. This means that there is a non-linearity in the impact of country size on the form of intermediation.

Result 3 *In a symmetric trading equilibrium, a symmetric increase in country size, $\overline{L}$, that leaves both distribution technologies operative results in export firms switching from intermediated trade to direct-to-market selling and*

a smaller fraction of trade via intermediaries. For a sufficiently large increase in $\overline{L}$, direct-to-market selling becomes cost dominated and all trade is via intermediaries.

These results contrast with those in Melitz. In the Melitz model, $\overline{L}$ has no impact on trading patterns. Each firm exports the same amount and does so by selling to more individuals but selling less to each one, In the current model, the cost of exporting is the cost of identifying individuals. As a result, it is cheaper for a firm to sell a lot to a few individuals than to sell a little to many individuals. An increase in $\overline{L}$ increases exporting costs by causing firms to sell less to more individuals. When both technologies are used, the impact on intermediation activities is as described above. However, because the impact of an increase in $\overline{L}$ on intermediation costs is larger for direct-to-market selling than for intermediated trade – the cost of selling to individuals can be spread over $\widehat{n}$ varieties for intermediated trade, ultimately direct-to-market selling becomes sufficiently expensive relative to intermediated trade that the former technology is not used. The non-linearity results. We will have more to say about this point below.

5.2 The three country case

Consider, next a three country setting and consider exports by firms in Country 1 to Countries 2 and 3. Consider also two situations: i) $\overline{L}_2 = \overline{L}_3 = \overline{L}$ but $\tau_{21} > \tau_{31}$ and ii) $\overline{L}_2 > \overline{L}_3$ but $\tau_{21} = \tau_{31} = \tau$. In other respects, the countries are assumed identical. We also assume initially that, in both countries, $\overline{L}_j\underline{m} < \underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_j\underline{m})/\widehat{n} \leq \overline{L}_j\overline{m}$ so that both forms of export selling occur.

For this three country setting, the values of the intermediation cutoffs will depend on the countries to which the firms are exporting. Analogous to (3) above, the lowest productivity exporter to Country j is given by

$$\underline{\phi}_{Ij} = \phi^* \tau_{j1} \left[\frac{\sigma - 1}{\sigma(2\sigma - 1)} \frac{F_{int}}{f} \right]^{1/(\sigma-1)}. \tag{7}$$

The value of the highest productivity producer that uses intermediation to Country j is given by the condition

$$r_{x2}(\overline{\phi}_I) + r_{x3}(\overline{\phi}_I) = \widehat{s}$$

where $r_{xj}(\overline{\phi}_I)$ gives the export revenues from selling to Country 2 of a firm of productivity $\overline{\phi}_I$. Analogous to the derivation in (4), the value of $\overline{\phi}_I$ is then defined as

$$\overline{\phi}_I = \phi^* \left[\frac{\widehat{s}}{\sigma f(\tau_{21}^{1-\sigma} + \tau_{31}^{1-\sigma})} \right]^{1/(\sigma-1)}. \tag{8}$$

Finally, the value of $\overline{\phi}_I/\underline{\phi}_{Ij}$ is given by

$$\frac{\overline{\phi}_I}{\underline{\phi}_{Ij}} = \frac{1}{\tau_{j1}} \left[\frac{\widehat{s}(2\sigma-1)}{(\sigma-1) f_{Ij}(\tau_{21}^{1-\sigma} + \tau_{31}^{1-\sigma})} \right]^{1/(\sigma-1)}. \tag{9}$$

For case i) ($\tau_{21} > \tau_{31}$), $\underline{\phi}_{I3} < \underline{\phi}_{I2}$ so that more exporting occurs to the country with the lower trade cost. In addition, $\overline{\phi}_I/\underline{\phi}_{I2} < \overline{\phi}_I/\underline{\phi}_{I3}$ so that more of the trade to Country 3 occurs through intermediation. For case ii) ($\overline{L}_2 > \overline{L}_3$), $\underline{\phi}_{I3} < \underline{\phi}_{I2}$ since $F_{in2} = [\underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_2\underline{m})/\widehat{n}] > F_{in3} = [\underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_3\underline{m})/\widehat{n}]$. Thus, there will be more trade to Country 3 than to Country 2. It will also then be that $\overline{\phi}_I/\underline{\phi}_{I2} < \overline{\phi}_I/\underline{\phi}_{I3}$ so that, again, more of the trade to Country 3 occurs through intermediation. Again, this last result can be reversed if $\overline{L}_2$ is sufficiently large that $\overline{L}_2\underline{m} > \underline{m} + (f_I + m_I(\widehat{n}) + \overline{L}_2\underline{m})/\widehat{n}$. These results are summarized below.

Result 4 *In a three-country trading world, if both intermediation technologies are active in Country 2 and Country 3 and $\tau_{21} > \tau_{31}$, then more Country 1 firms export to Country 3 than to Country 2. Further, a larger fraction of the Country 3 trade occurs via intermediaries. If $\overline{L}_2 > \overline{L}_3$ and both intermediation technologies are active in Country 2 and Country 3, more Country 1 firms will export to Country 3 than to Country 2 and a larger share of trade with Country 3 will be through intermediaries. If $\overline{L}_2$ is large enough, then all trade with Country 2 will be via intermediaries.*

An implication of these results is that a low variable trade cost in Country 3 allows export firms in Country 1 to become large. Importers in Country 2 take advantage of this fact and adopt the direct-to-market technology as a low cost means of creating imports. In this way, the lower trade costs in Country 3 bestow an external benefit on Country 2. A further implication is that very large countries find intermediation a low cost means of importing and so very large countries engage in much more intermediation than do very small countries.

This last point is worth additional consideration. In the model, a large country is a high cost place to export because exporting requires the identification of customers and the large country has more customers. Basically, as mentioned above, the disadvantage of exporting to a large country is that the firm sells a small amount to a large number of customers. This problem suggests that, as countries become large, there are incentives for intermediaries to arise between the final consumer and the importing intermediaries / firms. These "retail" intermediaries, reduce the number of agents that need to match up with the importing "wholesale intermediary" (or importing firm) and so reduce the costs of exporting to large countries. These retail intermediaries are efficient if the cost to these firms of matching with final consumers is low relative to that of the importing firm or intermediary. The creation of retail intermediaries for large countries then reverses the above results as exporting to sufficiently large countries can be inexpensive relative to exporting to smaller countries without retail intermediaries.

6 Concluding Remarks

Even though our model of the intermediation sector is quite simple, it produces predictions that fit well with a number of the features of the data. A somewhat richer model could allow for additional predictive power. Specifically, while we assume that there are no internal distribution costs in a country, the facts do not bear this out. An alternative specification would have import distributors serving subsets of the population in any country. An export firm would then have to decide not only which intermediation sector to employ but also the number of import intermediaries to employ if this technology is adopted. This variation allows for trade policy to impact the number of customers an exporter serves (a la Arkolakis) as well as allowing predictions on the way that population density impacts export-import activity. Further, if domestic firms also use distribution networks, export firms may also be able to utilize this network, allowing predictions on the impact of domestic market size on import-export activity.

We also assume in this model that there is a single factor of production and that labor cost is identical across countries. With two factors, one could allow for differences in factor intensity across the manufacturing and intermediation sectors. Thus, for instance, if intermediation is skilled labor intensive and manufacturing unskilled labor intensive, rich countries will have rela-

tively cheap intermediation sectors. This will result in more trade to rich countries than to poor countries, as is observed in the data.

References

[1] Arkolakis, Costas (2008) "Market Penetration Costs and the New Consumers Margin in International Trade". Manuscript.

[2] Bernard, Andrew, and J. Jensen (1995) "Exporters. Jobs, and Wages in U.S. Manufacturing: 1976-1987", *Brooking Papers: Microeconomics*, 67-119.

[3] Blum, Bernardo S., Sebastian Claro, and Ignatius Horstmann (2008) "Why Do Firms Export? Dumping, Marginal Costs, and the Gains from Trade", Manuscript.

[4] Butters, G. (1977) "Equilibrium Distributions of Sales and Advertising Prices", *The Review of Economic Studies* 44(3), 465-491.

[5] Eaton, Jonathan, Samuel Kortum and Francis Kramarz (2008) "An Anatomy of International Trade: Evidence from French Firms", Manuscript.

[6] Eaton, Jonathan, Marcela Eslava, Maurice Kugler, and James Tybout (2007) "Export Dynamics in Colombia: Transaction-Level Evidence", Manuscript.

[7] Hanson, Gordon and Chong Xiang (2008) "Testing the Melitz Model of Trade: An Application to U.S. Motion Picture Exports", Manuscript.

[8] Melitz, Mark (2003) "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry productivity", *Econometrica*, 71, 1695-1725.

[9] Petropoulou, Dimitra (2007) "Information Costs, Networks and Intermediation in International Trade", Oxford Working Papers.

[10] Townsend, Robert (1983) "Theories of Intermediated Structures", *Carnegie-Rochester Conference Series on Public Policy,* 18, 221-272

7 Appendix A: Are Chilean Exporters any Different than American, French, and Colombian Exporters?

A number of patterns characterizing exporting firms have been presented in the literature (see for example Bernard and Jensen 1995, Tybout 2003, and Eaton et al, 2004, 2008). Some of these patterns are obtained by comparing exporting and non-exporting firms. Although the data used in this paper do not provide information on non-exporters, Chile's manufacturing census confirms that all the features found for France, Colombia and the United States are also present in Chilean firms. Specifically, exporters are in the minority, exporters tend to be larger, more productive, and usually export a small fraction of their output. In a related paper we present and discuss these patterns (e.g. Blum et al 2008).

This appendix shows that Chilean exporters share the main characteristics of exporters in other countries when we look at Chile's transaction-level customs data.

i) *Exporters tend to sell to few destinations but a few exporters sell to many destinations*

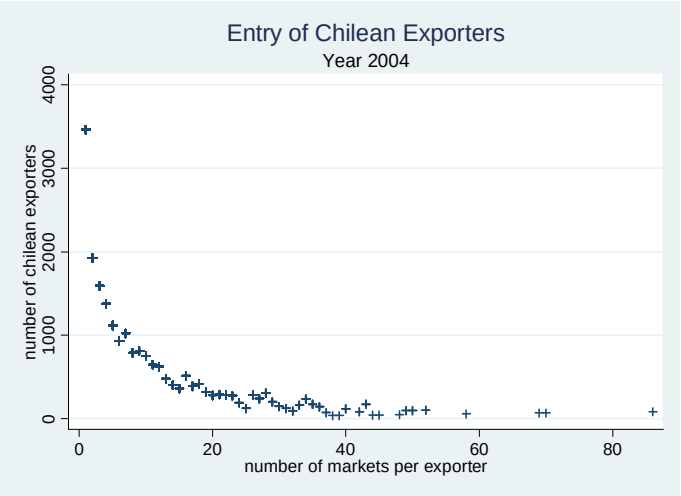
The figure below plots the frequency at which firms served different numbers of export destinations in 2004. Differently than the evidence in Eaton, Kortum and Kramarz (2004), we do not have data for sales in Chile, so we only report foreign sales. Nevertheless, the figure confirms that the majority of exporters sell only to one destination (more than 50%), and very few firms serve many destinations. Similar results are obtained for 2005 and 2006.

ii) *Exports are concentrated in a few firms selling to many destinations.*

Appendix Table 1 reports the share of firms and export values by number of destinations to which the firm sells. As in Eaton *et al* (2004), the small share of firms that exports to many destinations represent a large share in total exports; about 1% of exporters account for a third of total exports.

iii) *In any given year, a large fraction of exporters are new exporters. However, almost all export expansion or contraction comes from changes in sales of firms that have been exporting for at least one year.*

Appendix Table 2 reports a decomposition of total export value into number of exporters and average exports per exporter for new and continuing exporters. It confirms that, in every year, new exporters represent a significant share of exporters. However, they account for a small share of total exports.



Therefore, almost all export expansion in two consecutive years comes from firms that were already exporting.

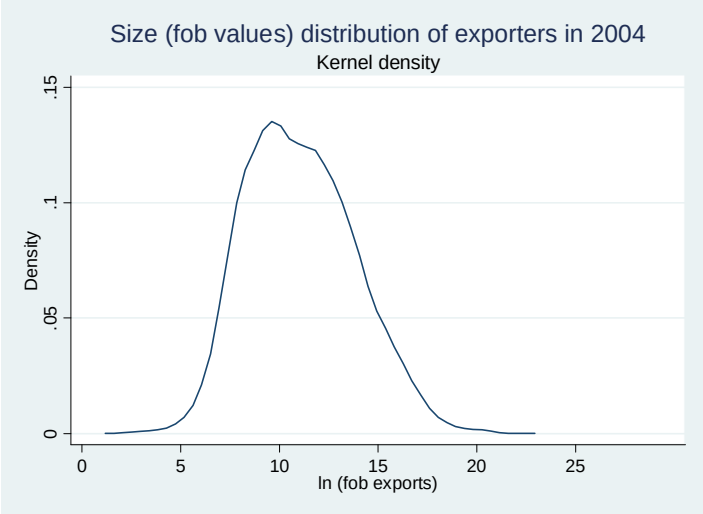
iv) *A large share of exporters exports small values.*

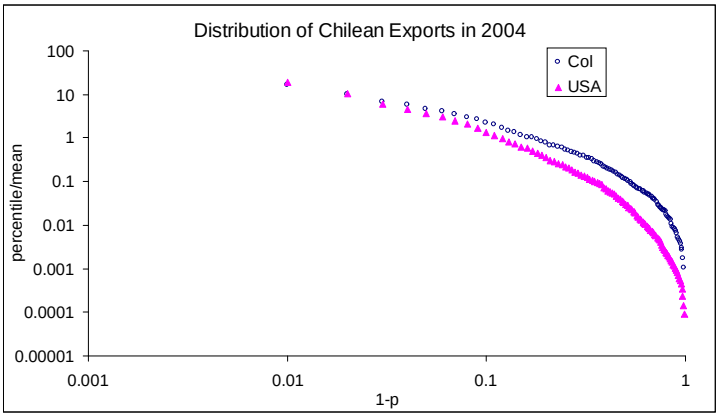
Appendix figure 2 plots the distribution of (ln) fob exports across exporters in 2004. More than 25% of exporters have (fob) export values lower than US$ 10,000. (See also Table 2.1.2 in the text for a more detailed description.) This pattern is also present in 2005 and 2006.

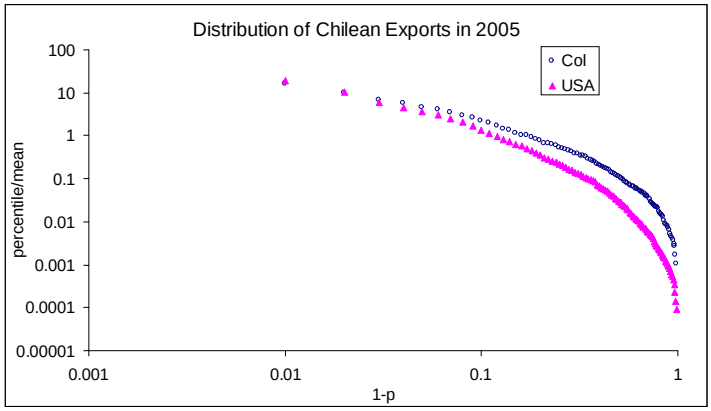
v) *At any given destination, there are a large number of exporters selling small values.*

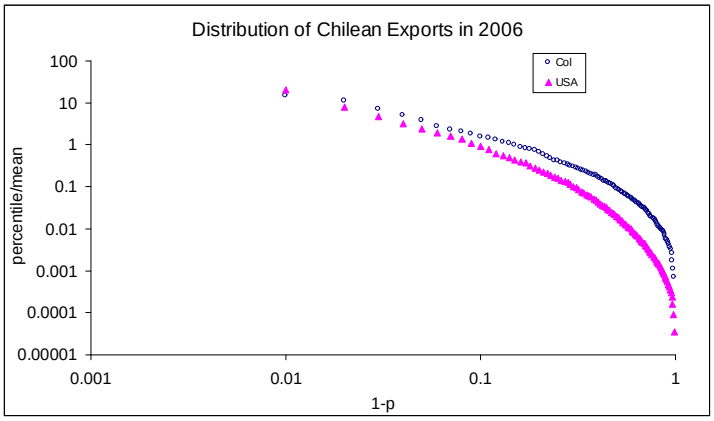
Following Eaton at al (2008), we compute the distribution of Chilean exports for each destination by year. Appendix Figure 3 plots, for Colombia and the United States, the percentile of Chilean sales normalized by their mean in that market against q, the probability that a firms´ total exports to that destination (normalized by average sales to that country) is lower than p. For example, the probability that a firm exports more than 10 times the mean exports to Colombia or the U.S. is about 1%. In general, the probability of exporting more than the average is about 15%, reflecting the presence of suppliers selling very small amounts. As in Eaton et al (2008), these results reveal a sizeable deviation from a Pareto distribution, in which case the slope of this relationship should be constant. The same relationship holds for other destinations.

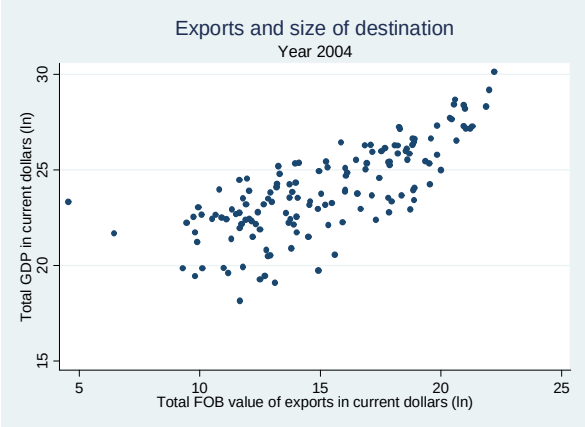
vi) *The number of exporters selling in a given destination and the amount*

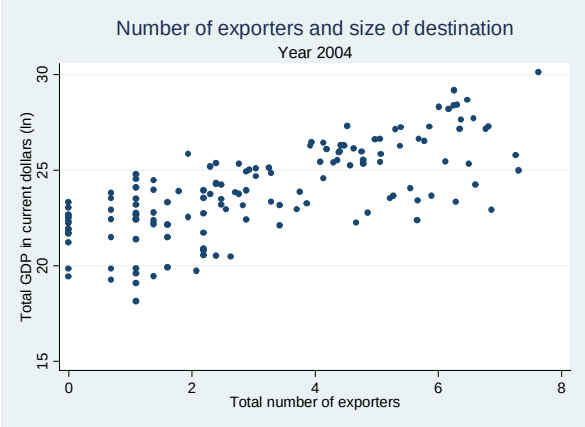

Size (fob values) distribution of exporters in 2004
Kernel density
Density
0
.05
.1
.15
0
5
10
15
20
25
ln (fob exports)


Distribution of Chilean Exports in 2004
Col
USA
percentile/mean
100
10
1
0.1
0.01
0.001
0.0001
0.00001
0.001
0.01
0.1
1
1-p


Distribution of Chilean Exports in 2005
Col
USA
100
10
1
0.1
0.01
0.001
0.0001
0.00001
percentile/mean
0.001
0.01
0.1
1
1-p


Distribution of Chilean Exports in 2006
Col
USA
100
10
1
0.1
0.01
0.001
0.0001
0.00001
percentile/mean
0.001
0.01
0.1
1
1-p



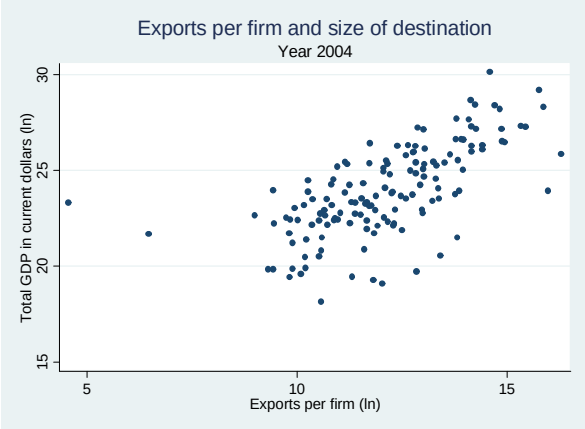


they sell vary with the destination's market size.

Appendix Figure 4 shows for 2004 that Chilean exports are higher to large destinations, measured as total Gross Domestic Product in current dollars (from World Development Indicators). This result is confirmed in a wide range of gravity-type estimations.

Appendix Figure 5 reveals that there is also a very close and positive association between the number of Chilean firms selling to a given destination and the size of the destination.

Finally, Appendix Figure 6 shows that Chilean exports per firm are also higher to larger economies. In other words, exports to large destinations are higher not only because a larger number of firms export to large destinations



(extensive margin) but also because exports per firms are higher (intensive margin).

vii) *There is no strong hierarchy in export destinations.*

Following Eaton et al (2008), we show that there is no strong hierarchy in Chilean export destinations. A strong hierarchy means that all firms exporting to the 2nd most popular destination must also export to the most popular destination. Appendix Table 4 shows the number of exporters to the top 10 destinations in 2004. It also shows the marginal probability of exporting to each of these destinations Given that the firm exports to at least one of the top 10 destinations.

Appendix Table 5 reports the actual number of exporters for each string of destinations, where each string indicates a 1 if a firms export to the kth most popular destination and 0 otherwise. The third column reports the probability that a firm would belong to each string assuming that the predicted probabilities above were independent, and the fourth column represent the predicted number of firms in each category for the sample including only those firms that export to at least one of the top 10 destinations. Only 19% of firms exporting to at least one of the top 10 destinations obey a strict hierarchy, but this number is twice as large as the number implicit if the marginal probabilities were independent.

It is worth noting that these numbers do not change significantly if we define the attractiveness of a destination in terms of total exports by Chilean firms instead of by the number of Chilean exporters serving it. Appendix Tables 6 and 7 show that for the 10 most popular Chilean destinations in

terms of total export values.

TABLES

Table 2.1:

	2004	2005	2006
Worldwide Sales of Chilean Exporters			
Total Exports (US$ mill.)	30,492.1	38,011.4	55,084.8
Number of Exporters	6,543	6,787	6,886
Number of destinations	180	184	181
Destinations per Exporter	3.5	3.5	3.6
Exports per Exporter (US$ mill.)	4.6	5.6	7.9
Colombian Sales of Chilean Exporters			
Total Exports (US$ mill.)	309.1	347.5	491.6
Number of Exporters	681	701	786
Destinations per Exporter	11.6	11.9	12.0
Exports per Exporter (US$ mill.)	0.454	0.497	0.626
Number Colombian Importers	961	952	1010
Distribution of Worldwide Sales of Chilean Exporters			
Percentiles (US$)			
1%	271	267	300
10%	2,172	2,135	2,500
25%	8,064	7,748	9,192
50%	53,570	49,176	58,786
75%	421,541	424,131	503,549
90%	2,661,129	2,727,850	3,201,458
99%	5.10e+07	5.98e+07	7.31e+07
Distribution of Colombian Sales of Chilean Exporters			
Percentiles (US$)			
1%	520	452	442
10%	3,250	3,782	3,625
25%	11,606	12,973	12,380
50%	49,719	54,313	57,526
75%	239,439	242,668	250,629
90%	1,005,598	1,076,733	976,863
99%	7,177,253	8,068,526	8,977,154

Source: Chilean Customs Office

Table 2.2: Summary statistics of Colombia's Importers*

	2004	2005	2006
Worldwide Purchases of Colombian Importers**			
Total Imports (US$ mill.)	4,865.7	6,286.8	9108.0
Imports per Importer (US$ mill.)	4.9	6.2	8.8
Sources per Importer	8.1	8.5	8.7
Chilean Purchases of Colombian Importers			
Total Imports (US$ mill.)	327.7	334.6	476.1
Number of Importers	993	1,014	1,035
Imports per Importer (US$ mill.)	0.33	0.33	0.46
Number of Chilean Exporters	696	740	795
Distribution of Worldwide Purchases of Colombian Importers**			
Percentile (US$)			
1%	60	68	100
10%	8,914	12,867	10,678
25%	73,501	85,362	84,846
50%	528,086	641,185	757,309
75%	2,556,570	2,954,676	3,848,801
90%	1.04e+07	1.14e+07	1.49e+07
99%	6.16e+07	7.39e+07	1.34e+08
Distribution of Chilean Purchases of Colombian Importers			
Percentile (US$)			
1%	20	29	40
10%	2,000	1,959	1,751
25%	9,786	11,200	12,780
50%	48,776	49,924	60,000
75%	200,978	239,964	278,598
90%	692,382	775,442	907,672
99%	4,364,936	5,665,570	7,400,114

Source: Colombian Customs Office.

Note: * Transactions with Chile as Country of Origin; ** This World Wide imports of Colombian firms that import from Chile.

Table 2.3: Summary Statistics of The Matching Procedures

Panel A: Matched Transactions (Conservative Version)

	2004	2005	2006
Transaction-Level			
All			
Transactions in Chilean data (HS8)	26,178	27,752	30,041
Transactions in Colombian data (HS10)	14,208	14,038	15,758
Matched based on exporters' names			
Transactions matched in Chilean Data (HS8)	25,893 (99%)	27,439 (99%)	29,592 (99%)
Transactions matched in Colombian Data (HS10)	13,828 (97%)	13,614 (97%)	15,290 (97%)
Matched based on importers' names			
Transactions matched in Chilean Data (HS8)	23,800 (91%)	25,566 (92%)	27,713 (92%)
Transactions matched in Colombian Data (HS10)	13,671 (96%)	13,142 (94%)	14,454 (92%)
Matched based on exporters' and importers' names			
Transactions matched in Col. data	23,265 (89%)	25,032 (92%)	27,169 (90%)
Transactions matched in Chi. data	12,812 (90%)	12,502 (89%)	13,612 (86%)

Panel B: Matched Firms (Conservative Version)

	2004	2005	2006
Firm-Level			
All			
Exporters in Chilean data	681	701	786
Exporters in Colombian Data	696	740	795
Importers in Colombian Data	993	1014	1035
Importers in Chilean Data	961	952	1010
Matched based on exporters' names			
Exporters matched	570	592	643
Importers matched	890	876	899
Matched based on importers' names			
Exporters matched	611	639	701
Importers matched	865	862	910
Matched based on exporters' and importers' names			
Exporters matched	540	564	610
Importers matched	803	797	823

Notes: A firm is considered matched if there is at least one transaction in which it can be found in the Chilean and Colombian datasets.

Table 2.4: Summary Statistics of Matched Exporters (Conservative version)

	2004	2005	2006
Matched based on exporters' names			
Total Exports to Colombia (US$)	2.88e+08	3.08e+08	4.48e+08
Number of Exporters	570	592	643
Destinations per Exporter	12.6	12.8	13.2
Exports per Exporter (US$ Th.)	506.1	521.1	696.2
Distribution of Colombian Sales of Chilean Exporters			
Percentiles (US$)			
1%	428	492	99
10%	3,556	5,211	4,448
25%	13,852	15,728	17,400
50%	61,559	63,296	79,749
75%	269,235	303,665	305,079
90%	1,275,718	1,205,136	1,165,874
99%	8,269,386	8,113,547	11.997,720
Matched based on importers' names			
Total Exports to Colombia (US$)	2.81e+08	3.08e+08	4.46e+08
Number of Exporters	611	639	701
Destinations per Exporter	11.9	12.3	12.4
Exports per Exporter (US$ Th.)	459.8	481.9	636.1
Distribution of Colombian Sales of Chilean Exporters			
Percentiles (US$)			
1%	658	610	695
10%	3,919	4,411	4,391
25%	16,478	14,616	15,729
50%	60,330	61,300	68,800
75%	275,749	270,089	282,912
90%	1,134,585	1,151,372	1,034,214
99%	6,662,307	7,731,384	8,927,862
Matched based on exporters' and importers' names			
Total Exports to Colombia (US$)	2.76e+08	2.94e+08	4.38e+08
Number of Exporters	540	564	610
Destinations per Exporter	12.7	12.8	13.1
Exports per Exporter (US$ Th.)	511.3	520.4	718.2
Distribution of Colombian Sales of Chilean Exporters			
Percentiles (US$)			
1%	990	1,250	695
10%	4,491	5,625	5,875
25%	21,100	19,390	19,640
50%	80,507	74,682	83,259
75%	306,697	311,166	363,616
90%	1,263,457	1,209,891	1,196,056
99%	7,177,253	8,068,526	8,977,154

Note:

Table 2.5: Summary Statistics of Matched Importers (Conservative Version)

	2004	2005	2006
Matched based on exporters' names			
Total Imports (US$)	3.19e+08	3.28e+08	4.7e+08
Number of Importers	890	876	899
Sources per Importer	8.2	8.5	8.9
Imports per Importer (US$ Th.)	358.4	374.7	528.0
Distribution of Chilean Purchases of Colombian Importers			
Percentiles (US$)			
1%	188	77	90
10%	3,860	4,631	5,237
25%	14,331	18,056	19,139
50%	60,250	62,096	81,637
75%	240,000	307,884	316,754
90%	716,494	831,832	1,046,278
99%	4,364,936	5,875,807	8,064,119
Matched based on importers' names			
Total Imports (US$)	3.03e+08	3.15e+08	4.57e+08
Number of Importers	865	862	910
Sources per Importer	8.7	9.0	9.1
Imports per Importer (US$ Th.)	350.6	365.0	501.8
Distribution of Chilean Purchases of Colombian Importers			
Percentiles (US$)			
1%	188	397	123
10%	4,500	4,704	4,305
25%	14,954	17,500	17,548
50%	61,512	64,869	76,543
75%	253,931	308,416	300,309
90%	741,778	821,982	990,798
99%	4,952,991	5,603,619	6,592,195
Matched based on exporters' and importers' names			
Total Imports (US$)	2.87e+08	3.02e+08	4.40e+08
Number of Importers	803	797	823
Sources per Importer	8.4	8.6	9.0
Imports per Importer (US$ Th.)	357.4	378.8	534.8
Distribution of Chilean Purchases of Colombian Importers			
Percentiles (US$)			
1%	990	610	331
10%	5,780	5,947	6,411
25%	17,500	21,633	24,453
50%	70,646	73,617	90,947
75%	271,733	329,460	337,195
90%	770,338	854,207	1,085,190
99%	4,364,936	5,603,619	6,592,195

Note:

Table 3.1: Summary Statistics of the Matched Exporter-Importer Pairs

	2004	2005	2006
# Chilean Exporters to Colombia	540	564	610
# Colombian Importers from Chile	803	797	823
# Exporter-Importer Pairs	1,264	1,284	1,370
Importers per Exporter	2.3	2.3	2.3
Exporters per Importer	1.6	1.6	1.7
Distribution of Importers per Exporter			
Percentiles			
1%	1	1	1
10%	1	1	1
25%	1	1	1
50%	1	1	1
75%	2	2	2
90%	5	5	4
99%	19	18	19
Maximum	33	29	30
Distribution of Exporters per Importer			
Percentiles			
1%	1	1	1
10%	1	1	1
25%	1	1	1
50%	1	1	1
75%	2	2	2
90%	3	3	3
99%	9	8	10
Maximum	18	20	24
Distribution of Bilateral Trade by Importer-Exporter Pair (1000 US$)*			
Percentiles			
1%	3.7	4.0	2.2
10%	40.1	44.6	61.9
25%	245.6	206.5	286.1
50%	1,008.4	1,105.8	1,269.8
75%	2,547.5	2,709.1	3,788.8
90%	5,724.9	6,759.8	7,991.7
99%	15,999.1	15,899.1	21,999.1
Distribution of Worldwide Trade by Importer-Exporter Pair (1000 US$)**			
Percentiles			
1%	25.1	27.7	59.6
10%	742.6	770.6	937.7
25%	2,848.2	3,106.9	3,773.7
50%	12,899.1	14,399.1	14,999.1
75%	28,699.1	30,299.1	38,399.1
90%	91,599.1	107,999.1	115,999.1
99%	738,999.1	745,999.1	875,999.1

Notes: Sample with Chile as Country of Origin using the Conservative Criterion. * Distribution of exports to Colombia plus imports from Chile by importer-exporter pair.** Distribution of exports to the world plus imports from the world by importer-exporter pair

Table 3.2: Characteristics of Exporters that Sell to Many and Few Importers and importers that Buy from Many and Few Exporters.

Panel A: Exporters' Characteristics

Independent Variables	**Dependent Variable**								
	Exporters								
Exporters that Trade with:	Log (Sales to Col.)	Log (Sales to Col.) per Importer	Log (World Sales)	HS-8 Codes Exported to Colombia	HS-8 Codes Exported to Colombia per Importer	HS-8 Codes Exported to World	HS-10 Codes Imported from Chile by Importer	Destination Countries	# of Number of Importers per Exporter*
1 Importer	-3.6	8.8	-2.9	-2.5	2.1	-8.0	3.1	-11.9	
	[.165]	[.165]	[.204]	[.387]	[.322]	[1.650]	[.925]	[.978]	
(1,5] Importers	-1.9	3.3	-1.5	-.8	1.0	-5.0	2.1	-6.1	
	[.170]	[.170]	[.210]	[.399]	[.331]	[1.697]	[.952]	[1.006]	
# of Exporters per Importer									-.21
									[.024]
Constant	11.6	-.92	15.3	4.5	-.1	13.8	-1.9	16.5	1.2
	[.691]	[.961]	[.854]	[1.619]	[1.345]	[6.891]	[3.852]	[4.086]	[.156]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS2 Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1714	1714	1714	1714	1714	1714	1714	1714	3918
R2	.45	.80	.39	.21	.21	.20	.29	.38	.46

Notes: * Standard error clustered at the importer level.

Panel B: Importers' Characteristics

Independent Variables	**Dependent Variables**						
	Importers						
Importers that Trade with:	Log (Purchases from Chi.)	Log (Purchases from Chi.) per Exporter	Log (World Purchases)	HS-10 Codes Imported from Chile	HS-10 Codes Imported from Chile per Exporter	HS-8 Codes Exported to Colombia by Exporter	# of Exporters per Importer*
1 Exporter	-2.5	8.3	-2.1	-7.0	.6	.7	
	[.144]	[.138]	[.188]	[.382]	[.286]	[.309]	
(1,3] Exporters	-0.9	3.01	-0.8	-4.5	.5	.8	
	[.153]	[.147]	[.200]	[.405]	[.304]	[.328]	
# of Importers per Exporter							-.04
							[.007]
Constant	12.3	1.54	12.5	8.1	.6	.1	.8
	[.481]	[.462]	[.628]	[1.275]	[.964]	[1.032]	[.125]
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS2 Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	2423	2423	2423	2423	2423	2423	3918
R2	.37	.78	.24	.29	.21	.23	.44

Notes: * Standard error clustered at the exporter level.

Table 3.3:

Panel A: Who do Small Chilean Exporters Sell To?

# Chilean Exporters that sell less than U$ 30K to Colombia and Sell to:			
Importers that buy from Chile:	2004	2005	2006
Less than U$ 30K only	116	119	110
More than U$ 30K only	73	82	90
Both	6	6	5
Total	195	207	205

Panel B: Who do Small Chilean Exporters that Sell Exclusively to Small Colombian Importers Sell To?

	# Chilean Exporters that Sell Less than 30kU$ to Colombia AND			
		2004		
		Total	**0-30kU$ to the World**	**30k+ U$ to the World**
Sell Exclusively to Importers that import Less than 30kU$ from Chile AND	Total	116	25	91
	0-30k U$ from the World	76	12	64
	30k U$ + from the World	37	13	24
	Both	3	0	3
		2005		
		Total	**0-30kU$ to the World**	**30k+ U$ to the World**
Sell Exclusively to Importers that import Less than 30kU$ from Chile AND	Total	119	35	84
	0-30k U$ from the World	76	16	60
	30k U$ + from the World	37	17	20
	Both	6	2	4
		2006		
		Total	**0-30kU$ to the World**	**30k+ U$ to the World**
Sell Exclusively to Importers that import Less than 30kU$ from Chile AND	Total	110	21	89
	0-30k U$ from the World	71	10	61
	30k U$ + from the World	36	10	26
	Both	3	1	2