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 distribution technologies and choose a mode of distribution as part of the equilibrium. We show that a two-distribution 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. Finally, we provide evidence in support of the model's predictions.

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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 potentially important implications for assessing the impact of trade policy. To illustrate, in a case study by Ernst and Young (1992) 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 high tariffs or other trade barriers but the fact that distribution of the sheets involved both a longer supply chain in Canada, due to the use of Canadian importing agents, and significantly higher markups throughout the supply chain in Canada. As a consequence, even were tariffs zero, costs created by the longer supply chain, that are then marked-up substantially throughout the supply chain, result in substantially higher prices for imported products relative to similar domestic ones. An implication is that, unless free trade were also to alter the distribution system, imported products would have to land at costs significantly lower than domestically produced products in order to be competitive. Taken to the extreme, if there is no efficient system for getting foreign products across the border and into the domestic distribution system, trade does not occur.

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 both cases, trade liberalization alters the mix of firms that export. In Arkolakis (2007), exporting firms incur no fixed cost of exporting but incur a variable selling cost that is increasing in

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

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 technologies. The Melitz specification, for instance, involves some distribution 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 provides a discussion of technologies that implicitly generate his distribution cost specification, including the advertising technology assumed in Butters (1977). What any of these technologies correspond to, in fact, is unclear. In all cases, the distribution technology itself is unaffected by the trading environment, including trade policies.

In this paper, we seek to accomplish three 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 distribution technologies and choose a distribution technology as part of the equilibrium. As a result, distribution 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. Finally, we provide evidence in support of the predictions of our trade and distribution model.

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 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 distribution. Specifically, as a destination 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. In a final section of the paper, we provide evidence from our data in support of many of these predictions.

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 provides evidence in support of the model's predictions while section 7 concludes. Additional information about the data set and proofs are 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 we use are collected by Chile's customs office. For each export transaction in the 2004-2006 period, the data set provides information on the identity of the exporting firm (name and tax ID), the 8-digit Harmonized System code of the products 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 customs 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 importers that buy from Chile shows many fewer small importers: 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 of 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 customs' office may have the consolidator's country as the products' destination. There is nothing we can do to deal with this source of measurement error other than to note that this problem occurs for only a tiny fraction of all transactions.[2] 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

[2] To determine how many of these cases occurred in the data, we proceeded as follows. From the Chilean export data we identified exports from Chile to importers not in Colombia. From the Colombia import data we identified imports into Colombia originating from the same non-Chilean firm. It turns out that only very few of these sorts of matches occur in the data.

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 98% of them. When we use both of them we can match around 85% of all transactions. 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 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$ 328 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 to 19 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

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

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) 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 importer and deal with importers that buy many HS codes from many exporters. Panel B shows evidence on the features of Colombian importers.

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 to Colombia. 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. Panel B shows that, of the 116 small (to Colombia) Chilean exporters that sold to small (from Chile) Colombian importers, only 13 exported less than US$ 30,000 to the world and dealt with Colombian importers that purchased less than that from the world. The other 103 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.

[INSERT FIGURE 1]

4 A Model of Trade and Distribution

The analysis of the matched data reveal three key features of importers and exporters: i) There are virtually no small importer-small exporter pairs; ii) most exporters sell to few – typically one – importer while a few exporters sell to many importers; iii) exporters that sell to few importers export smaller amounts and fewer HS codes in total but export more *per importer;* these exporters sell to importers that import large amounts in total, import more total HS codes and deal with more exporters. In what follows, we develop a

[4] Upon closer inspection, we find that the 13 cases of apparently small-small matches do not actually contravene our basic result that one of the parties has to be large. In several cases, for instance, the exporters are individuals shipping what seem to be gifts to friends/family in Colombia. Another case is an individual in Colombia buying from a specialized online bookstore in Chile.

model of international trade and distribution that captures these features of the data. We use this model to generate additional predictions about trading behavior and then provide supporting evidence for these predictions.

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 $\overline{L}_k$.

4.1.1 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 $Y = \left[\int y(\omega)^{\rho}d\omega\right]^{1/\rho}$ 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 Y and given a total measure N_k of sellers of the differentiated product in Country k, demand for a variety ω produced by a firm with productivity ϕ is given by the expression $y(\phi) = \alpha I_k p(\phi)^{-\sigma}P^{\sigma-1}$. In this demand expression $P = \left[\int p(\phi)^{1-\sigma}N_k\nu(\phi)d\phi\right]^{1/1-\sigma}$ 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 producing 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 $\pi(\widetilde{\phi}) = f\left[(\widetilde{\phi}/\phi^*)^{\sigma-1} - 1\right]$.

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 k and k'. These costs are of the iceberg variety and are such that a firm requires $\tau_{kk'} > 1$ units of production of variety ω to deliver 1 unit from Country k to Country k'. 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 $\tau_{kk'}/\phi$. 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 k' is $\tau_{kk'}/\rho\phi$. 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 determines 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 and so to confront the transactions level data on exporting. It also lets one determine how the distribution system, and so international trade, are impacted by the trading environment.

4.2.1 The distribution technology

The stance we take here is that the significant, non-transportation cost associated with exporting is a distribution cost associated with matching customers in Country k' with firms in Country k. In essence, the ultimate problem that any exporter has is identifying and selling to customers in the foreign country. This problem is highlighted in Rauch (2001) and one for which Rauch and Trinidade (2000) provide evidence. Both Rauch and Watson (2004) and Petropoulou (2007) model this distribution problem as a random matching procedure. Here we take a somewhat simpler approach that is based on a model by Townsend (1983). We flesh the model out in what follows.

We start with what we consider the simplest specification and one that delivers an exporting environment very similar to that in Melitz. 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 k' 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 (surplus maximizing) 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 k' 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^*. Therefore, the efficient exporting solution involves consumers in Country k' sharing some fraction of the matching cost in order to obtain 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 $\tau_{kk'} = \tau$ for all k, k' pairs. Since exporters set price equal to $\tau/\rho\phi$, consumer surplus for an individual in Country k' purchasing a variety exported by a firm with productivity ϕ is given by

$$\begin{aligned} CS^{kk'}(\phi) &= \alpha P_{k'}^{\sigma-1} \int_{\tau/\rho\phi}^{\infty} p_{k'}(\phi)^{-\sigma} dp \\ &= \frac{\alpha}{\sigma - 1} P_{k'}^{\sigma-1} (\tau/\rho\phi)^{1-\sigma}. \end{aligned}$$

Profit for the exporter to Country k' with productivity ϕ from a customer match is given by

$$\pi_x^{kk'}(\phi) = \alpha P_{k'}^{\sigma-1}(1-\rho)(\tau/\rho\phi)^{1-\sigma}.$$

Total surplus generated by the match is then

$$
\begin{aligned}
TS_x^{kk'}(\phi) &= \alpha P_{k'}^{\sigma-1}(\tau/\rho\phi)^{1-\sigma}\frac{2\sigma-1}{\sigma(\sigma-1)} \\
&= \frac{r_x^{kk'}(\phi)}{\sigma\overline{L}_{k'}}\frac{2\sigma-1}{(\sigma-1)}
\end{aligned}
$$

where $r_x^{kk'}(\phi)$ is revenues from exporting to Country k' for a firm in Country k with productivity ϕ and is defined as in Melitz.

The marginal exporter will be the firm with productivity ϕ'_x such that the per customer total surplus from exporting – $TS_x^{kk'}(\phi'_x)$ – is just equal to the cost of creating the export match – m. From the definition of $TS_x^{kk'}(\phi)$ above, the marginal exporter is the one for which $r_x(\phi'_x)/\sigma = \overline{L}_j m \times (\sigma-1)/(2\sigma-1)$. Note that, if the exporter were to bear the full cost of exporting, the marginal exporter would be the one for which profit from exporting equals the cost of creating a match. In this case, the marginal exporter would be defined by the condition $r_x^{kk'}(\phi^*_x)/\sigma = \overline{L}_{k'} m$, implying that $\phi'_x < \phi^*_x$. Thus, the marginal exporter under cost sharing will have lower productivity, higher prices and smaller export sales. Welfare of the importing country will also be higher.

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 k' or none and the cost of exporting to Country k' is $f_{ex} = \overline{L}_{k'} m \times (\sigma-1)/(2\sigma-1)$. 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 cannot, by itself, explain 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. In particular, recall that 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.

The above analysis suggests that, not only is there heterogeneity on the exporter side of the market, but there must be heterogeneity on the importer side as well. The data help us structure the form that this latter heterogeneity takes. Specifically, the data suggest that i) the cost of distributing in any particular country is likely affected by either global export sales or global import purchases and ii) small global exporters seem able to share market entry costs by using large import agents who consolidate their products – an import intermediary – for sale in the foreign country. Below we flesh out a 2 technology model of trade and distribution that captures these features and that reproduces our basic trading facts.

4.3 A two-technology model of distribution

We consider a model in which there are two possible distribution modes. 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 consumer 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 exporting 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, $s_x^k = \sum_{k'} s_x^{kk'}$, where $s_x^{kk'} = p_x^{kk'} y_x^{kk'}$ gives export sales

by a Country k firm to each Country k'. We assume that this match cost relationship is given by the step function

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

implying that globally large exporting firms are cheap for the consumer to identify while globally small ones are expensive to identify.

Alternatively, the exporting firm can expend resources identifying individual foreign market consumers. In this case, the resource cost of creating a match is $m \geq \underline{m}$ per customer.

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. If the consumer is also "small" globally and so is hard for the exporter to find – $m = \overline{m}$, for instance – then the cost of creating the match is high both for the firm and the consumer. Effectively, there are global scale economies in market entry, similar to 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.

To model this sort of intermediation, we assume that a consumer in the foreign country k' 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 $n_{kk'}$ be the measure of varieties/firms from countries other than k' identified by an intermediary in Country k', then the cost of identifying these firms is given by $m_I(n_{kk'}) > 0$, with $m_I'(n_{kk'}) > 0$. 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 $m_I''(n_{kk'}) > 0$, 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 direct intermediation costs, foreign consumers incur some cost to match with an intermediary as must exporting firms. To maintain consistency, we model these matching costs as being identical to the direct-to-market costs specification above. Specifically, we assume that the resource cost for a consumer to identify and match with an intermediary having global purchasess of $s_I^{k'}$ is $m_D(s_I^{k'})$; similarly, the resource cost for an exporting firm to identify and match with the same intermediary is also $m_D(s_I^{k'})$.

4.3.3 The distribution equilibrium

In order to focus attention on the link between the distribution technologies and trading behavior, as well as to provide a simple benchmark analysis, we assume in what follows 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 case, since all distribution costs are fixed costs, the efficient intermediation contract has the intermediary buying output from exporting firms of productivity ϕ that use the intermediary for a price $\tau/\rho\phi$ and selling to consumers at the same price. The intermediary charges fixed fees to both its exporting firm customers and consumers to cover the fixed costs.

To further simplify the exposition of the distribution equilibrium, we assume in what follows that intermediaries specialize in the exporters of

a particular country. Since intermediation costs $m_I(\cdot)$ depend only on the value of $n_{kk'}$ and not on the country of origin of the exporting firm or the exporting firm's productivity, this is without loss of generality as long as there are sufficiently many exporting firms from each country that employ intermediaries. We will be more precise about this idea below. Also, we focus on symmetric intermediation outcomes in which the distribution of outputs and prices for firms exporting from Country k – the distribution of ϕ's for Country k exporters using intermediaries in Country k' – is the same across all intermediaries in Country k' that deal with Country k exporters.

In these circumstances, if we let $N_I^{kk'}$ be the measure of intermediaries in Country k' dealing with Country k exporting firms and $[\underline{\phi}_I^{kk'}, \overline{\phi}_I^{kk'}]$ the support of exporting firm productivity types in Country k that use an intermediary in k' to export, then $N_I^{kk'}$ is defined by $\int_{\underline{\phi}_I^{kk'}}^{\overline{\phi}_I^{kk'}} N_k \nu_k(\phi) d\phi = N_I^{kk'} n_{kk'}$. The sales for an intermediary are then given by: $s_I^{kk'} = \int_{\underline{\phi}_I^{kk'}}^{\overline{\phi}_I^{kk'}} (\tau/\rho\phi) y_{kk'}(\phi)(N_k/N_I^{kk'})\nu_k(\phi) d\phi$, where $y_{kk'}(\phi)$ are export sales to Country k' of a firm of productivity ϕ in Country k.

How does intermediation work? A measure $n_{kk'}$ of exporting firms from Country k with productivities on the interval $[\underline{\phi}_I^{kk'}, \overline{\phi}_I^{kk'}]$ match with an intermediary in Country k'. Each exporting firm match results in a resource cost of $m_D(s_I^{kk'})$. There are $N_I^{kk'}$ identical intermediaries that import from Country k. The establishment of each intermediary requires a resource cost of $f_I + m_I(n_{kk'})$. Consumers in Country k' match with each intermediary, resulting in a resource cost of $m_D(s_I^{kk'})$ per consumer, per intermediary match. Each consumer buys all $n_{kk'}$ 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 $f_I + m_I(n_{kk'})$ and matching costs. The total surplus, gross of the fixed resource costs, generated from the transaction with a given

intermediary is $TS_I^{kk'} = \int_{\underline{\phi}_I^{kk'}}^{\overline{\phi}_I^{kk'}} \overline{L}_{k'} TS_x^{kk'}(\phi)(N_k/N_I^{kk'})\nu_k(\phi)d\phi$. Intermediation costs for each intermediary are $n_{kk'}m_D(s_I^{k'}) + (f_I + m_I(n_{kk'}) + \overline{L}_{k'}m_D(s_I^{k'}))$.

From the above, for fixed $[\underline{\phi}_I^{kk'}, \overline{\phi}_I^{kk'}]$, the value of $N_I^{kk'}TS_I^{kk'}$ is independent of $N_I^{kk'}$ (and so $n_{kk'}$). As a result, the value of $n_{kk'}$ is defined simply as the one for which the per-variety cost of intermediation is minimized; that is, $n_{kk'}$ is such that $m_D(s_I^{k'})+ (f_I + m_I(n_{kk'}) + \overline{L}_{k'}m_D(s_I^{k'}))/n_{kk'}$ is minimized. Since both $N_I^{kk'}$ and $m_D(\cdot)$ are (weakly) decreasing in $n_{kk'}$, the number of varieties carried by any intermediary, $n^*_{kk'}$, is greater than $\widehat{n}$. As long as there are sufficiently many exporters from any country that that the intermediaries specializing in that country achieve the cost minimizing value $n^*_{kk'}$, then our specialization assumption is without loss of generality. We assume that this value is achieved in what follows.

Finally, should the intermediation technology be adopted, then the values of $\underline{\phi}_I^{kk'}$ and $\overline{\phi}_I^{kk'}$ are determined as follows. 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. Further, if the intermediation technology is used, $\underline{\phi}_I^{kk'}$ must be such that

$$\overline{L}_{k'} TS_x^{kk'}(\underline{\phi}_I^{kk'}) = m_D(s_I^{k'}) + (f_I + m_I(n_{kk'}) + \overline{L}_{k'}m_D(s_I^{k'}))/n_{kk'}. \qquad (1)$$

This condition guarantees that the gain in total surplus from adding the least productive exporters is just equal to the added cost of intermediation. Additionally, it must be the case that

$$m_D(s_I^{k'})+(f_I+m_I(n_{kk'})+\overline{L}_{k'}m_D(s_I^{k'}))/n_{kk'} \leq \overline{L}_{k'}m_D(s_x^k(\phi_I)) \;\forall\; \underline{\phi}_I^{kk'} \leq \phi_I \leq \overline{\phi}_I^{kk'} \qquad (2)$$

that is, it must be that the cost of the intermediated trade technology for any exporting firm using it is less than the cost of the direct-to-market selling technology. Similarly, it must be that

$$m_D(s_I^{k'})+(f_I+m_I(n_{kk'})+\overline{L}_{k'}m_D(s_I^{k'}))/n_{kk'} > \overline{L}_{k'}m_D(s_x^k(\phi_I)) \quad \forall \quad \phi_I > \overline{\phi}_I^{kk'}; \qquad (3)$$

that is, the cost of the direct-to-market selling technology is less than the cost of the intermediated trade technology for any firm employing direct selling.

The structure of the distribution equilibrium can now be determined. Consider, first, a case in which $m = \overline{m}$. In this case, it is always weakly cheaper for customers to identify sellers than sellers to identify customers. As a result, one or both of the above intermediation technologies is employed. If conditions (2) and (3) are both satisfied, then $[\underline{\phi}_I^{kk'}, \overline{\phi}_I^{kk'}]$ is non empty and both technologies are used. In particular, the 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 $\phi < \underline{\phi}_{Ik'}$ – don't export. If one of (2) or (3) is violated, then only one of the distribution technologies is employed. In particular, if $m_D(s_I^{k'}) + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'} m_D(s_I^{k'}))/n_{kk'}^* < \overline{L}_{k'} m_D(s_x^k(\phi))$ for all ϕ, then only the intermediated trade technology is employed; if $m_D(s_I^{k'}) + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'} m_D(s_I^{k'}))/n_{kk'}^* > \overline{L}_{k'} m_D(s_x^k(\underline{\phi}_I^{k'k}))$, then only the direct-to-market selling technology is employed.

If, by contrast, $m = \underline{m}$, so that it is always weakly cheaper for exporters to find customers than customers to find exporters, then the outcome is as described in the one distribution technology section above. Specifically, all selling is direct-to-market selling and all exporters match with all customers.

What can we say about exporting and importing firms in the two technology world? First, as long as $m_D(s_I^{k'}) + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'} m_D(s_I^{k'}))/n_{kk'}^* < \overline{L}_{k'} m_D(s_x^k(\underline{\phi}_{Ik'}))$, the intermediated trade technology allows (small) firms to export that would not be able to export if direct-to-market selling were the only option. This might occur for two reasons: 1) the larger size of the intermediary may make matching cheaper – $m_D(s_I^{k'}) < \overline{m}$ – 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-to-market selling technology sells to each of the $\overline{L}_{k'}$ consumers in the destination country k'. An exporter that uses the intermediated trade technology exports to a single intermediary who then sells to consumers. Thus, firms that export large amounts to Country k' (and globally) will have more exporting partners than firms that export small amounts to Country k' (and globally). Further, each import partner of these large export firms will tend to import less than the single intermediary partner of the small export firms. Finally, there are no small importer - small exporter matches. Small exporters match with large inter-

mediaries and large exporters match with (small) consumers. This is as the data suggest.

5 Patterns of Trade and Distribution

In this section, we investigate how trade and distribution are affected by transportation costs, country size and the extent of product differentiation. Because all costs of exporting to Country k', other than the transportation cost, are fixed costs, the trading equilibrium will be defined as in Melitz. To close our model, we need to take some stand on the way that the fixed distribution costs are shared between customers and exporting firms. This is necessary to define the free-entry condition for firms and so pin down the value of ϕ_k^* (the lowest productivity producer in Country k'). Recall from section 2.2.1 that, for the marginal exporting firm, this sharing rule is pinned down: the exporting firm bears a share $(\sigma-1)/(2\sigma-1)$ of the exporting cost and the consumer bears the rest. For simplicity, we assume that this sharing rule is applied to all exporters. We note that none of our results on the relative amounts of trade intermediated by the different technologies depend on this assumption. Finally, to make the analysis interesting, we assume that $\widehat{s}$ is sufficiently small that there exists some productivity level for which the direct-to-market technology generates costs of $\underline{m}$.

If both distribution technologies are employed in equilibrium, then from (2) and (3) above, it must be that i) $s_x^k(\phi_I) \leq \widehat{s}$ $(m_D(s_x^k(\phi_I)) = \overline{m})$ for all $\underline{\phi}_I^{kk'} \leq \phi_I \leq \overline{\phi}_I^{kk'}$ and ii) $s_x^k(\phi_I) > \widehat{s}$ for $\phi_I > \overline{\phi}_I^{kk'}$. As a result, the productivity cut-off for direct-to-market selling versus intermediated trade is given by the value $\overline{\phi}_I^{kk'}$ such that $s_x^k(\overline{\phi}_I^{kk'}) = \widehat{s}$. We assume for simplicity that $s_I^{kk'} \geq \widehat{s}$ for all k', k so that the matching costs for an intermediary is $\underline{m}$. In this case, (2) and (3) imply that, if both distribution technologies are employed, then i) $\overline{L}_{k'}\underline{m} < \underline{m} + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'}\underline{m})/n_{kk'}^* \leq \overline{L}_{k'}\overline{m}$ and ii) intermediated trade is preferred to direct-to-market selling for $\underline{\phi}_I^{kk'} \leq \phi_I \leq \overline{\phi}_I^{kk'}$ while the opposite is true for $\phi_I > \overline{\phi}_I^{kk'}$. Finally, the productivity cut-off for exporting at all (condition (1) above) is given by the condition $\overline{L}_{k'} T S_x^{kk'}(\underline{\phi}_I^{kk'}) = \underline{m} + (f_I + m_I(n_{kk'}) + \overline{L}_{k'}\underline{m})/n_{kk'}$.

With both distribution technologies active, we have from above that the marginal exporter uses the intermediated trade technology and so is defined by the value $\underline{\phi}_I^{k'k}$. For this exporter, it *must be* that $r_x^{kk'}(\underline{\phi}_I^{kk'})/\sigma =$

$\pi_x^{kk'}(\underline{\phi}_I^{k'k}) = [(\sigma-1)/(2\sigma-1)] \times [\underline{m} + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'}\underline{m})/n_{kk'}^*]$; that is, the share of total intermediation costs, $F_{int} = [\underline{m} + (f_I + m_I(n_{kk'}^*) + \overline{L}_{k'}\underline{m})/n_{kk'}^*]$, borne by the exporter is $(\sigma-1)/(2\sigma-1)$. The remaining share is borne by the consumer and just exhausts consumer surplus.[5] The lowest productivity producer in Country k that is active, ϕ_k^*, is defined such that $\pi_d(\phi_k^*) = r_d(\phi_k^*)/\sigma - f = 0$, where $r_d(\phi_k^*)$ is revenues from domestic sales in Country k for the ϕ_k^* type. Finally, as in Melitz, the profit from exporting to Country k' for the $\underline{\phi}_I^{kk'}$ type can be written as $\pi_x^{kk'}(\underline{\phi}_I^{k'k}) = [r_x^{kk'}(\underline{\phi}_I^{kk'})/r_d(\phi_k^*)] \times r_d(\phi_k^*) - [(\sigma-1)/(2\sigma-1)]F_{int}$, so that $[\underline{\phi}_I^{kk'}/\phi^*\tau]^{\sigma-1} \times \sigma f = [(\sigma-1)/(2\sigma-1)]F_{int}$. This implies that

$$\underline{\phi}_I^{kk'} = \phi_k^* \tau \left[\frac{\sigma - 1}{\sigma(2\sigma - 1)} \frac{F_{int}}{f} \right]^{1/(\sigma-1)}. \tag{4}$$

We analyze the pattern of trade and distribution for two settings: a symmetric, two-country setting and an asymmetric three-country setting. In both cases we assume that the distribution of ϕ is the same across all countries and is Pareto on the interval $[1, \infty)$, implying that $G(\phi) = 1 - \phi^{-\theta}$.

5.1 The symmetric, two-country case

In the two-country symmetric case, $\overline{\phi}_I^{12} = \overline{\phi}_I^{21} = \overline{\phi}_I$ and, from above, the common value of $\overline{\phi}_I$ is defined by the condition $r_x(\overline{\phi}_I) = \widehat{s}$. From the definition of $r_x(\overline{\phi}_I)$, we have that the value of $\overline{\phi}_I$ is given by

$$\overline{\phi}_I = \phi^* \tau \left[\frac{\widehat{s}}{\sigma f} \right]^{1/(\sigma-1)}. \tag{5}$$

In the same way, we have that $\underline{\phi}_I^{12} = \underline{\phi}_I^{21} = \underline{\phi}_I$ and the common value is defined by equation (4) above.

We consider two measures of distribution activity. The first is a measure of the relative shares of trade distributed via intermediaries versus via direct-to-market selling, $RS_x = \int_{\underline{\phi}_I}^{\overline{\phi}_I} r_x(\phi) g(\phi) d\phi / \int_{\overline{\phi}_I}^{\infty} r_x(\phi) g(\phi) d\phi$. In this

[5] While we have assumed this sharing rule for all exporting firms, we note this fact here to emphasize that our results on relative amounts of trade intermediated by different technologies will hold regardless of the assumption on cost sharing for firms other than the marginal exporter.

expression, the numerator gives total sales by intermediaries and the denominator total direct-to-market sales of exporting firms. Given productivity is distributed Pareto and assuming that $\sigma < \theta + 1$, we have that when both distribution technologies are active

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

otherwise, RS_x is either 0 or 1.

The second measure is simply the average number of importers per exporter. Since intermediated trade involves a single importer while direct-to-market selling involves $\overline{L}$ importers, if both distribution technologies are active, then this measure is

$$\frac{\int_{\underline{\phi}_I}^{\overline{\phi}_I} g(\phi)d\phi + \overline{L}\int_{\overline{\phi}_I}^{\infty} g(\phi)d\phi}{\int_{\underline{\phi}_I}^{\infty} g(\phi)d\phi} = \left[\frac{\underline{\phi}_I}{\overline{\phi}_I}\right]^{\theta} [\overline{L} - 1] + 1. \tag{7}$$

When only the direct selling technology is used, this average is $\overline{L}$; when only the intermediated trade technology is used, it is 1.

Consider, then, the impact of a symmetric decrease in the variable trade costs, τ. As in Melitz, a reduction in variable trade costs increases ϕ^* and lowers $\underline{\phi}_I$. If both distribution technologies are employed, the impact on the structure of distribution can be seen by noting that, from (4) and (5),

$$\frac{\overline{\phi}_I}{\underline{\phi}_I} = \left[\frac{\widehat{s}(2\sigma - 1)}{(\sigma - 1)F_{int}}\right]^{1/(\sigma-1)}. \tag{8}$$

The prediction then is that changes in τ have no impact on either the relative market shares of the two distribution technologies or the average number of importers per exporter. Obviously, the same is true if only one of the distribution technologies is used. These results are summarized below:

Result 1 *In a symmetric trading equilibrium in which both distribution technologies are active, 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) a larger absolute amount of exports being undertaken via intermediaries and iii) both the relative share of trade undertaken by intermediaries and the average number of*

importers per exporter being unchanged. Result iii) also holds if only one of the distribution technologies is used.

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 selling technology effectively expand enough to switch. The lower variable trade costs also allow firms that previously did not export to begin exporting. Because these firms are small, they employ intermediaries and so this sector expands in absolute size.

A similar analysis can be 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 distribution patterns. Specifically, when both distribution technologies are used we have from (8) that a symmetric increase in σ decreases the value of $\overline{\phi}_I/\underline{\phi}_I$. As a result, the relative share of exports sold via intermediaries declines and the average number of importers per exporter increases. Thus, when both distribution technologies are used, direct-to-market selling gains in market share relative to sale via intermediaries as goods become closer substitutes.[6] When only one distribution technology is active, changes in σ have no impact on relative share or average number of importers.

Result 2 *In a symmetric trading equilibrium with both distribution technologies employed, the share of trade undertaken via intermediaries declines and the average number of importers per exporter increases as goods become closer substitutes in consumption. There is no impact on either measure if only one technology is active.*

Basically, what happens in this case is that an increase in the degree of substitutability between varieties causes an increase in 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 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 (8) 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

[6] For a proof of this result, see Appendix B.

of exporting done via direct-to-market selling as long as both technologies are viable. From (7), it also increases the average number of importers per exporter. 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 $\overline{L}\underline{m} < \underline{m} + (f_I + m_I(n^*) + \overline{L}\underline{m})/n^* \leq \overline{L}\overline{m}$, if $\overline{L}$ increases enough, then $\overline{L}\underline{m}$ will become greater than $\underline{m} + (f_I + m_I(n^*) + \overline{L}\underline{m})/n^*$ 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 distribution.

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. This results in a decline in the relative share of trade via intermediaries and an increase in the average number of importers per exporter. For a sufficiently large increase in $\overline{L}$, direct-to-market selling becomes cost dominated and all trade is via intermediaries. In this case, the average number of importers per exporter declines.*

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 large amounts 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 distribution 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 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, $\overline{L}_{k'}\underline{m} < \underline{m} + (f_I + m_I(n^*_{kk'}) + \overline{L}_{k'}\underline{m})/n^*_{kk'} \leq \overline{L}_{k'}\overline{m}$. This guarantees that both forms of export selling occur initially.

For this three country setting, the values of the intermediation cutoffs will depend on the countries to which the firms are exporting. Analogous to (4) above, the lowest productivity Country 1 firm that exports to Country k' is given by

$$\underline{\phi}_I^{1k'} = \phi_1^* \tau_{1k'} \left[\frac{\sigma - 1}{\sigma(2\sigma - 1)} \frac{F_{int}}{f} \right]^{1/(\sigma-1)}. \tag{9}$$

Since the cost of direct-to-market selling depends on global sales, the value of the highest productivity producer in Country 1 that uses intermediation to Country k' is given by the condition

$$r_x^{12}(\overline{\phi}_I) + r_x^{13}(\overline{\phi}_I) = \widehat{s}$$

where $r_x^{1k'}(\overline{\phi}_I)$ gives the export revenues from selling to Country k' of a firm of productivity $\overline{\phi}_I$. Analogous to the derivation in (5), the value of $\overline{\phi}_I$ is then defined as

$$\overline{\phi}_I = \phi_1^* \left[\frac{\widehat{s}}{\sigma f(\tau_{21}^{1-\sigma} + \tau_{31}^{1-\sigma})} \right]^{1/(\sigma-1)}. \tag{10}$$

Finally, the value of $\overline{\phi}_I / \underline{\phi}_I^{1k'}$ is given by

$$\frac{\overline{\phi}_I}{\underline{\phi}_I^{1k'}} = \frac{1}{\tau_{k'1}} \left[\frac{\widehat{s}(2\sigma - 1)}{(\sigma - 1) F_{int}(\tau_{21}^{1-\sigma} + \tau_{31}^{1-\sigma})} \right]^{1/(\sigma-1)}. \tag{11}$$

For case i) ($\tau_{21} > \tau_{31}$), $\underline{\phi}_I^{13} < \underline{\phi}_I^{12}$; that is, more exporting occurs to the country with the lower trade cost. In addition, $\overline{\phi}_I / \underline{\phi}_I^{12} < \overline{\phi}_I / \underline{\phi}_I^{13}$ so that more of the trade to Country 3 occurs through intermediation. For case ii) ($\overline{L}_2 > \overline{L}_3$), $\underline{\phi}_I^{13} < \underline{\phi}_I^{12}$ since $F_{in2} = [\underline{m} + (f_I + m_I(n^*_{12}) + \overline{L}_2\underline{m})/n^*_2] > F_{in3} = [\underline{m} + (f_I + m_I(n^*_{13}) + \overline{L}_3\underline{m})/n^*_3]$. Thus, there will be more trade to Country 3 than to Country 2. It will also then be that $\overline{\phi}_I / \underline{\phi}_I^{12} < \overline{\phi}_I / \underline{\phi}_I^{13}$ 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 $\overline{L}_2\underline{m} > \underline{m} + (f_I + m_I(n^*_{12}) + \overline{L}_2\underline{m})/n^*_{12}$. These results are summarized below.

Result 4 *In a three-country trading world, if both distribution 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 selling 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 Evidence on the Model's Predictions

The two-country trade model in the previous section predicts that the mode of distribution for internationally traded goods will depend on the number of consumers in the destination country ($\overline{L}$) and the degree of product heterogeneity in consumption (σ), but not on the variable cost of trade (τ). These predictions can be taken to the data using cross-product variation in the Chile-Colombia trade data. To the extent that products vary in the number of consumers they have, on how substitutable they are in consumption, and how costly to trade they are, the data will provide variation that can be linked to the model's predictions.[7]

Our model makes predictions on both the relative share of exports carried out via intermediaries versus direct-to-market selling and the average number of importers per exporter for a given product. The former predictions are difficult to test using the current data set. This is because, except for a relatively small fraction of all importers, one cannot identify with precision which importers are intermediaries and which are final customers. In addition, some importers serve both as intermediaries and final customers. The latter predictions can be tested at the HS8 product level and it is these predictions that we explore below.

Recall that the model predicts that, if it is costly for exporters to identify final customers ($m = \overline{m}$), then distribution occurs via intermediaries and direct-to-market selling when the measure of final customers, $\overline{L}$, is not too large. In this case, the average number of importers per exporter, $N_{hs8,t}$, is less than $\overline{L}$ and is increasing as $\overline{L}$ increases. This is the pattern in area A of Figure 2. As $\overline{L}$ become sufficiently large, only intermediaries are used and each exporter sells to exactly one importer, the intermediary. This is the pattern in area B of the figure. When it is cheap for exporters to identify final customers ($m = \underline{m}$), then only direct-to-market selling is used and the average number of importers per exporter is $\overline{L}$.

[INSERT FIGURE 2]

The model also predicts the relationship between $N_{hs8,t}$ and σ. In the cases where only intermediation or direct-to-market selling is used, σ does

[7] The predictions related to number of consumers and variable trade costs can also be taken to the data using cross-country variation in export destinations. However, the data used in this paper include Chilean exporter–Colombian importer pairs only and do not provide cross-country variation in export destinations.

not affect $N_{hs8,t}$. When both distribution technologies are active, more homogenous goods (large σ) will tend to use direct-to-market selling and thus sell to more exporters. Therefore, in terms of Figure 2, σ does not affect $N_{hs8,t}$ in area B, while $N_{hs8,t}$ and σ are positively correlated in area A. Finally, the model predicts that changes in variable trade costs should have no impact on the average number of importers per exporter.

Because data on the number final customers for a product is not available, we cannot test this prediction directly. We can provide indirect evidence in support of our prediction, and do so as follows. The Chilean Central Bank classifies each HS8 product into one of three categories: consumer products, intermediate goods or capital goods. This classification uses the guidelines for National Accounts published by the United Nations. Consumer products are defined as the ones that are used, without any further transformation, by households, government institutions and non-profit organizations for direct satisfaction of their needs. Intermediate goods are products used as intermediate inputs in production processes, with the exception of goods that could be considered assets (used many times to produce), which are categorized as capital goods. From the definitions, we think it is reasonable to assume that consumer products are ones for which: i) it is costly for exporters in Chile to identify directly final consumers in Colombia ($m = \overline{m}$) and ii) the number of final customers is large. In this case, the model predicts that consumer products should be ones for which intermediaries dominate the import market. As a result, consumer products should fall in area B of Figure 2. By contrast, we expect that intermediate goods and capital goods are products for which either i) it is relatively cheap for the Chilean exporter to identify the Colombian customer (($m = \underline{m}$) or ii) the number of final customers is relatively small. The former case results in direct-to-market selling, the latter locates capital and intermediate goods in area A of Figure 2.

Tables 6.1-6.4 show data patterns that are consistent with these predictions. Table 6.1 lists, for each industry in the first column of the table, one Colombian importer that we were able to classify unambiguosly as a distributor in the 2005 data.[8] The last three columns in this table report the amount this firm imported from Chile and the world and its import market share in 2005. This table reveals that virtually all industries feature some amount of trade via intermediaries. Tables 6.2-6.4 show the pattern of distribution for

[8] We classify importers using the Colombia's Official Directory of Importers published by Colombia's Customs Office, and by looking at the importer's web site.

some specific consumer and non-consumer products. Table 6.2 lists the set of Colombian importers in the largest consumer product market, by export value, from Chile: HS4 code 0808 - Apples, Pears, and Quinces, Fresh. The second column gives the description of the importers business function. The following columns report the number of Chilean exporters it dealt with in 2005, the amount it imported from Chile and the world, and the number of HS10 codes it imported from the world. What is clear from this table is that this market is dominated by intermediaries – wholesale and retail traders. As a contrast, Table 6.3 lists the set of Colombian importers for the largest non-consumer product, by export value imported from Chile: HS4 4810 - Paper and Paperboard. We see that this market has both intermediaries and Colombian manufacturers buying directly from the Chilean exporter. Relative to the previous table, however, trade in this product seems dominated by direct selling. Table 6.4 reveals a similar pattern. Even within the same industry – HS code 39, plastics – consumer product imports (HS4 code 3924 - Tableware & Other Household Articles, Plastic) are dominated by intermediaries while non-consumer product imports (HS4 code 3901 - Polymers of Ethylene in Primary Forms) are dominated by direct selling.

To provide a more systematic check on these predictions, we estimate the relationship between $N_{hs8,t}$ and d^c_{hs8}, where $d^c_{hs8} = 1$ if the product is a consumer good and zero otherwise:[9]

$$\log\left(N_{hs8,t}\right) = \alpha + \delta_t + \delta_{hs2} + \beta * d^c_{hs8} + \varepsilon_{hs8,t} \tag{12}$$

Results are shown in column 1 of Table 6.5. The β parameter is negative and statistically significant. Column 2 of the table shows parameter estimates for a regression that includes a control for the degree of product heterogeneity in consumption (σ). We use the Rauch classification of homogeneous, differentiated, and referenced priced goods (Rauch 1999) as a proxy for σ, with $d^h_{hs6} = 1$ if the hs6 product is classified as a differentiated product and zero otherwise. Controlling for σ, consumer goods (large $\overline{L}$) have fewer importers per exporter. These results are exactly what one would expect if consumer products are predominantly (all) in area B of Figure 2 – if consumer product distribution is dominated by intermediaries – while intermediate and capital goods distribution is predominantly direct-to-market selling or uses both distribution technologies.

[9]The regressions in this section are estimated using data on 2004, 2005, and 2006.

If the pattern above is the distribution pattern, then our model also predicts that σ should have no impact on $N_{hs8,t}$ for consumer products. We check for this by estimating the following equation:

$$\log(N_{hs8,t}) = \alpha + \delta_t + \delta_{hs2} + \gamma * d^h_{hs6} + \varepsilon_{hs8,t} \qquad \text{if } d^c_{hs8} = 1 \quad (13)$$

Column 3 in Table 6.5 confirms that $\widehat{\gamma}$ is statistically not different from zero. We also estimate the same equation on a sample of intermediate and capital goods ($d^c_{hs8} = 0$). These results are shown in column 4 of Table 6.5. We see that, in this sample, $\widehat{\gamma}$ is estimated to be statistically negative.[10] This outcome provides additional evidence for a pattern of distribution in which at least some intermediate or capital goods are exported using both technologies – intermediate and capital goods are, at least in part, in area A of Figure 2.

Finally, our model predicts that variable trade costs (τ) do not affect the pattern of distribution. As a result, we should expect that variable trade costs are uncorrelated with the number of importers per exporter. One way to test this prediction would be to use variations in tariffs across products. Over the period of our sample, however, Chile and Colombia have a uniformly flat tariff with respect to each other so that no cross-product variation in tariffs occurs.

As an alternative, we estimate the value of τ using data on freight and insurance costs at the transaction level. Doing so presents two problems. First, for many HS8 codes, information on freight and insurance costs is missing in our data. For others, the HS8 product appears only in transactions with other HS8 codes, making it impossible to disentangle the part of freight and insurance costs due to each product. Therefore, we estimate the value of τ using only the subsample of transactions for which freight and insurance values are available and only a single HS8 product is shipped.

Our estimating equation for τ is:

$$(F_{i,t} + I_{i,t}) = \alpha_{hs4} + \tau_{hs4} * FOB_{i,t} + \varepsilon_{i,t} \quad (14)$$

where $F_{i,t}$ and $I_{i,t}$ are the freight and insurance costs of transaction i at year t and $FOB_{i,t}$ is the fob value of the same transaction. This equation is estimated separately for each of 84 HS4 categories that have at least

[10] The same results hold when we include d^c_{hs8}, d^h_{hs6}, and an interaction term $d^c_{hs8} * d^h_{hs6}$ in a regression using the full sample.

10 transactions with freight and insurance cost information for unique HS8 codes. The parameter τ_{hs4} is our measure of the variable trade cost for trade between Chile and Colombia for products within a particular HS4 category. For three industries we obtain small negative estimates for τ_{hs4}. Figure 3 shows the distribution of the non-negative values for $\widehat{\tau}_{hs4}$. They range from 0.001 to 0.31 with an average of 0.081 and a standard deviation of 0.07.

[INSERT FIGURE 3]

Using our estimates for τ_{hs4} we investigate the correlation between variable trade costs and the number of importers per exporter:

$$\log\left(N_{hs8,t}\right) = \alpha + \delta_t + \delta_{hs2} + \eta * \widehat{\tau}_{hs4} + \varepsilon^{\tau}_{hs8} \tag{15}$$

Column 5 of Table 6.5 shows that the average number of importers per exporter is not correlated with variable trade cost in a statistically significant way. To check that this lack of significance is not due simply to the reduced sample size, we re-estimate equation (12) on the same sub-sample. The result is reported in Column 6 of Table 6.5. We see that d^c_{hs8} continues to be statistically correlated with the average number of importers per exporter even in this reduced sample. Finally, in Column 7 we report regression results for this sub-sample using the full set of controls. The coefficient on $\widehat{\tau}_{hs4}$ continues to be not statistically significant, while the coefficients on d^c_{hs8} and d^h_{hs6} are of the correct sign and weakly significant.

7 Concluding Remarks

Even though our model of the distribution 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 distribution sectors. So, for instance, if distribution is skilled labor intensive and manufacturing unskilled labor intensive, rich countries will have relatively cheap distribution sectors. This will result in more trade to rich countries than to poor countries, as is observed in the data.

Our analysis also assumes that the distribution sector is, effectively, perfectly competitive. The case study of sheets imported into Canada suggests that imperfect competition within the supply chain may be a significant factor in determining consumer prices. This suggests that cross-country differences in the extent of competition within distribution sectors may be important in determining the impact of trade liberalization on importing/exporting behavior. Large, rich countries, for instance, may be more likely export destinations than small, rich countries because the distribution sectors in the former are more competitive than those in the latter.

Finally, we know from the data that about half of all trade is intra-firm trade. In some cases, the foreign affiliate of a multinational firm serves as an import distributor of a final product; in other cases, the foreign affiliate is importing an intermediate good. The latter situation essentially correpsonds to our direct-to-market technology. The former situation is like our intermediated trade technology, except that the affiliate typically imports and distributes only the parent's product. A richer model of the distribution sector would allow for this sort of intra-firm trade and for an exporter to make a choice between dealing at arms length with a distributor or using a foreign affiliate to distribute. Hostmann and Markusen (1996) provide a model of this latter choice problem.

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8 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*

Figure A1 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.

[INSERT FIGURE A1]

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

Table A1 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.*

Table A2 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.*

Figure A2 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 in the text for a more detailed description.) This pattern is also present in 2005 and 2006.

[INSERT FIGURE A2]

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. Figure A3 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.

[INSERT FIGURE A3]

vi) *The number of exporters selling in a given destination and the amount they sell vary with the destination's market size.*

Figure A4 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.

[INSERT FIGURE A4]

Figure A5 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.

[INSERT FIGURE A5]

Finally, Figure A6 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).

[INSERT FIGURE A6]

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. Table A3 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.

Table A4 reports the actual number of exporters for each string of destinations, where each string indicates a 1 if a firm exports 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. Tables A5 and A6 show that for the 10 most popular Chilean destinations in terms of total export values.

9 Appendix B

Result 2 claims that, if both distribution technologies are active, then the relative share of trade via intermediation declines and the average number of importers per exporter increases. The proof for this claim follows from the proposition below.

Proposition 5 *If both distribution technologies are active, then* $\overline{\phi}_I/\underline{\phi}_I$ *is decreasing in* σ*.*

Proof. Recall from equation (8) that

$$\frac{\overline{\phi}_I}{\underline{\phi}_I} = \left[\frac{\widehat{s}(2\sigma-1)}{(\sigma-1)F_{int}}\right]^{1/(\sigma-1)}, \tag{16}$$

where $F_{int} = [\underline{m} + (f_I + m_I(n^*_{k'k}) + \overline{L}_{k'}\underline{m})/n^*_{k'k}]$ and the value of $n^*_{k'k}$ depends only the parameters $\underline{m}, \overline{m}, f_I$, and $\overline{L}$ and the form of the function $m_I(n)$. We can write equation (16) as

$$\ln \overline{\phi}_I - \ln \underline{\phi}_I = \frac{1}{\sigma-1}[\ln \widehat{s}(2\sigma-1) - \ln(\sigma-1)F_{int}].$$

The derivative of this equation with respect to σ is

$$\frac{d[\ln \overline{\phi}_I - \ln \underline{\phi}_I]}{d\sigma} = -\frac{1}{(\sigma-1)^2}[\ln \widehat{s}(2\sigma-1) - \ln(\sigma-1)F_{int}] + \frac{1}{\sigma-1}[\frac{2}{2\sigma-1} - \frac{1}{\sigma-1}].$$

From (16) and given $\overline{\phi}_I > \underline{\phi}_I$, it must be that $\widehat{s}(2\sigma-1) > (\sigma-1)F_{int}$, implying that both terms are negative and the result is proved. ■

TABLES

Table 2.1: Summary Statistics of Chile's Exporters

	2004	2005	2006
Worldwide Sales of Chilean Exporters			
Total Exports (US$ Mill.)	30,492	38,011	55,089
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	348	492
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$ Th.)			
1%	0.3	0.3	0.3
10%	2.2	2.1	2.5
25%	8.1	7.7	9.2
50%	53.6	49.2	58.8
75%	421.6	424.1	503.6
90%	2,661.1	2,727.9	3,201.5
99%	51,044.7	59,819.2	73,058.3
Distribution of Colombian Sales of Chilean Exporters (Percentiles; US$ Th.)			
1%	0.5	0.5	0.4
10%	3.3	3.8	3.6
25%	11.7	13.0	12.4
50%	49.7	54.3	57.5
75%	239.4	242.7	250.6
90%	1,005.6	1,076.7	976.9
99%	7,177.3	8,068.5	8,977.2

Source: Chilean Customs Office

Notes: Total exports are the FOB value of exports. The number of Colombian importers is determined using the identity of the consignee in each export transaction as recorded by Chile's customs forms.

Table 2.2: Summary Statistics of Colombia's Importers

	2004	2005	2006
Worldwide Purchases of Colombian Importers			
Total Imports (US$ Mill.)	4,866	6,287	9,108
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.)	328	335	476
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 (Percentiles; US$ Th.)			
1%	0.1	0.1	0.1
10%	8.9	12.9	10.7
25%	73.5	85.4	84.8
50%	528.1	641.1	757.3
75%	2,556.6	2,954.7	3,848.8
90%	10,425.4	11,622.6	15,074.9
99%	61,777.2	74,055.1	136,556.4
Distribution of Chilean Purchases of Colombian Importers (Percentiles; US$ Th.)			
1%	0.02	0.03	0.04
10%	2.0	2.0	1.8
25%	9.8	11.2	12.8
50%	48.8	49.9	60.0
75%	201.0	240.0	278.6
90%	692.4	775.4	907.7
99%	4,364.9	5,665.6	7,400.1

Source: Colombian Customs Office.

Notes: Total imports are the FOB value of imports. The number of Chilean exporters is determined using the identity of the exporting firm in each import transaction in the Colombian customs forms.

Table 2.3: Summary Statistics of the Matching Procedures

Panel A: Matched Transactions (Conservative Version)

	2004	2005	2006
All Transactions			
Export Transactions in Chilean data	10,078	9,876	10,768
Import Transactions in Colombian data	14,208	14,038	15,758
Matched based on exporters' names			
Transactions matched in Chilean Data	9,886 (98%)	9,634 (98%)	10,493 (97%)
Transactions matched in Colombian Data	13,828 (97%)	13,614 (97%)	15,290 (97%)
Matched based on importers' names			
Transactions matched in Chilean Data	9,103 (90%)	8,967 (91%)	9,779 (91%)
Transactions matched in Colombian Data	13,671 (96%)	13,142 (94%)	14,454 (92%)
Matched based on exporters' and importers' names			
Transactions matched in Chilean Data	8,600 (85%)	8,489 (86%)	9,166 (85%)
Transactions matched in Colombian Data	12,812 (90%)	12,502 (89%)	13,612 (86%)

Notes: The criteria based upon exporter's names considers a match successful when the identity of the exporting firm as recorded in Chile coincides with the identity of the exporting name as recorded in Colombia. The criteria based upon importers' names defines a match when the identity of the importer as recorded in Colombia coincides with the identity of the importer as recorded in Chile. Finally, the criteria based on exporters' and importers' names declares a transaction matched when both the identity of the importer and the exporter as reported by Chile's and Colombia's customs coincide.

Panel B: Matched Firms (Conservative Version)

	2004	2005	2006
All Firms			
Exporters in Chilean data	681	701	786
Exporters in Colombian Data	696	740	795
Importers in Colombian Data	993	1,014	1,035
Importers in Chilean Data	961	952	1,010
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: The number of exporters in the Chilean database corresponds to the number of firms exporting to Colombia in any given year, while the number of exporters in the Colombian database is obtained by adding exporters as reported in each import form. This procedure requires significant cleaning because exporters are identified with their names only. See the text for a description of the cleaning procedure. The accounting of importers in Colombia's import database and in Chile's export database is done symmetrically.

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

	2004	2005	2006
Matched based on exporters' names			
Total Exports to Colombia (US$ Mill)	288	308	448
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$ Th.)			
1%	0.4	0.5	0.1
10%	3.6	5.2	4.4
25%	13.9	15.7	17.4
50%	61.6	63.3	79.7
75%	269.2	303.7	305.1
90%	1,275.7	1,205.1	1,165.9
99%	8,269.4	8,113.6	11.997.7
Matched based on importers' names			
Total Exports to Colombia (US$ Mill)	281	308	446
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$ Th.)			
1%	0.7	0.6	0.7
10%	3.9	4.4	4.4
25%	16.5	14.6	15.7
50%	60.3	61.3	68.8
75%	275.7	270.1	282.9
90%	1,134.6	1,151.4	1,034.2
99%	6,662.3	7,731.4	8,927.9
Matched based on exporters' and importers' names			
Total Exports to Colombia (US$ Mill)	276	294	438
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$ Th.)			
1%	1.0	1.3	0.7
10%	4.5	5.6	5.9
25%	21.1	19.4	19.6
50%	80.5	74.7	83.3
75%	306.7	311.2	363.6
90%	1,263.5	1,209.9	1,196.1
99%	7,177.3	8,068.5	8,977.2

Notes: This Table reports the same statistics as in Table 2.1 for the sub sample of exporters for which a successful match is obtained using the three different criteria specified in the text.

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

	2004	2005	2006
Matched based on exporters' names			
Total Imports from Chile (US$ Mill)	319	328	470
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$ Th.)			
1%	0.2	0.1	0.1
10%	3.9	4.6	5.2
25%	14.3	18.1	19.1
50%	60.3	62.1	81.6
75%	240.0	307.9	316.8
90%	716.5	831.8	1,046.3
99%	4,364.9	5,875.8	8,064.1
Matched based on importers' names			
Total Imports from Chile (US$)	303	315	457
Number of Importers	865	862	910
Sources per Importer	8.7	9.0	9.1
Imports per Importer (US$ Th.)	350.6	365.0	501.8
Distribution of Chilean Purchases of Colombian Importers (Percentiles; US$ Th.)			
1%	0.2	0.4	0.1
10%	4.5	4.7	4.3
25%	15.0	17.5	17.5
50%	61.5	64.9	76.5
75%	253.9	308.4	300.3
90%	741.8	822.0	990.8
99%	4,953.0	5,603.6	6,592.2
Matched based on exporters' and importers' names			
Total Imports from Chile (US$)	287	302	440
Number of Importers	803	797	823
Sources per Importer	8.4	8.6	9.0
Imports per Importer (US$ Th.)	357.4	378.8	534.8
Distribution of Chilean Purchases of Colombian Importers (Percentiles; US$ Th.)			
1%	1.0	0.6	0.3
10%	5.8	5.9	6.4
25%	17.5	21.6	24.5
50%	70.6	73.6	90.9
75%	271.7	329.5	337.2
90%	770.3	854.2	1,085.2
99%	4,364.9	5,603.6	6,592.2

Notes: This Table reports the same statistics as in Table 2.2 for the sub sample of importers for which a successful match is obtained using the three different criteria specified in the text.

Table 3.1: Summary Statistics of the Matched Exporter-Importer Pairs using exporters' and importers' names as matching criterion

	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 (Percentiles; US$ Th.)*			
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 (Percentiles; US$ Th.)**			
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 using the Conservative Criterion as defined in the text. * Distribution of total exports to Colombia plus total imports from Chile by importer-exporter pair. ** Distribution of total exports to the world plus total imports from the world by importer-exporter pair.

Table 3.2: Trade Patterns of Matched Exporters and Importers

Panel A: Exporters' Characteristics

	Dependent Variable								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exporters that Trade with:	Log (Sales to Col.)	Log (Sales to Col.) per Importer	Log (World Sales)	HS8 Codes Exported to Colombia	HS8 Codes Exported to Colombia per Importer	HS8 Codes Exported to World	HS10 Codes Imported from Chile by Importer	Number of 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

Standard errors in parenthesis are clustered at the importer level

Notes: Sales to Colombia are computed as total FOB exports to Colombia by matched exporter per year, and World Sales are computed as total FOB exports to the world by matched exporter per year. The number of HS 8-digit products (HS8) sold by each exporter to Colombia and to the world is computed using Chile's export database, while the number of 10-digit products bought by each importer from Chile is computed using Colombia's import database. The Number of Importers per Exporter is computed as the number of (matched) importers for each (matched) exporter.

Panel B: Importers' Characteristics

	Dependent Variable						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Importers that Trade with:	Log (Purchases from Chi.)	Log (Purchases from Chi.) per Exporter	Log (World Purchases)	HS10 Codes Imported from Chile	HS10 Codes Imported from Chile per Exporter	HS8 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

Standard errors in parenthesis are clustered at the importer level

Notes: Purchases from Chile are computed as total FOB imports from Chile by matched importer per year, and World purchases are computed as total FOB imports from the world by matched importer per year. The number of 10-digit HS products (HS10) bought by each importer is obtained using Colombia's database, while the number of 8-digit HS products (HS8) sold by each exporter is obtained using Chile's database. The number of Exporters per Importer is computed as the number of (matched) exporters for each (matched) importer.

Table 3.3: Who do Small Chilean Exporters Sell To? Characteristics of Colombian Importers dealing with Small Chilean Exporters

Panel A: Chilean Exporters selling less than US$ 30,000 to Colombia

	2004	2005	2006
Total Number of Chilean Exporters	195	207	205
Sell to Colombian Importers that buy from Chile			
More than US$ 30,000	73	82	90
Less than US$ 30,000	116	119	110
Both	6	6	5

Notes: Small Chilean exporters (selling less than US$ 30,000 in any year to Colombia) sorted based on whether the Chilean firm deals exclusively with large Colombian importers (total imports from Chile larger than US$ 30,000), exclusively with small Colombian importers (total imports from Chile of less than US$ 30,000), or with both large and small importers.

Panel B: Chilean Exporters selling less than US$ 30,000 to Colombia and selling exclusively to Colombian Importers buying less then US$ 30,000 from Chile

Number of Chilean Exporters that Sell Less than US$ 30,000 to Colombia and Sell Exclusively to Importers buying Less than US$ 30,000 from Chile

	2004		
		Sales to the World	
	Total	< US$ 30,000	> US$ 30,000
Total Number of Chilean Exporters	116	25	91
Sell to Colombian Importers that buy from the World			
More than US$ 30,000	76	12	64
Less than US$ 30,000	37	13	24
Both	3	0	3

	2005		
		Sales to the World	
	Total	< US$ 30,000	> US$ 30,000
Total Number of Chilean Exporters	119	35	84
Sell to Colombian Importers that buy from the World			
More than US$ 30,000	76	16	60
Less than US$ 30,000	37	17	20
Both	6	2	4

	2006		
		Sales to the World	
	Total	< US$ 30,000	> US$ 30,000
Total Number of Chilean Exporters	110	21	89
Sell to Colombian Importers that buy from the World			
More than US$ 30,000	71	10	61
Less than US$ 30,000	36	10	26
Both	3	1	2

Notes: Small Chilean exporter - Colombian importer pairs (total exports to Colombia / imports from Chile less than US$ 30,000 in any year) sorted by world exports and imports of the paired firms. Sorting based on world sales of the exporting firm being either larger or smaller than US$ 30,000 and the firm dealing either exclusively with large global importers (world purchases larger than US$ 30,000), with small global importers (world purchases lower than US$ 30,000),or both large and small global importers.

Table 6.1: Examples of Importer/Distributor by Sector

Sector	HS Codes	Description of Importer's Main Activity	Imports (US$ Th.)		Share of Imports from Chile
			From Chile	From World	
Animal & Animal Products	01-05	Wholesale Trader of Seafood and other Food Products	3,125	5,427	21.4%
Vegetable Products	06-15	Wholesale Trader of Fruits and Vegetables	4,590	17,200	10.0%
Foodstuffs	16-24	Wholesale Trader of Miscellaneous Products	5,254	5,524	4.5%
Mineral Products	25-27	Wholesale Trader of Fertilizers and Agricultural Products	4,108	30,500	12.7%
Chemicals & Allied Industries	28-38	Wholesale Trader of Fertilizers and Agricultural Products	4,108	30,500	16.5%
Plastics / Rubbers	39-40	Wholesale Trader of Miscellaneous Products	622	930	0.2%
Raw Hides, Skins, Leather, & Furs	41-43	Wholesale/Retail Trader of Home and Construction Prod.	1,543	24,800	10.8%
Wood & Wood Products	44-49	Wholesale Trader of Office Equipment	2,131	5,273	4.6%
Textiles	50-63	Wholesale Trader of Textiles	785	3,891	7.4%
Footwear / Headgear	64-67	Retail Trader of Footwear and Leather Products	22	22	19.8%
Stone / Glass	68-71	Wholesale Trader of Construction Products	1,713	8,057	39.4%
Metals	72-83	Wholesale Trader of Miscellaneous Products	1,836	2,633	6.8%
Machinery / Electrical	84-85	Wholesale Trader of Electrical Appliances	4,616	9,099	20.7%
Transportation	86-89	Assembler and Distributors of Motor Vehicles	9,708	235,000	97.4%
Miscellaneous	90-97	Wholesale Trader of Construction Products	152	5,473	16.5%

Notes: Table uses data for 2005 only. For each sector the table describes the activity of the largest (matched) Colombian importer that we are able to unambiguously classify as wholesaler/retailer after a search in the web and on Colombia's Official Directory of Importers. Imports are the FOB value. The last column gives the share that the importer represents in total Colombian imports from Chile in the sector.

Table 6.2: Colombian Importers of Chile's Largest Consumption Good Exported; Apples, Pears, and Quinces, Fresh (HS4 0808).

#	Description of Importer's Main Activity	Exporters per Importer	Imports from Chile (US$ Th.)	Imports from World (U$$ Th.)	HS Codes Imported from World
1	Supermarket Chain	2	51	51,400	547
2	Wholesale Trader of Fruits and Vegetables	14	1,311	17,200	8
3	Manufacturer and Wholesale Trader of Food Products	3	31	16,000	564
4	Wholesale Trader of Agricultural Products	2	788	10,700	11
5	Exporter and Wholesale Trader of Fruits and Vegetables	1	9	9,157	14
6	Supermarket Chain	1	11	7,217	210
7	Retailer of Fruits and Vegetables	2	1,151	4,354	8
8	Importer and Distributor of Fruits and Vegetables	3	445	3,472	7
9	Wholesale Trader of Fruits	4	439	2,270	5
10	Manufacturer and Wholesale Trader of Processed Food Products	1	139	2,062	23
11	Wholesale Trader of Agricultural Products	3	173	1,424	9
12	Wholesale Trader of Agricultural Products	5	260	1,126	6
13	Wholesale Trader of Fruits and Vegetables	3	160	1,084	8
14	Retailer of Fruits and Vegetables	5	275	1,046	8
15	Wholesale Trader of Fruits	6	262	1,021	4
16	Wholesale Trader of Fruits	4	363	945	6
17	Wholesale Trader of Miscellaneous Products	6	410	874	7
18	Wholesale Trader of Fruits	8	108	819	9
19	Natural Person	3	254	554	3
20	Importer and Wholesale Trader of Fruits	2	214	513	3
21	Wholesale Trader of Agricultural Products	1	152	382	3
22	N/A	1	53	328	5
23	Wholesale and Retail Trader of Fresh Fruits	1	101	324	4
24	Manufacturer and Wholesale Trader of Fruits	1	34	310	9
25	Importer and Wholesale Trader of Fruits	2	94	263	3
26	Wholesale Trader of Fruits	4	35	198	3
27	Natural Person	1	87	87	2
28	Natural Person	3	21	84	4
29	Natural Person	2	68	68	3
30	N/A	1	16	46	4
31	Importer and Distributor of Fruits and Vegetables	1	27	27	1
32	Importer and Exporter of Agricultural Products	2	2	22	4

Notes: Characteristics of each (matched) Colombian importer of HS4 0808. The table reports the main business activity for each importer (see notes to Table 6.1). Imports are FOB value.

Table 6.3: Colombian Importers of Chile's Largest Non-consumption Good Exported; Paper and Paperboard (HS4 4810).

#	Description of Importer's Main Activity	Exporters per Importer	Imports from Chile (US$ Th.)	Imports from World (US$ Th.)	HS Codes Imported from World
1	Manufacturer of Paper Products & Diapers	1	294	48,900	201
2	Manufacturer of Office Products	1	67	10,300	83
3	Manufacturer of Articles for Graphic Art	1	11	8,246	64
4	Wholesale Trader of Office Supplies	1	355	5,273	18
5	Cooperative of Manufacturers of Paper Products	1	27	3,884	16
6	Manufacturer of Boxes and Cases	1	132	3,619	41
7	Manufacturer of Wood Products and Cases	1	259	2,946	17
8	Book Publisher	1	2	2,486	29
9	Manufacturer of Paperboard Boxes	1	152	1,790	34
10	Importer and Wholesale Trader of Paper and Paperboard	1	47	1,651	12
11	Cooperative of Manufacturers of Paper Products	1	62	1,287	10
12	Wholesale Trader of Office Supplies	1	26	1,266	7
13	Wholesale Trader of Paper and Paperboard	1	236	1,156	4
14	Manufacturer of Articles for Graphic Art	1	115	1,139	13
15	Wholesale Trader of Office Supplies	1	364	1,042	2
16	Wholesale Trader of Paper and Paperboard	1	13	891	9
17	Manufacturer of Notebooks	1	6	857	12
18	Manufacturer of Paperboard Boxes	1	154	806	25
19	Manufacturer of Paperboard Boxes and Cases	1	109	720	7
20	Manufacturer of Boxes and Tags	1	277	568	2
21	Manufacturer of Articles for Graphic Art	1	257	514	2
22	Wholesale Trader of Paper Products	1	136	496	3
23	Manufacturer of Articles for Graphic Art	1	46	388	17
24	Manufacturer of Articles for Graphic Art	1	114	349	2
25	Natural Person	1	16	275	16
26	Book Publisher	1	44	230	7
27	Manufacturer of Boxes and Tags	1	37	224	6
28	Manufacturer of Articles for Graphic Art	1	24	166	2
29	Manufacturer of Boxes and Cases	1	6	52	3
30	Manufacturer of Articles for Graphic Art	1	22	22	1

Notes: See notes to Table 6.2.

Table 6.4: Colombian Importers of a Consumption and a Non-Consumption Products within the Plastic Industry (HS2 39).

#	Description of Importer's Main Activity	Exporters per Importer	Imports from Chile (US$ Th.)	Imports from World (US$ Th.)	HS Codes Imported from World
#	**Consumption Good; Tableware & Other Household Articles, Plastic (HS 3924)**				
1	Wholesale and Retail Trader of Home and Building Products	3	64	24,800	399
2	Wholesale Trader of Miscellaneous Products	1	89	930	28
#	**Non-Consumption Good; Polymers of Ethylene in Primary Forms (HS 3901)**				
1	Manufacturer of Sanitary Paper Products	1	72	34,200	80
2	Manufacturer of Paper	1	473	20,800	247
3	Manufacturer of Packaging Products	1	38	17,300	80
4	Wholesale Trader of Plastics, Chemicals and Textiles	1	21	10,200	39
5	Manufacturer of Plastic Materials and Resin	1	72	9,993	73
6	Manufacturer of Plastic Products	1	27	8,504	99
7	Manufacturer of Plastic Materials and Resin	1	2	7,269	28
8	Manufacturer of Plastic in Primary Form	1	95	5,540	19
9	Manufacturer of Plastic in Primary Form	1	4	5,340	12
10	Manufacturer of Packaging Products	1	45	4,324	21
11	Manufacturer of Packaging Products	1	26	3,766	22
12	Wholesale Trader of Chemical and Plastic Products	1	7	3,402	29
13	Manufacturer of Packaging Products	1	122	2,479	4
14	Manufacturer of Packaging Products	1	37	1,612	5
15	Manufacturer of Packaging Products	1	34	1,437	6
16	Manufacturer of Packaging Products	1	51	1,374	11
17	Manufacturer of Plastic and Foam Products	1	125	1,299	4
18	Manufacturer of Plastic Products	1	39	157	2

Notes: See notes to Table 6.2.

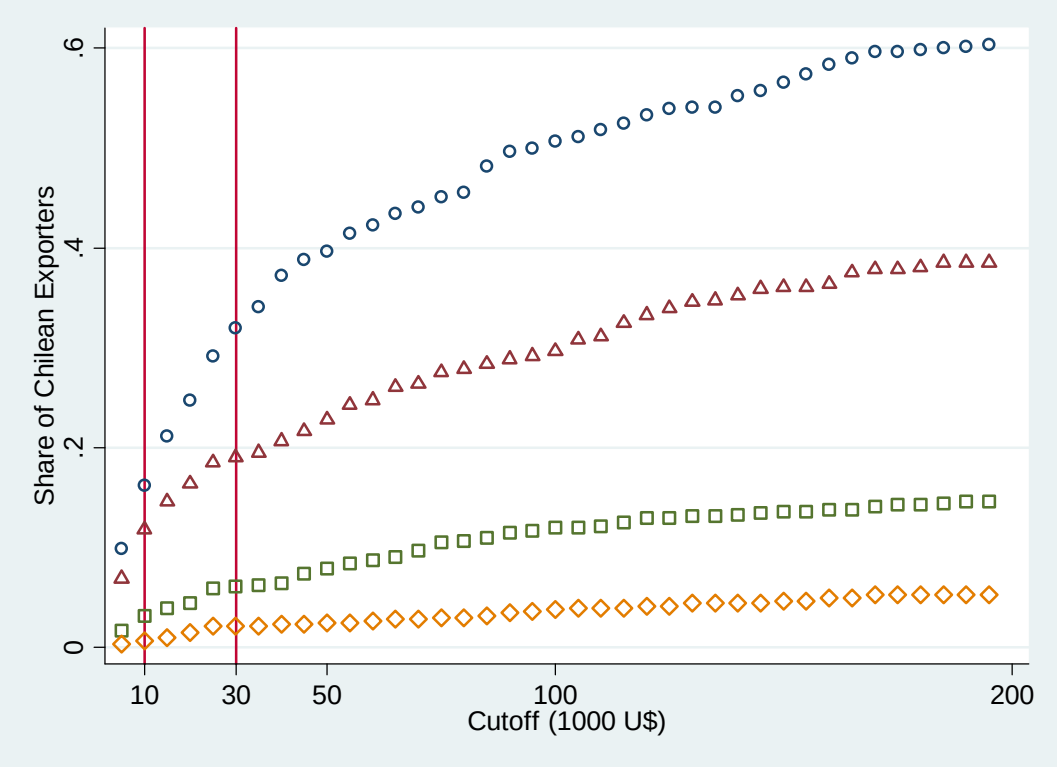
Table 6.5: Determinants of the Number of Importers per Exporter by HS8 product N_{hs8}

Dependent Variable	(1) $\log(N_{hs8})$	(2) $\log(N_{hs8})$	(3) $\log(N_{hs8})$	(4) $\log(N_{hs8})$	(5) $\log(N_{hs8})$	(6) $\log(N_{hs8})$	(7) $\log(N_{hs8})$
$d^{c}_{hs8}=1$	-0.12	-0.11				-0.21	-0.15
	[.04]	[.04]				[.08]	[.13]
$d^{h}_{hs6}=1$		-0.18	-0.04	-0.21			-0.32
		[.07]	[.11]	[.08]			[.27]
τ_{hs4}					-1.56		-0.77
					[1.50]		[1.36]
HS2 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Obs.	2,768	2,766	752	2,014	800	800	800
# HS8	1,425	1,425	372	1,046	353	353	353
R2	.18	.19	.16	.19	.31	.30	.33
Sample	Full sample	Full sample	Consumer goods	Non-consumer goods	Trade cost sample	Trade cost sample	Trade cost sample

Notes: Robust Standard errors in parenthesis. They are bootstrapped and clustered at the HS4 level for the regressions that include τ_{hs4}. They are clustered at the HS6 level for regressions that include the dummy variable for differentiated products. The dependent variable is the ratio of total number of (matched) Colombian importers to the total number of (matched) Chilean exports within each HS8 product category (in logs). The dummy variable $d^{c}_{hs8}=1$ if HS8 is classified as a consumer good; the dummy variable $d^{h}_{hs6}=1$ if HS6 is classified as differentiated according to Rauch's (1999) product classification. The variable τ_{hs4} is the estimated value for variable trade costs between Chile and Colombia at the HS4 level.

FIGURES

Figure 1: Characteristics of Importer - Exporter Pairs.



Notes: 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. Series marked with triangles shows the share of Chilean exporters meeting first criterion and that traded exclusively with Colombian importers that bought less than the "Cutoff Value" from Chile. Series marked with squares shows the share of Chilean exporters to Colombia meeting the first two criteria and that sold exclusively to Colombian importers that bought less than the "Cutoff Value" from the World in 2004. Series marked with diamonds shows the share of Chilean exporters that satisfy the first three criteria and that sold less than the "Cutoff Value" to the World.

Figure 2: Patterns of Use of Intermediation Technologies.

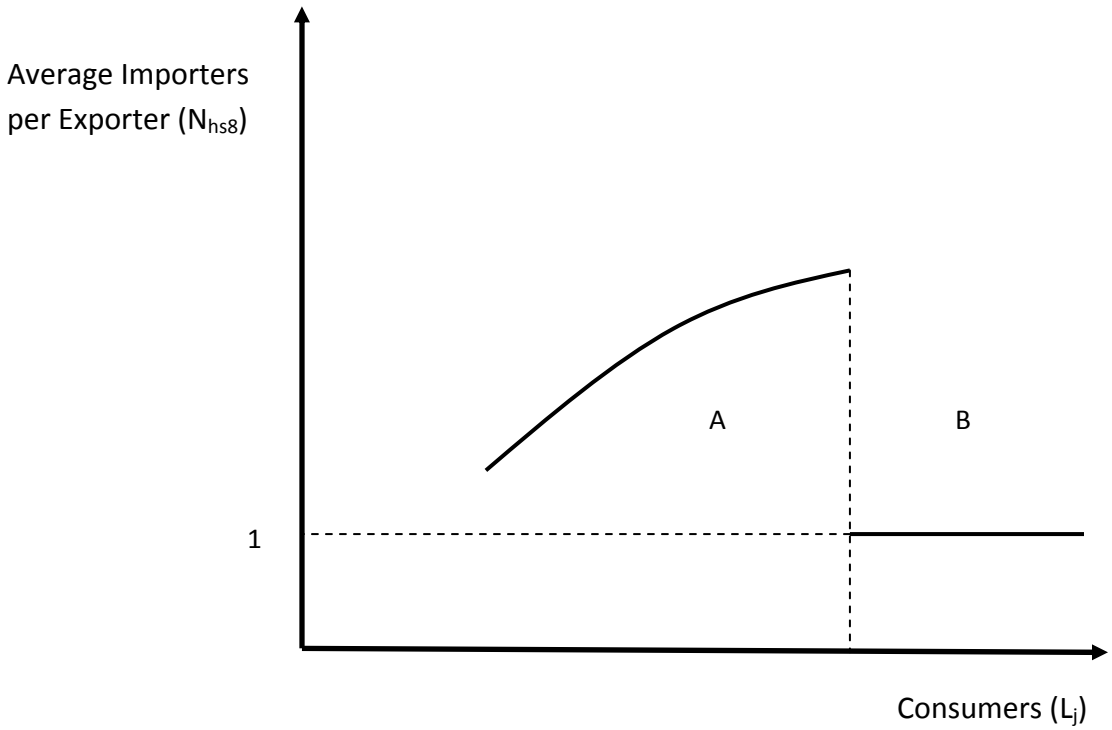
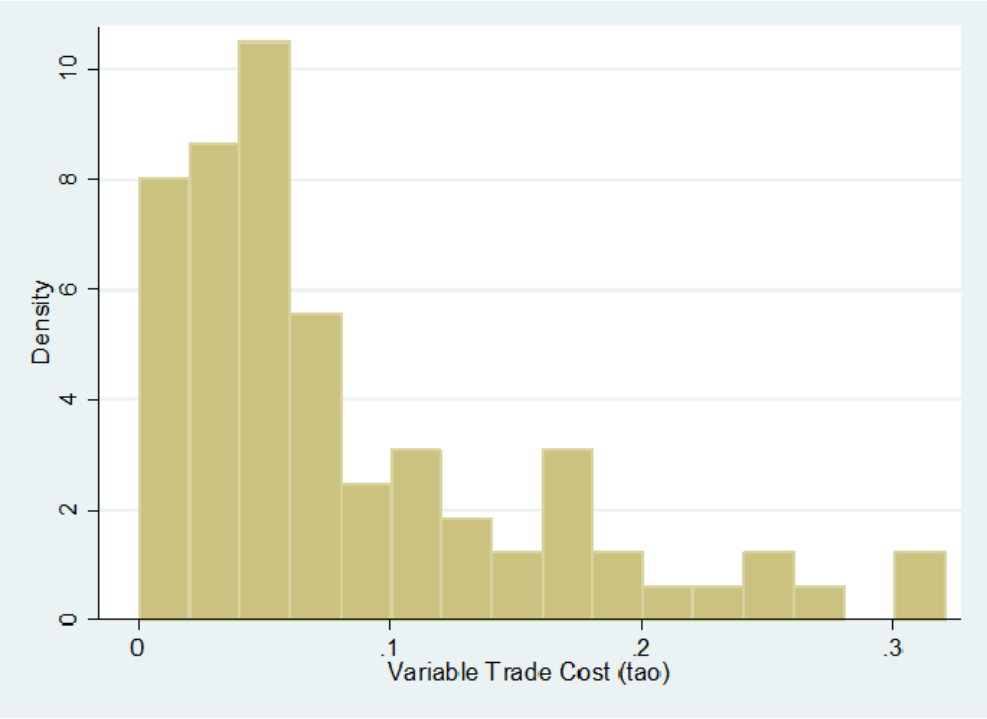


Figure 3: Distribution of Estimated Variable Trade Cost



APPENDIX TABLES

Table A.1: Distribution of Foreign Sales by Destination

	Firms exporting to Exactly one market		Firms exporting to 10 or more markets		Firms exporting to 30 or more markets	
	% exporters	% exports	% exporters	% exports	% exporters	% exports
2004	52.9	2.1	8.1	82.3	0.9	31.4
2005	54.2	1.7	8.1	84.1	1.0	33.4
2006	51.9	1.5	8.7	85.6	1.1	32.2

Source: Chilean Customs Office

Table A.2: Decomposition of Chile's Exports into New and Continuing Exporters

	2004	2005	2006
All			
Total Value of Exports (US$ Mill)	30,492	38,011	55,089
Number of exporters (#)	6,543	6,787	6,886
Exports per Exporter (US$ Th.)	4,660	5,601	7,999
New Exporters in year *t*			
Total Value of Exports (US$ Mill)		262	784
Number of exporters (#)		2,414	2,401
Exports per Exporter (US$ Th.)		108	327
Exporters in t that were also exporting in t-1			
Total Value of Exports (US$ Mill)		37,749	54,300
Number of exporters (#)		4,373	4,485
Exports per Exporter (US$ Th.)		8,632	12,107

Source: Chilean Customs Office

Table A.3: 10 Most Popular Export Destinations in 2004 ranked by Number of Chilean Exporters

Country	Number of Chilean Exporters	Marginal Probability
United States	2,127	0.40
Peru	1,533	0.29
Argentina	1,465	0.28
Bolivia	978	0.19
Mexico	934	0.18
Brazil	899	0.17
Ecuador	759	0.14
Spain	742	0.14
Colombia	681	0.13
Germany	669	0.13
Total firms exporting to at least one of the top 10	5,289	1.00
Total firms exporting	6,543	

Source: Chilean Customs Data

Notes: Marginal Probability is the ratio of the number of firms exporting to the destination relative to the number of exporting to at least one of these ten countries

Table A.4: Hierarchy of 10 Most Popular Export Destinations in 2004 ranked by Number of Chilean Exporters

Exporting to (string):	Observed Number of Firms	Under Independence	
		Predicted Probability	Number of Firms
1000000000	885	0.064	341
1100000000	53	0.026	139
1110000000	22	0.010	53
1111000000	8	0.002	12
1111100000	2	4.92E-04	3
1111110000	8	1.01E-04	1
1111111000	4	1.69E-05	0
1111111100	0	2.76E-06	0
1111111110	5	4.07E-07	0
1111111111	16	5.15E-08	0
Total	1003	0.104	549
% of firms	0.190		0.104

Source:

Notes: Each string has 10 positions; a 1 in the *kth* position indicates whether a firm exports to the *kth* most popular destination, and 0 otherwise. The observed number of firms refers to the number of Chilean exports whose export patterns correspond to that of the string. The last two columns represent the probability and predicted number of firms that would belong to each string if the probabilities of exporting to any country were independent.

Table A.5: 10 Most Popular Export Destinations in 2004 by Export Values

Country	Number of Chilean Exporters	Marginal Probability
United States	2,127	0.59
Japan	539	0.15
China	416	0.12
South Korea	354	0.10
Netherlands	585	0.16
Brazil	899	0.25
Italy	487	0.14
Mexico	934	0.26
France	535	0.15
Taiwan	329	0.09
Total firms exporting to at least one of the top 10	3,577	1.00
Total firms exporting	6,543	

Source:

Notes: Marginal Probability is the ratio of the export values exported to each destination relative to the export values exported to at least one of these ten countries

Table A.6: Hierarchy of 10 Most Popular Export Destinations in 2004 by Export Values

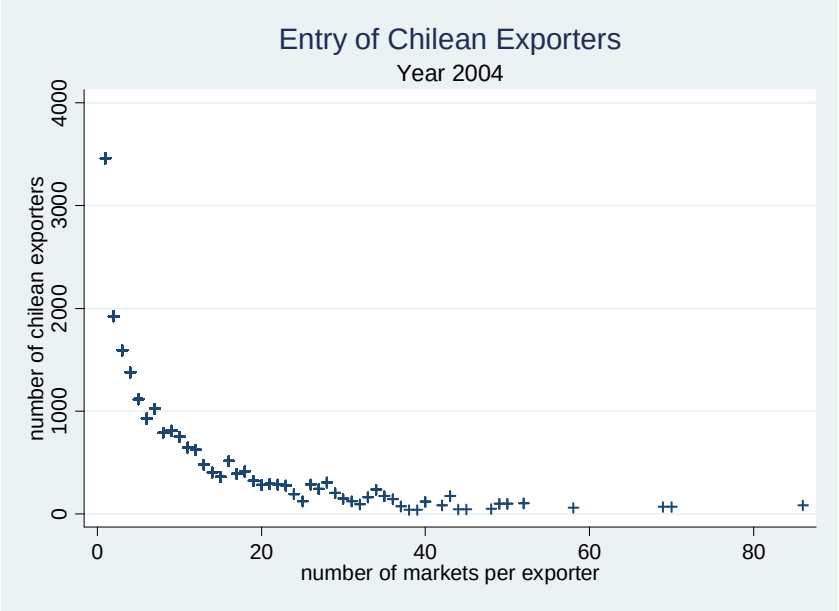
Exporting to (string):	Observed Number of Firms	Under Independence	
		Predicted Probability	Number of Firms
1000000000	1,026	0.124	444
1100000000	43	0.022	79
1110000000	4	0.003	10
1111000000	5	3.18E-04	1
1111100000	1	6.23E-05	0
1111110000	1	2.09E-05	0
1111111000	0	3.29E-06	0
1111111100	2	1.17E-06	0
1111111110	1	2.05E-07	0
1111111111	17	1.89E-08	0
Total	1,100	0.149	535
% of firms	0.308		0.149

Source:

Notes: Each string has 10 positions; a 1 in the *kth* position indicates whether a firm exports to the *kth* most popular destination, and 0 otherwise. The observed number of firms refers to the number of Chilean exports whose export patterns correspond to that of the string. The last two columns represent the probability and predicted number of firms that would belong to each string if the probabilities of exporting to any country were independent.

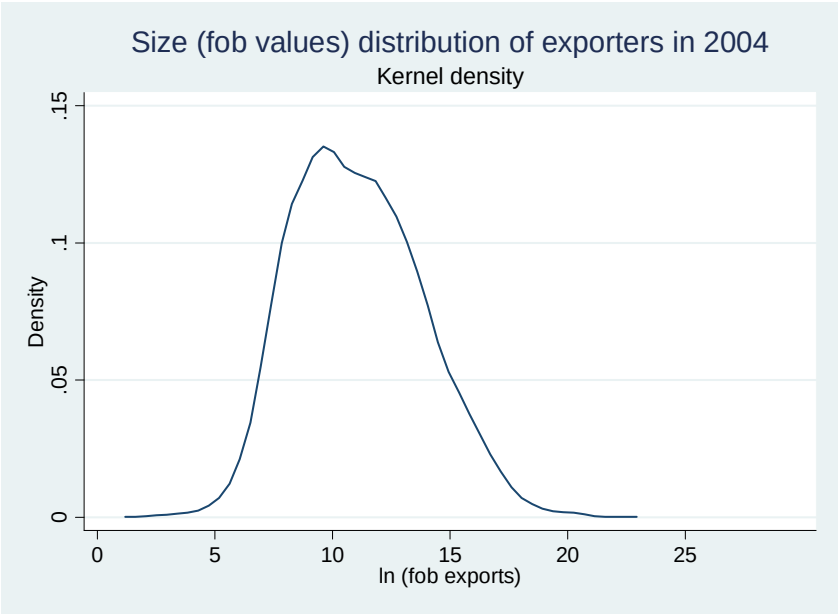
APPENDIX FIGURES

Figure A.1: Frequency of Destinations of Chilean Exporters in 2004



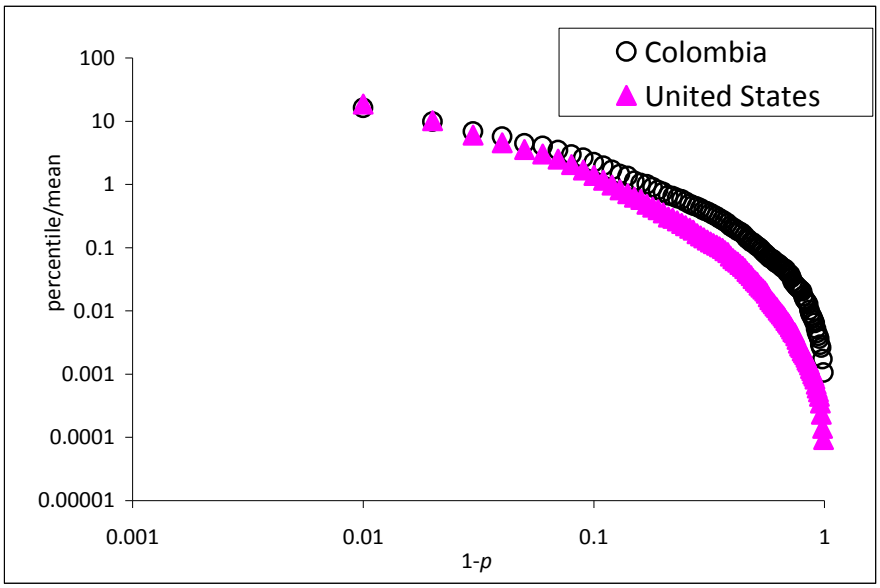
Source: Chilean Customs Office
Notes: The Figure shows the number of Chilean exporters in 2004 shipping to different number of destinations (excluding Chile).

Figure A.2: Size Distribution of Exports in 2004



Source: Chilean Customs Office
Notes: The Figure shows the distribution of (FOB) export values (in logs) of Chilean exporters in 2004.

Figure A.3: Foreign Sales Distribution of Chilean Exports to Colombia and the United States in 2004

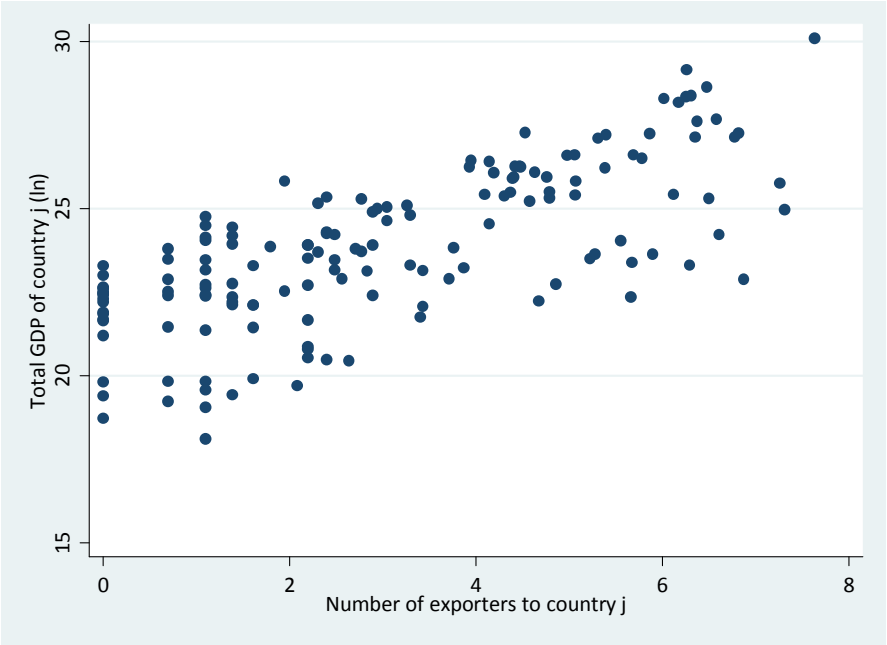


Source: Author's estimation
Notes: The y axis shows the percentile of Chilean foreign sales (by exporter) normalized by the sample mean; the x-axis is a probability.

Figure A.4: Chilean Export Values in 2004 by size of Destination

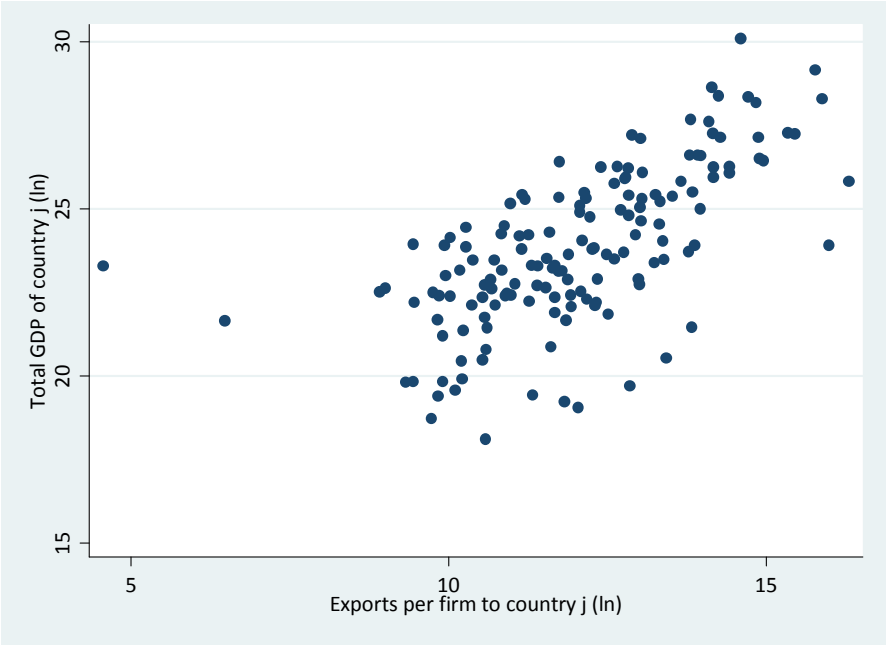
Source: Chilean Customs Office and World Development Indicators
Notes: GDP and Export Values are in current 2004 dollars.

Figure A.5: Number of Chilean Exporters in 2004 by Size of Destination



Source: Chilean Customs Office and World Development Indicators
Notes: GDP in current 2004 dollars.

Figure A.6: Exports per firm in 2004 by Size of Destination



Source: Chilean Customs Office and World Development Indicators