Contracting and the Division of the Gains from Trade[*]

Andrew B. Bernard[†]

Tuck School of Business at Dartmouth, CEPR & NBER

Swati Dhingra[‡]

LSE, CEP & CEPR

This Version: August, 2015

Abstract

This paper examines the microstructure of import markets and the division of the gains from trade among consumers, importers and exporters. When exporters and importers transact through anonymous markets, double marginalization and business stealing among competing importers lead to lower profits. Trading parties can overcome these inefficiencies by investing in richer contractual arrangements such as bilateral contracts that eliminate double marginalization and joint contracts that internalize business stealing by maximizing joint profits of the exporter and its import partners. Introducing these contractual choices into a trade model with heterogeneous exporters and importers, we show that trade liberalization increases the incentive to engage in joint contracts, thus raising the profits of exporters and importers at the expense of consumer welfare. We examine the implications of the model for prices, quantities and exporter-importer matches in Colombian import markets before and after the US-Colombia free trade agreement. US exporters that started to enjoy duty-free access were more likely to increase their average price, decrease their quantity exported and reduce the number of import partners.

Keywords: Heterogeneous firms, exporters, importers, vertical integration, contracts, consumer welfare.
JEL codes: F10, F12, F14.

[†]100 Tuck Hall, Hanover, NH 03755, USA, *tel:* +1 603 646 0302, *email:* andrew.b.bernard@tuck.dartmouth.edu

[‡]Houghton Street, London, WC2A 2AE UK; *tel:* +44(0)20-7955-7804, *email:* s.dhingra (at) lse.ac.uk

1 Introduction

Trade liberalization can generate substantial improvements in welfare through increased varieties, lower prices and the reallocation of resources. Recent theoretical and empirical work focuses on the role of liberalization on the shift of production from less to more efficient producers. This paper examines how the behavior of importers and their interactions with exporters affect the division of gains from trade. Trading partners make endogenous choices among different types of contracts resulting in potential welfare gains to foreign exporters and domestic importers and welfare losses for domestic consumers.

This paper argues trade liberalization affects the choice of contracts between exporters and importers. The resulting change in the microstructure of import markets leads to qualitatively different results for the division of the gains from trade. In line with the concerns of the European Commission and the Federal Trade Commission, market integration can induce firms to replace trade barriers with contracts that limit the gains from market access to consumers (Raff and Schmitt 2005). Typically, foreign competition is associated with lower price-cost margins (Tybout 2003; Levinsohn 1993; Harrison 1994) but a growing literature documents that the pass-through of border prices into home market prices is low in macro studies and in detailed micro work.[1] In our framework, the low pass-through of trade cost reductions into import prices is a result of changes in the contracts between exporters and importers.

Following Hart and Tirole (1990), we consider contracting choices that move away from anonymous market transactions to allow for richer effects of trade liberalization on import markets. These contracts arise to address two inefficiencies from anonymous market transactions. First, market power of importers leads to double marginalization and lower profits when exporters and importers engage through anonymous transactions with market-clearing prices. Exporters can overcome this inefficiency by moving away from unit prices and offering bilateral contracts that specify fixed payments and quantities. Second, an importer in an anonymous market is unable to internalize the business stealing effect of his sales on competing importers that sell varieties of the same foreign product. The exporter can mitigate this externality by investing in joint contracts with these competing importers. This leads to higher profits by restricting sales and driving up prices charged to consumers. We embed the choices of bilateral and joint contracts into a standard trade model, and show how trade liberalization affects the division of the gains from trade through changes in the

---

[1]See for example Engel and Rogers (1996); Burstein et al. (2003); Campa and Goldberg (2005) in the macro literature. Detailed micro studies include Ganslandt and Maskus (2004) for Swedish pharmaceuticals, De Loecker et al. (2012) and Mallick and Marques (2008) for Indian manufacturing, Badinger (2007) for manufacturing and services in the European Single Market, and Konings et al. (2005) for Bulgarian and Romanian manufacturing industries.

contractual choice between exporters and importers.

Building on Aghion et al. (2006), our main assumption is that investments in joint contracts embody product-specific knowledge that can be used by the other party in the event of a disagreement. This drives a wedge between the impact of trade liberalization on the exporter's profit from bilateral and joint contracts. Lower trade costs imply importers forgo a higher level of profits in the event of a disagreement with the exporter. Trade liberalization therefore strengthens the bargaining power of exporters and increases their incentive to negotiate joint contracts. We refer to this as the "contracting choice effect" of trade liberalization. The contracting choice effect leads to higher prices because an exporter is able to reduce competition through a joint contract with her importers. We show the contracting choice effect can dominate the standard gains from lower trade costs and variety expansion, leading to a rise in profits at the expense of consumer welfare. Trade liberalization therefore alters the absolute and relative gains from trade across consumers, exporters and importers.

To test for the contracting choice effect, we would ideally like to examine the impact of trade liberalization on the actual contracts between exporters and importers. Such data is unavailable so we examine implications of the framework on prices, quantities and exporter-importer matches during a period of trade liberalization. If contracting choice matters, trade liberalization will induce exporters to consolidate their import market by simultaneously increasing price, reducing the total quantity sold, and lowering the number of importing partners in the liberalizing country. We test these implications for Colombian imports before and after the US-Colombia Free Trade Agreement (FTA) using transaction-level matched importer-exporter data. US exporters whose products started to enjoy duty-free access through the FTA were more likely to raise their import prices, ship lower quantities and reduce the number of their importer partners in Colombia.

This paper introduces contacting choices in a trade model with heterogeneous exporters and heterogeneous importers to see how market power in exporting and importing changes the gains from trade. This is related to several different strains of work in international trade. Bernard et al. (2009), Castellani et al. (2010) and Muuls and Pisu (2009) document the substantial heterogeneity across importing firms for the US, Italy and Belgium respectively and also show that importers differ from non-importers. Papers by Rauch (1999), Rauch and Watson (2004), Antràs and Costinot (2011), Chaney (2014) and Petropoulou (2011) model the formation of matches between exporters and importers. These papers adopt a search and matching approach to match formation while in this paper we abstract from these mechanisms and instead focus on the contracting choice between the trading parties.

A growing literature also shows how imported inputs increase the productivity of importers, see Amiti and Konings (2007), Halpern et al. (2011) and Boler et al. (ming). We do not consider production side gains and instead focus on consumption side gains, similar to a large literature

on the impact of trade liberalization on markups and prices. Tybout (2003) surveys the research using industry-level data and plant-level panel data and concludes that most studies find higher industry-level exposure to foreign competition is associated with lower price-cost margins or markups (example, Levinsohn (1993); Harrison et al. (2005)). The pass-through of reductions in trade costs to domestic prices is typically low, and recent studies find the behavior of domestic firms determines the extent to which trade policy affects prices at home. Mallick and Marques (2008) find low tariff rate pass-through into import prices in Indian manufacturing during the liberalization of 1991. De Loecker et al. (2012) estimate that on average, factory-gate prices fell by 18 percent despite average import tariff declines of 62 percentage points, as domestic Indian firms did not pass on the reductions in trade costs to consumers. Badinger (2007) finds the European Single Market led to an overall reduction in markups for manufacturing products, but markups rose in several manufacturing and services industries that also experienced an increase in industry concentration and average firm size. In early work on Japanese imports, Lawrence and Saxonhouse (1991) document that the presence of large conglomerates in an industry is associated with lower import penetration, suggesting the import-inhibiting effects of firms with high market power. Lawrence (1991) argues market power of intermediaries can explain why Japanese consumer prices were higher than German import prices for the same export from the US.

We build on the vertical relations literature in industrial organization to model the relationship between exporters and importers. The focus on vertical relations is related to work in international trade on intermediation (Bernard et al. 2010; Ahn et al. 2011; Atkin and Donaldson 2012; Blum et al. 2010; Akerman 2010), retailing (Eckel 2009; Raff and Schmitt 2012; Blanchard et al. 2013), vertical integration (Antràs and Helpman 2004; Feenstra et al. 2003; Conconi et al. 2012), competition policy (Evenett and Stern 2011; Neary 2003), and the Metzler paradox (Venables 1985; Bagwell and Staiger 2012; Bagwell and Lee 2015). Raff and Schmitt (2009, 2005) examine importer market power in an oligopoly model of trade and retailing to show trade liberalization can reduce welfare due to vertical restraints. We embed vertical restraints in a general setting with many heterogeneous exporters and importers to obtain predictions that can be taken to the data. In early work, Venables (1985) shows unilateral reductions in trade barriers can increase consumer prices in the liberalizing country when entry and exit induce profit shifting across countries.

Our paper is also closely related to the recent set of papers using matched exporter-importer data. Blum et al. (2010) and Blum et al. (2012) examine characteristics of trade transactions for the exporter-importer pairs of Chile-Colombia and Argentina-Chile while Eaton et al. (2012) consider exports of Colombian firms to specific importing firms in the United States. Carballo et al. (2013) and Bernard et al. (2014) use matched data to study the role of buyers in firm-level trade flows. Unlike these papers, we concentrate on the role of contracting between the buyer and seller and the resulting effects on prices, quantities and the division of the gains from trade.

The rest of the paper is organized as follows: Section 2 introduces a contracting choice model where exporters and importers transact through anonymous markets, bilateral contracts or joint contracts. Trade liberalization affects the division of the gains from trade among domestic consumers, home importers, and foreign exporters. Section 3 develops the key predictions of the model on prices, quantities, and matches. Section 4 takes the observable implications to Colombian import data and Section 5 concludes.

2   Contracting Choice Model of Exporters and Importers

This section describes the economy consisting of consumers, exporters and importers and introduces the contracting arrangements between exporters and importers. We work with a standard trade model akin to Melitz (2003) and Chaney (2008) to provide the simplest setting that leads to an impact of trade liberalization on consumer welfare through changes in the contracts between exporters and importers. There are two countries, Home and Foreign (with x indexing exports from the foreign country to the home country). Differentiated products are produced at home and abroad, and further differentiated by domestic firms (importers) who sell to consumers. The home country has L workers, each of whom is endowed with a unit of labor and has preferences over consumption goods. Having specified the preferences, we discuss how consumption goods for the workers are exported from the foreign country and imported into the home country.

2.1   Preferences

Each worker has identical preferences over a homogeneous good and varieties of a differentiated good. To ease interpersonal welfare comparisons, preferences are quasilinear. Preferences for differentiated goods follow a standard nested CES form. A differentiated product in the upper nest is indexed by i, and is a composite of further differentiated variants in the lower nest which are indexed by ij. The utility function is as follows:

$$U = q_0 + Q^\theta/\theta, \qquad Q \equiv \left(\int q_i^\rho di\right)^{1/\rho}, \qquad q_i = \left(\int q_{ij}^\eta dj\right)^{1/\eta}, \qquad 0 < \theta < \rho < \eta < 1.$$

We assume the homogeneous good q_0 is produced one for one with labor in a perfectly competitive market and can be traded freely. As is well-known, this eliminates income effects from trade liberalization and allows us to focus on price effects. The assumption of CES preferences provides the simplest way to describe how consumer prices differ when exporters and importers engage in different types of contracts. Assuming both goods are consumed in equilibrium, the demand for variety ij is $q_{ij} = p_{ij}^{1/(\eta-1)} p_i^{(\eta-\rho)/(\eta-1)(\rho-1)} P^{(\rho-\theta)/(\rho-1)(\theta-1)}$ and the indirect utility for a worker with income I is

$$U = I + ((1-\theta)/\theta) P^{-\theta/(1-\theta)}, \qquad P = \left(\int p_i^{\rho/(\rho-1)} di\right)^{(\rho-1)/\rho}, \qquad p_i \equiv \left(\int p_{ij}^{\eta/(\eta-1)} dj\right)^{(\eta-1)/\eta}.$$

We normalize labor earnings to one and describe how the differentiated varieties are supplied to workers.

2.2 Exporters

Following Krugman (1980), each exporter supplies a unique differentiated product. Exporters are monopolistically competitive and pay fixed operation costs f_x. The production function for product i is $x_i = l_i/c$. Following Melitz (2003), exporters differ in their unit costs c and we index them by c (rather than i). As we are interested in the division of the gains from trade, the mass of potential entrants is fixed as in Bernard et al. (2003) to allow for positive profits.

2.3 Importers

Exporters cannot directly access the final consumers in the home country. They must engage importers to deliver these goods. Each exporter meets a continuum of importers drawn from a cost distribution, G_d with support $[d_{\min}, d_{\max}]$. Importers transform the exporter's product into differentiated varieties. An importer with productivity $1/d$ transforms exporter c's product into $y(c, d) = x(c)/\tau d$ units of the final differentiated variety. If $m(c)$ is the unit price of variety c charged by the exporter. Then the unit cost of an importer is $\tau m(c)d$ where $\tau > 1$ is the iceberg trade cost for imported varieties. Under this formulation, importers perform the function of lowering the costs of delivery to final consumers.

2.4 Anonymous Markets

A natural way of introducing importers into a standard trade model is through anonymous market transactions. An exporter chooses the market price for her product. She takes her product to an import market. The importers choose how much to buy. They further differentiate the product and supply a final variety to consumers. Therefore cd indexes a variety exported by c and imported by d.

We start with this benchmark case to illustrate the inefficiencies that lead to richer contracts between exporters and importers. To formalize the setting, the timing is as follows.

- Exporters and importers meet each other.

- Unit costs of exporters and importers (c and d) are observed.

- Exporters pay the fixed costs f_x of exporting to the import market.

- Exporter c chooses her market price $m(c)$.

- Importer d buys x_{cd} units from the exporter.

- Quantities q_{cd} are supplied to final consumers.

We solve for an equilibrium by first determining the final quantities sold by importers to final consumers. Then we derive the importers' demand for the exporter's product and determine the optimal price chosen by the exporter.

2.4.1 Importers

Importers choose final quantity q_{cd} to maximize the following profit function:

$$\max_{q_{cd}} \pi_{cd}^M = \left(p(q_{cd}, \hat{q}_c, \hat{Q}) - \tau m_c d \right) q_{cd}$$

where M denotes an anonymous market. Taking aggregate quantities q_c and Q as given, the optimal price chosen by d is

$$p_{cd} = \tau m_c d / \eta.$$

The markup $1/\eta$ depends on the differentiation parameter in the lower nest of the CES utility function. Substituting for the optimal price, importer d's demand for exporter c's product is

$$x_{cd} = \tau d q_{cd} = (\eta/m_c) \, p_{cd}^{\eta/(\eta-1)} p_c^{(\eta-\rho)/(\eta-1)(\rho-1)} P^{(\rho-\theta)/(\rho-1)(\theta-1)}.$$

2.4.2 Exporters

Exporter c observes the demand for her product from all importers, and chooses the market price m_c to maximize profits

$$\max_{m_c} \pi_c^M = \int_{d_{\min}(c)}^{d_{\max}(c)} (m_c - c) \, x_{cd} dG_d.$$

Taking q_c into account, the total demand for exporter c's product is

$$\int_{d_{\min}(c)}^{d_{\max}(c)} x_{cd} = (\eta/m_c) \, p_c^{\rho/(\rho-1)} P^{(\rho-\theta)/(\rho-1)(\theta-1)} \tag{1}$$

where $p_c = \tau m_c \bar{d}/\eta$ and the average import cost is $\bar{d}^{\eta/(\eta-1)} \equiv \int_{d_{\min}(c)}^{d_{\max}(c)} d^{\eta/(\eta-1)} dG_d$. Exporter c chooses to sell to all importers because she benefits from having more differentiated varieties $(d_{\max}(c) = d_{\max})$.[2]

The optimal price chosen by c is $m_c = c/\rho$. This shows that anonymous market transactions lead to two inefficiencies in the relationship. First, exporters take into account the derived demand for their product and charge c/ρ (instead of c). Importers further mark up the price to

---

[2]In the next section, we introduce fixed costs per importer $(\int_{d_{\min}(c)}^{d_{\max}(c)} f_{dx} dG_d)$ and study how the importer cost cutoff $d_{\max}(c)$ varies across c. We assume throughout that the exporter's contracting costs and fixed costs are relatively higher than the importer's. For simplicity, Sections 2 and 3 set the contracting costs and the fixed costs incurred by importers to zero because this does not affect the key outcomes of interest in the model.

$p = \tau m_c d/\eta = \tau cd/\rho\eta$. This double marginalization leads to lower bilateral profits.[3] Second, competition among importers in the final goods market implies profit for a particular product is not maximized. Importers do not account for the substitutability among their varieties cd. They cannibalize each other's demand and this business stealing lowers multilateral profits.

Substituting for the optimal import price, importer d's profit is

$$\pi_{cd}^{M}(d) = (1 - \eta)P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(d/\bar{d}\right)^{\eta/(\eta-1)} \left(\tau c\bar{d}/\rho\eta\right)^{\rho/(\rho-1)}. \tag{2}$$

The equilibrium profit of exporter c is

$$\pi_c^{M} = \eta(1 - \rho)P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau c\bar{d}/\rho\eta\right)^{\rho/(\rho-1)}. \tag{3}$$

Exporters supply their products abroad as long as $\pi_c^{M} \geq f_x$. Defining $z \equiv c\bar{d}$, the cutoff cost for operational varieties, z_{Mx}, is given by $\eta(1 - \rho)P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau z_{Mx}/\rho\eta\right)^{\rho/(\rho-1)} = f_x$. Proceeding analogously for domestic products (with $\tau = 1$ and fixed costs of operation f), we can solve for the ratio of the import to domestic cost cutoff. This ratio is $(z_{Mx}/z_M)^{\rho/(\rho-1)} = f_x/f\tau^{\rho/(\rho-1)}$ and the importing cost cutoff is lower as long as the export costs are sufficiently higher than the domestic selling cost ($f_x\tau^{\rho/(1-\rho)} \geq f$).

2.5   Contractual Choice

Exporters and importers often have long-standing and complex relationships. It is therefore likely that they engage in contracts that overcome the inefficiencies from anonymous market transactions. Following the seminal work of Hart and Tirole (1990), we consider two distinct forms of market structure that overcome these inefficiencies. The first type of contract overcomes double marginalization by specifying quantities and payments that maximize bilateral profits of the exporter and importer pair. The second type of contract overcomes double marginalization and business stealing by specifying quantities and payments that maximize joint profits of an exporter and her importers. The main advantage of the Hart-Tirole approach is that we do not need to specify the contractual instruments through which firms maximize bilateral or joint profits, and instead can focus on the observable outcomes of quantities and payments that result from implementing profit-maximizing contracts. For instance, an exporter can set a two-part tariff that charges the importer a price equal to her marginal cost ($m_c = c$) and use fixed fees to recoup the bilateral profits. This would maximize bilateral profits of the exporter and importer pair. The exporter could also have maximized bilateral profits through resale price maintenance. The importer is then obliged to sell at a price chosen by the exporter. As we will show later in this Section, when the exporter chooses the final price of $p_{cd} = \tau cd/\eta$, the resulting quantity allocation is the same as the two-part tariff case and

---

[3] An alternative assumption is that exporters do not account for the aggregate effect of their actions on their price index p_c. This would not affect our qualitative results on double marginalization but the exporter's markup would be $m_c = c/\eta$ instead of c/ρ.

bilateral profits of the exporter and importer pair are maximized. The industrial organization literature provides different methods through which firms can avoid double marginalization (e.g. fixed fees, quantity discounts, resale price maintenance etc).[4] The specific methods through which firms implement bilateral or joint profit maximization with other firms are rarely observable, and these methods often take the form of informal practices that are sustained through repeated interaction. Following Hart and Tirole (1990), we therefore abstract from the methods used to implement contracts that maximize bilateral or joint profits, and focus instead on the implications for observable outcomes, such as quantity allocations, that are the same across different methods.

We start with bilateral profit maximization and then discuss joint profit maximization. The market does not maximize bilateral profits of an exporter-importer pair due to double marginalization. This problem is overcome when an exporter engages in a *bilateral private contract* with an importer. The bilateral contract specifies a final quantity and payments (q_{cd} and T_{cd}). As the exporter no longer relies on unit prices that are marked up, the final quantity is chosen to maximize the bilateral profit of the exporter-importer pair. Following Horn and Wolinsky (1988), the exporter and the importer split the bilateral profits through Nash bargaining, and this determines the payments from the importer to the exporter. The bilateral contract overcomes double marginalization and results in higher quantities and lower prices for the final consumers.

While bilateral contracts overcome double marginalization, they do not mitigate the business stealing externality imposed by importers on each other. The competition between different importers implies that prices are lower than the monopolistic price that the exporter would have chosen. The key insight of Hart and Tirole (1990) is that a seller cannot commit to selling lower quantities of her product because she would prefer to bypass her existing importers and sell more to earn higher profits. Even though the exporter could offer contracts that account for the business stealing externality, this opportunism of the exporter prevents importers from accepting such offers because they know the exporter would find it more profitable to deviate from these contracts. The exporter's opportunism prevents maximization of multilateral joint profits. To overcome this problem, the exporter can commit to restricting the total sales of her product to induce higher consumer prices by forming a *joint contract* with her importers.[5] Just like bilateral contracts, joint contracts specify bilateral quantities and payments, but now the total quantity of the exporter q_c is also specified in the contract and not simply an outcome of the different bilateral contracts. Joint contracts can be implemented through various methods such as vertical integration that would eliminate the exporter's opportunism by aligning the interests of all parties. The integrated parties would inter-

---

[4]This is an area of ongoing research in industrial organization and Miklos-Thal et al. (2010) provide an overview of the findings.

[5]Joint contracts often refer to cross-ownership between the parties. We use the term joint contract to refer to a contacting choice between the exporter and importer which might, but does not necessarily, include cross-ownership. Martin et al. (2001) and Mollers et al. (2014) use experimental data to show vertical restraints of various forms (that do not entail vertical integration of firms) are sufficient to maximize joint profits.

nalize business stealing to maximize joint profits, and consumers would end up with lower quantities and higher prices than under bilateral contracts. The exporter could also implement joint profit maximization through other methods. For instance, importers would internalize business stealing if the exporter assigns them exclusive territories to sell the exporter's varieties. The outcomes of the joint contract can also be replicated through "implicit exclusive dealing" when exporters have reputational concerns due to repeated interaction with their importers (Rey and Tirole 2007). We abstract from the specific methods through which joint profit maximization is implemented, and focus instead on observable outcomes such as quantities.

To formally model the different market structures resulting from these contracts, we specify the timing as follows:[6]

- Exporters and importers meet each other.

- Unit costs of exporters and their importers (c and d) are observed.

- Exporter c proposes bilateral or joint contracts.

- Importers decide whether to accept c's proposal.

- Exporters and importers pay the fixed costs of bilateral or joint contracts.

- Importers order quantities x_{cd} from the exporters.

- Quantities q_{cd} are supplied to final consumers.

2.6 Bilateral Private Contracts

To overcome double marginalization, an exporter can make fixed investments in bilateral contracts that depart from linear pricing. After paying the fixed costs, an exporter engages in private contracts with each importer bilaterally. Importers hold passive beliefs which means that they expect the contracts offered to the other importers to be fixed at their equilibrium values. Under bilateral contracts, the importer's profit function is

$$\pi_{cd}^B = p(q_{cd}, \hat{q}_c, \hat{Q})q_{cd} - T_{cd}$$

where T_{cd} is the payment to exporter c for supplying $x_{cd} = \tau d q_{cd}$ units of her product. The importer holds passive beliefs so he takes the contracts offered to his competitors as given ($(\hat{T}_{cd'}, \hat{q}_{cd'})$ for any $d' \neq d$).

---

[6]No new information is revealed after the fixed costs are paid. If the fixed costs of each party are sunk, then the opportunism problem remains but it would be more reasonable to think that the division of surplus is over the revenues, rather than the profits net of fixed costs.

The exporter's profit from selling to all her importers is

$$\pi_c = \int_{d_{\min}(c)}^{d_{\max}(c)} [T_{cd} - \tau c d q_{cd}] \, dG_d. \tag{4}$$

For flexibility, we follow Horn and Wolinsky (1988) and assume that the payments are set through bilateral Nash bargaining with β denoting the bargaining power of the exporter. Using experimental data, Martin et al. (2001) show that the ability to reject an upstream firm's offer enables the downstream firm to get a positive share of the surplus from the relationship. In the event of a disagreement, the exporter has no other importer to turn to and the importer receives nothing from the exporter. The disagreement payoff for each party is therefore zero. The optimal payment is the solution to

$$\max_{T_{cd}} \left[p(q_{cd}, \hat{q}_c, \hat{Q}) q_{cd} - T_{cd} \right]^{1-\beta} [T_{cd} - \tau c d q_{cd}]^{\beta}.$$

As d takes the contracts offered to other importers as given, the optimal payment is

$$\hat{T}_{cd} = \left[\beta p(q_{cd}, \hat{q}_c, \hat{Q}) + (1 - \beta)\tau c d \right] q_{cd} \tag{5}$$

which ensures the division of gross surplus is proportional to the bargaining weights.

Substituting for the optimal payments into the exporter's problem, c chooses quantities to maximize:

$$\max_{q_{cd}} \pi_c^B = \beta \int_{d_{\min}(c)}^{d_{\max}(c)} \left[p(q_{cd}, \hat{q}_c, \hat{Q}) - \tau c d \right] q_{cd} dG_d.$$

The profit function shows that each importer ignores how his quantity affects the profit of other importers of exporter c's product. The exporter therefore cannot force the "monopoly" price that maximizes multilateral profits.

As earlier, the exporter finds it optimal to sell to all importers. Now the exporter can overcome double marginalization, and no longer charges $m = c/\rho$. The optimal contract is equivalent to a two-part tariff where the exporters do not mark up their costs and set the price of the marginal unit equal to marginal cost, $m = c$. The double marginalization inefficiency is eliminated and exporters extract part of the surplus through payments T_{cd} from importers. The optimal price charged by importers is

$$p^B = \tau c d/\eta < p^M = \tau c d/\rho\eta. \tag{6}$$

We summarize this result in Proposition 1.

Proposition 1. *Bilateral private contracts ensure lower prices than anonymous market transactions because they eliminate double marginalization.*

Even though cost savings are passed on to consumers, the total variety profit is higher. An exporter prefers bilateral contracts to anonymous markets as long as $\pi_c^B - f_{bx} \geq \pi_c^M - f_x$ where $f_{bx} > f_x$ is the cost of writing a bilateral contract. Recalling $z \equiv c\bar{d}$, the cost cutoff for imported varieties that earn higher profits under bilateral contracts, z_{Bx}, is:

$$P^{(\rho-\theta)/(\rho-1)(\theta-1)} (\tau z_{Bx}/\eta)^{\rho/(\rho-1)} \left[\beta(1-\eta) - \eta(1-\rho)/\rho^{\rho/(\rho-1)}\right] = f_{bx} - f_x \tag{7}$$

As expected, a fall in trade costs increases the cost cutoff z_{Bx} through its direct effect on import costs. The price index also responds to trade costs and a higher price index further increases the ability to import. The cost cutoff ratio for bilateral contracts and market transactions is

$$(z_{Bx}/z_{Mx})^{\rho/(\rho-1)} = (f_{bx} - f_x)/f_x \left[\frac{\beta(1-\eta)}{\eta(1-\rho)/\rho^{\rho/(\rho-1)}} - 1\right] \geq 1. \tag{8}$$

We assume the RHS is greater than one to ensure bilateral contracts are viable for more productive exporter-importer pairs.

2.7 Joint Contracts

By partnering with her importers, an exporter can ensure that the profit from her product is maximized by internalizing the business stealing effect imposed by importers on each other. Joint contracts provide higher prices, but involve larger fixed investments in building a relationship. Following the vertical relations literature in industrial and international economics, we assume $f_{jx} > f_{bx} > f_x$. When firms make these investments, variety-specific knowledge is imparted to the importers and we show that this leads to changes in the contracts after trade liberalization. We start with a discussion of the optimal supply decisions and then determine the surplus division within the joint contract.

When the exporter negotiates jointly with her importers, the importer's profit function is the same as earlier but now the exporter's total quantity is no longer taken as given. In a joint contract, the importer chooses quantities q_{cd} to maximize

$$\pi_{cd}^J(d) = p(q_{cd}, q_c, \hat{Q})q_{cd} - T_{cd}.$$

The exporter's profit from selling to all importers is

$$\pi_c^J = \int_{d_{\min}(c)}^{d_{\max}(c)} \pi_{cd}(c) = \int_{d_{\min}(c)}^{d_{\max}(c)} [T_{cd} - \tau c d q_{cd}] \, dG_d. \tag{9}$$

The split of profits and hence the payments T_{cd} are again determined by Nash bargaining but now the disagreement payoffs differ due to knowledge transfers. As a joint contract involves investments in building a relationship, the importer learns aspects of the exporter's production process. This information enables the importer to use the production design to make a variety at a (higher) cost,

$v_c c > \tau c$ (or to get some producer at home to mimic the production process). In the event of a disagreement, the exporter can use the knowledge from her relationship with the importer to distribute the variety at a (higher) cost, $v_d d > d$. Without loss of generality, we assume that the disagreement surplus is shared with the other new party. Then the disagreement payoffs are

$$\pi_d^{dis} = p(q_{v_c cd}, \hat{q}_c, \hat{Q}) q_{v_c cd} - T_{v_c cd} \tag{10}$$
$$\pi_c^{dis} = T_{v_d d} - \tau c v_d d q_{c v_d d}.$$

where the disagreement quantities are chosen optimally after the disagreement and the payments are determined through Nash bargaining. As the disagreement payoffs do not depend on T_{cd}, the optimal payment is the solution to

$$\max_{T_{cd}} \left[p(q_{cd}, q_c, \hat{Q}) q_{cd} - T_{cd} - \pi_d^{dis} \right]^{1-\beta} \left[T_{cd} - \tau c d q_{cd} - \pi_c^{dis} \right]^{\beta}$$

and is given by

$$\hat{T}_{cd} = \left[\beta p_{cd}(q_{cd}, q_c, \hat{Q}) + (1 - \beta) \tau cd \right] q_{cd} + (1 - \beta) \pi_c^{dis} - \beta \pi_d^{dis}. \tag{11}$$

Substituting for the optimal payments and summing over all importers, the exporter chooses quantities to maximize:

$$\max_{q_{cd}, q_c} \beta \int_{d_{\min}(c)}^{d_{\max}(c)} \left[p(q_{cd}, q_c, \hat{Q}) - \tau cd \right] q_{cd} dG_d.$$

The exporter chooses to supply to all importers. Importantly, the exporter internalizes the aggregate effect of quantities on prices (through q_c). Thus the business stealing externality is mitigated and prices are set at the profit-maximizing monopoly levels. The exporter ensures $p_{cd}^J = \tau cd / \rho > p_{cd}^B = \tau cd / \eta$. However, the joint contract price is lower than the price from anonymous markets ($p^J < p^M = \tau cd / \rho \eta$) because double marginalization is avoided. The optimal quantity sold to consumers corresponds to the monopoly quantity in the final goods market and is therefore lower than the quantity supplied under bilateral contracts. Revenues are also lower but profits are higher. We summarize this result in Proposition 2.

Proposition 2. *Joint contracts eliminate double marginalization and competition in the final goods market, leading to $p^M > p^J > p^B$.*

The pair-specific profit is $\pi_{cd}^J = (1-\rho) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau c \bar{d} / \rho \right)^{\rho/(\rho-1)} \left(d / \bar{d} \right)^{\eta/(\eta-1)}$ and the share of profit earned by the exporter is

$$\beta_J \equiv \beta \left[1 + (1 - \beta) v_d^{\eta/(\eta-1)} - ((1 - \eta) / (1 - \rho)) (1 - \beta) (v_c \rho / \eta \tau)^{\eta/(\eta-1)} \right]. \tag{12}$$

The exporter's bargaining power rises with her distribution cost advantage ($1/v_d$) and falls with the learning ability of the importer $1/v_c$. An important point is that the ability to learn from

the production design enables the importer to avoid trade costs. Therefore, higher trade costs strengthen the bargaining power of importers while lower trade costs strengthen the bargaining power of exporters:

$$d\beta_J/d\tau = -\frac{\eta}{1-\eta}\frac{1-\eta}{1-\rho}\left(1-\beta\right)\left(v_c\rho/\eta\tau\right)^{\eta/(\eta-1)}\tau^{-1} < 0. \tag{13}$$

Exporters prefer joint contracts to bilateral contracts as long as $\pi_c^J - f_{jx} \geq \pi_c^B - f_{bx}$. Using the bilateral contracting cutoff condition, the relative cost cutoff for joint contracts is

$$(z_{Jx}/z_{Bx})^{\rho/(\rho-1)} = \frac{f_{jx} - f_{bx}}{f_{bx} - f_x}\frac{(1-\eta)\eta^{\frac{\rho}{1-\rho}}/(1-\rho)\rho^{\frac{\rho}{1-\rho}} - \eta^{1/(1-\rho)}/\beta}{\beta_J/\beta - (1-\eta)\eta^{\frac{\rho}{1-\rho}}/(1-\rho)\rho^{\frac{\rho}{1-\rho}}} \geq 1. \tag{14}$$

We assume the RHS of this expression is greater than one. Then the highest productivity exporter-importer pairs choose joint contracts over bilateral contracts. A fall in trade costs increases the cost cutoff for joint contracts relative to bilateral contracts because

$$\frac{d\ln\left(z_{Jx}/z_{Bx}\right)}{d\ln\tau} = \frac{1-\rho}{\rho}\frac{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\rho/(\rho-1)}}{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\rho/(\rho-1)} - 1}\left(d\ln\beta_J/d\ln\tau\right) < 0. \tag{15}$$

The economic reasoning for this result is as follows. A fall in trade costs increases the relative value of products imported from the exporter. Importers have a lower incentive to reproduce the exporter's design and this increases the exporter's bargaining power under a joint contract. The exporter is therefore more likely to engage in a joint contract and the relative cost cutoff for joint contracts rises with trade liberalization. We summarize this result in Proposition 3.

Proposition 3. *Trade liberalization increases the share of varieties supplied through joint contracts between exporters and importers.*

Propositions 2 and 3 provide two implications for contractual choice and pricing. First, after trade liberalization, we expect to find a rise in the percentage of varieties that are supplied by joint contracts between exporters and importers. Second, these varieties that undergo a change from bilateral contracts to joint contracts are sold at relatively higher prices after trade liberalization. One point is worth emphasizing here. Under CES demand and Pareto cost draws, it is the difference in the ex-post bargaining power which drives the expansion of varieties under joint contracts. As long as the outside option under joint versus bilateral contracts is more sensitive to trade costs, Proposition 3 holds and consumers face higher prices for these varieties after trade liberalization. Moving away from CES demand, it may be shown that the share of varieties under joint versus bilateral contracts would increase after trade liberalization even in the absence of knowledge transfers between exporters and importers. For instance, under linear demand as in Dhingra (2013), trade liberalization induces a higher percentage increase in profits under joint versus bilateral contracts,

leading to a higher share of varieties under joint contracts. This occurs because the change in profits is larger for more profitable varieties (even under the same contract) and because the joint contracts provide firms with more margins of adjustment, leading to bigger responses to trade liberalization. The result therefore reflects a general economic principle that holds in richer settings. We do not use a richer variable markup setting because it makes price-setting more complicated and the key results for prices are less transparent. Having determined the equilibrium outcomes, we proceed to examining the impact of trade liberalization on welfare.[7]

2.8 The Impact of Trade Liberalization

In order to understand the aggregate impact of trade liberalization, we first determine the equilibrium price index and then discuss the impact on profits.

Prices depend on the nature of contracts between exporters and importers. In particular, the anonymous market price of variety cd is $p_{cd}^M = \tau cd/\rho\eta$. Varieties under bilateral contracts are priced at $p_{cd}^B = \tau cd/\eta$. Joint contracts ensure joint profit maximization resulting in $p_{cd}^J = \tau cd/\rho$. Price of a variety can therefore be written as $p_{cd}^V = \mu_V \tau cd$ where μ_V is the final markup under vertical contract $V \in \{M, B, J\}$. The aggregate price index faced by consumers is $P^{\rho/(\rho-1)} = \int \int p_{ij}^{\rho/(\rho-1)} didj$. Substituting for optimal prices, the price index is

$$P^{\rho/(\rho-1)} = \sum_V \int 1_V (\mu_V c\bar{d})^{\rho/(\rho-1)} dG_{c\bar{d}} + \tau^{\rho/(\rho-1)} \sum_{Vx} \int 1_{Vx} (\mu_{Vx} c\bar{d})^{\rho/(\rho-1)} dG_{c\bar{d}} \qquad V \in \{M, B, J\} \tag{16}$$

where 1_V is an indicator for vertical contract V. The first term in the price index consists of the prices of domestic varieties and the second component consists of the prices of imported varieties.

For simplicity, we assume $z \equiv c\bar{d}$ follows a Pareto distribution $G(z) = (z/z_{\max})^k$ for $k(1-\rho)/\rho > 2$.[8] Though we have not defined the c and d distributions separately, the resulting $c\bar{d}$ distribution suffices for getting a familiar price index:

$$P^{-k/\varepsilon} \equiv P_{home}^{-k/\varepsilon} + P_{import}^{-k/\varepsilon}$$
$$\equiv \left[P_M^{-k/\varepsilon} + P_B^{-k/\varepsilon} + P_J^{-k/\varepsilon} \right] + \left[P_{Mx}^{-k/\varepsilon} + P_{Bx}^{-k/\varepsilon} + P_{Jx}^{-k/\varepsilon} \right]$$

where $\varepsilon(k, \rho, \theta) \equiv -k/\left(k(\rho-\theta)/\rho(\theta-1) + \theta/(\theta-1) \right)$. The import price index for each contractual

---

[7].

[8]The parametric restriction $k(1-\rho)/\rho > 2$ ensures a finite mean for revenues. All results apply to the case of $k(1-\rho)/\rho > 1$, except we would need a stronger condition to ensure monotonicity of the contractual choice effect of trade liberalization on the price index.

choice is

$$P_{Mx}^{-k/\varepsilon} \equiv \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Mx}^{\rho/(\rho-1)} \left(1 - \left(z_{Bx}/z_{Mx} \right)^{k+\rho/(\rho-1)} \right)$$

$$P_{Bx}^{-k/\varepsilon} \equiv \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Bx}^{\rho/(\rho-1)} \left(z_{Bx}/z_{Mx} \right)^{k+\rho/(\rho-1)} \left(1 - \left(z_{Jx}/z_{Bx} \right)^{k+\rho/(\rho-1)} \right)$$

$$P_{Jx}^{-k/\varepsilon} \equiv \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Jx}^{\rho/(\rho-1)} \left(z_{Bx}/z_{Mx} \right)^{k+\rho/(\rho-1)} \left(z_{Jx}/z_{Bx} \right)^{k+\rho/(\rho-1)}$$

where $\kappa_1 \equiv k z_{\max}^{-k}/2 \left(k + \rho/(\rho-1) \right)$ and $\kappa_2 \equiv \left\{ \rho \eta \left[f/\eta(1-\rho) \right]^{(\rho-1)/\rho} \right\}^{k+\rho/(\rho-1)}$ for brevity. In order to explain the role of importers in welfare, we start with the benchmark case where exporters and importers can only engage in anonymous market transactions. We then discuss the impact of trade liberalization in a model with richer contracting choices.

2.8.1 Price Index in Anonymous Markets

When all varieties are supplied through anonymous markets, the aggregate price index is

$$P_{market}^{-k/\varepsilon} = \kappa_1 \kappa_2 \left(\rho \eta \right)^{\rho(1-\rho)} \left[1 + \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \right]. \tag{17}$$

This leads to two key observations. First, we can compare this price index with that from an import sector of many price-taking importers ($\eta = 1$), as shown below.

$$P/P_{perfect} = \left(\kappa_2(\eta)/\kappa_2(1) \right)^{-\varepsilon/k} = \left(\eta^{k+\rho/(\rho-1)} \right)^{-\varepsilon/k} > 1.$$

As expected, market power in importing increases the *level* of prices charged to final consumers. Second, we can also look at the *change* in the price index with respect to trade costs. The elasticity of the aggregate price index is $d \ln P/d \ln \tau = \left(P_{import}/P \right)^{-k/\varepsilon} \left(d \ln P_{import}/d \ln \tau \right)$ and the relevant parameter for this elasticity is

$$d \ln P_{import}/d \ln \tau = \varepsilon(k, \rho, \theta).$$

The trade elasticity depends on the Pareto shape parameter k for variety costs which includes both the exporter costs c and the importer costs d. Although the shape parameter includes the importer's costs, the comparative static of the price index with respect to trade costs is similar to standard trade models. The role of importing is confined to double marginalization and market power in importing does not provide any new channels for trade liberalization to affect the price index. In the subsequent analysis, we show that departing from anonymous market transactions enables us to understand how market power in importing affects the price index through the contracting arrangements between exporters and importers.

2.8.2 Price Index in the Contracting Choice Model

Under richer contracting, trade liberalization affects the relative cutoff for joint contracts between exporters and importers (z_{Jx}/z_{Bx}). This in turn alters the import price index under bilateral contracts P_{Bx} and joint contracts P_{Jx}. Solving for changes in these price indices, the percentage change in the import price index with respect to trade costs is

$$
\frac{d\ln P_{import}}{d\ln\tau} = \varepsilon \left[1 + \underbrace{\frac{k + \rho/(\rho-1)}{k} \frac{\left((\eta/\rho)^{\rho/(1-\rho)} - 1\right) P_{Jx}^{-k/\varepsilon}}{P_{Mx}^{-k/\varepsilon} + P_{Bx}^{-k/\varepsilon} + P_{Jx}^{-k/\varepsilon}} \frac{d\ln(z_{Jx}/z_{Bx})}{d\ln\tau}}_{\text{Contracting Choice Effect}} \right]. \tag{18}
$$

where

$$
\frac{d\ln(z_{Jx}/z_{Bx})}{d\ln\tau} = -\frac{1-\rho}{\rho} \frac{\eta}{1-\eta} \frac{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\rho/(\rho-1)}}{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\rho/(\rho-1)} - 1} \frac{1-\eta}{1-\rho} \frac{(1-\beta)(v_c\rho/\eta\tau)^{\eta/(\eta-1)}}{\beta_J}.
$$

The first term ε in Equation 18 is the usual negative effect of trade costs on the price index. It consists of the direct cost-reducing effect of lower trade costs and the change in variety through the home and import cost cutoffs (z_M and z_{Mx}). As expected, a fall in trade costs lowers the consumer price index through its impact on costs and variety. The new term in Equation 18 (in square brackets) arises from the impact of trade liberalization on the contracting arrangements between exporters and importers. We refer to this indirect effect of trade liberalization on the price index as the "contracting choice effect". A fall in trade costs increases the cost cutoff for cross-border joint contracts. As joint contracts entail higher prices, the contracting choice impact of trade liberalization has the opposite effect on the consumer price index. We summarize this in Proposition 4.

Proposition 4. *The impact of trade liberalization on the consumer price index consists of a negative cost effect (through trade costs and variety) and a positive contracting choice effect as more exporters engage in joint contracts with their importers.*

Proposition 4 leads us to examine the total impact of a reduction in trade costs on the price index. In the Appendix, we show that the contractual choice effect can dominate the cost effect, leading to a higher consumer price index after trade liberalization. To understand when this occurs, it is instructive to consider the case where the fixed costs are small enough for joint contracts to be viable and when the exporters' profit share is initially small. As trade costs fall, many exporters switch from bilateral contracts to joint contracts and this leads to a large contracting choice effect of trade liberalization.

It can be shown that the magnitude of the contracting choice effect rises with the exporter's profit share in joint contracts and falls with the fixed costs of establishing joint contracts. This is

because lower profit shares and higher fixed costs make joint contracts less viable, and lower the fraction of the price index that comes from varieties under joint contracts. Lower profit shares also reduce the exporter's incentive to offer joint contracts instead of bilateral contracts, leading to a smaller contracting choice effect. We summarize these results in Proposition 5.

Proposition 5. *The magnitude of the contracting choice effect rises with the relative profit share of exporters under joint contracts (β_J/β) and falls with the relative fixed costs of joint contracts (f_{jx}/f_{bx}).*

Proof. See Appendix. □

Having determined the price index, we examine the impact of trade liberalization on the profits earned by exporters and importers. Let $\Pi(cd)$ denote the sum of profits earned by exporter c and importer d from selling variety cd. The change in total profits from an imported variety cd is

$$\frac{d\ln\Pi(cd)}{d\ln\tau} = \underbrace{-\frac{\rho}{1-\rho}}_{\text{Cost Effect}} + \underbrace{\frac{\rho-\theta}{(1-\rho)(1-\theta)}\frac{d\ln P}{d\ln\tau}}_{\text{Aggregate Price Effect}} \ . \tag{19}$$

As usual, the direct effect of trade liberalization is to reduce costs and increase total profits. The indirect effect works through the price index. When the price index rises with trade liberalization, the indirect effect also raises total profits. When the price index falls with trade liberalization, the direct effect still dominates but profits rise more slowly. Profit of an incumbent variety is therefore more sensitive to trade liberalization when there is an industry-wide anti-competitive price effect (see Appendix for details). The division of profits between exporters and importers depends on the change in bargaining power. As explained earlier, trade liberalization increases the share of profits earned by exporters and lowers the share earned by importers in joint contracts. This, however, does not imply that importers are always worse off. The rise in profits can overwhelm the drop in bargaining power so that importers are better off. We summarize these results in Proposition 6.

Proposition 6. *Profit from an incumbent variety rises after trade liberalization and exporters in joint contracts experience a rise in their profit shares.*

Before proceeding to a test of the contracting choice effect, we briefly discuss the impact of trade liberalization under alternative assumptions on sequencing and nesting. Propositions 4 and 6 establish the impact of trade liberalization on welfare and profits when exporters offer contracts to importers. In settings where importers offer contracts to exporters and consumers perceive products of competing exporters as more substitutable, the pricing decisions would be the same under each contract (see Appendix). More generally, moving to linear demand relaxes the nesting structure and the results for the price index are similar. Trade liberalization would increase the consumer price index through the contracting choice effect and raise the share of profits earned by exporters, as

long as exporters incurred relatively higher contracting costs than importers. Under an alternative scenario where substitutability of the upper nest is greater than substitutability in the lower nest ($\eta < \rho$), exporters would have an incentive to sell to all importers and our setting is not well-defined for this case. But the logic is consistent with the vertical foreclosure literature in industrial organization which would imply exporters of perfectly substitutable products have an incentive to sell to fewer importers to obtain higher joint profits.

3 Variety-Level Predictions

Section 2 highlights how market power and contracting choice in importing affect the division of the gains from trade. Ideally we would test the model by examining how contracts change between exporters and importers in a period of falling trade costs. Actual data on contracting choice is not available in standard datasets, so we focus on the unique predictions of the model for prices, quantities and importer-exporter matches. In this section, we start by incorporating differences in importer cost cutoffs across exporters. We then provide "difference-in-difference" predictions for changes in prices, quantities and the number of importers per exporter under different contracts.

3.1 Contracting Choice Model with Observable Predictions

Continuing with the framework of Section 2, we introduce two key differences. First, exporters pay a fixed cost to transact with each importer. This implies exporters will not supply to less productive importers who do not generate sufficiently high profits leading to an endogenous importer cost cutoff for each exporter.[9] Second, importers can carry the products of multiple exporters, and we find that more productive importers buy from a larger range of exporters. As the rest of the analysis is similar to Section 2, we provide a brief summary resulting from the theoretical extensions and relegate details to the Appendix.

Exporters can sell to multiple importers and incur fixed costs ($f_{dx} > 0$) to transact with each importer. In this setting, exporters and importers follow the same pricing strategy as earlier. As importers are monopolistically competitive, they do not account for demand linkages across exporters (through Q), and their pricing strategy is unchanged. The exporter incurs relationship-specific fixed costs f_{dx} and chooses a cutoff rule for supplying to importers. Exporter c supplies to all importers with $d \leq d^V_{\max}(c)$. Under anonymous transactions, exporter c chooses an importer cost cutoff that equates its incremental contribution to variable profits to the fixed cost of transacting with an additional importer: $(m_c - c)\left(dx_c/dd^M_{\max}(c)\right) = f_{dx}g_d(d^M_{\max}(c))$ where g_d denotes the pdf of the importers' cost distribution. Importers do not account for the business stealing

---

[9]Bernard et al. (2014) introduce importer-specific fixed costs in a trade model with heterogeneity of both exporters and importers. They focus on the implications of variation in importer heterogeneity across destination markets and do not model contracting choice.

impact of their actions under bilateral contracts. Exporters under bilateral contracts therefore choose an optimal cutoff that equates the profit from the marginal importer to the relationship-specific fixed cost, $T_{cd_{\max}^B} - cx_{cd_{\max}^B} = f_{dx}$. On the other hand, importers in joint contracts account for the business stealing effect of their actions and this induces a narrower range of importers, $\left[\frac{\rho}{1-\rho}\frac{1-\eta}{\eta}\right]\left[T_{cd_{\max}^J} - cx_{cd_{\max}^J}\right] = f_{dx}$ where the first term in square brackets is less than one. Substituting for optimal prices and assuming $G_d(d) = k_d d^{k_d-1}/d_{\max}^{k_d}$ (for $k_d > \eta/(1-\eta)$), we get explicit solutions for the importer cost cutoff chosen by exporter c under each contract. These are derived in detail in the Appendix and here we discuss the impact of trade liberalization on observable outcomes.[10]

3.2 The Impact of Trade Liberalization on Observable Outcomes

We focus on unique predictions for changes in final prices, import prices, import cost cutoffs and imported quantities arising from the contractual choice effect of trade liberalization.

3.2.1 Consumer Prices of Imported Varieties

The final price of a variety exported by c and imported by d is $p_{cd} = \tau cd\mu_{cd}$ where $\mu_{cd} \in \{1/\rho\eta, 1/\eta, 1/\rho\}$ is the final markup for variety cd. The change in final price of variety cd is

$$\Delta \ln p_{cd} = \Delta \ln \tau + \Delta \ln \mu_{cd}.$$

As is well-known, lower trade costs reduce prices directly. The new finding is that the price response to trade liberalization differs across the contractual choice of exporters and importers. As exporters and importers switch from bilateral contracts to joint contracts, they increase the final markup charged to consumers. Exporters and importers moving from anonymous markets to bilateral contracts lower the final markup charged to consumers by overcoming double marginalization. The change in final prices differs across varieties, as summarized in Figure 1a.

3.2.2 Import Prices of Imported Varieties

The import price paid by the importer to the exporter embodies two crucial aspects of the theoretical framework. It depends on the final markup charged to consumers and the surplus division between exporters and importers. Let $\tilde{m}_{cd}$ denote the unit "price" paid to exporter c by importer d. In anonymous markets, it is straightforward to determine the unit price as the importer pays $\tau m_c d = \tau cd/\rho$ per unit of the imported product. The unit price under bilateral contracts is the variable component of the payments to exporters, $[\beta + (1-\beta)\eta]\tau cd/\eta$ and the unit price in joint contracts is $[\beta_J + (1-\beta_J)\rho]\tau cd/\rho$. Therefore, the unit import price can be written as $\tilde{m}_{cd} = \tau cd\mu_{cd}^x$ where

---

[10]An alternative assumption for anonymous markets is that exporters do not perceive the aggregate impact of their actions on consumer prices p_c. This would not alter our qualitative results, though the exporter markup and the optimal cost cutoff for importers would change to $m_c = c/\eta$ and $(m_c - c) x_{cd_{\max}^M} = f_{dx}$.

Figure 1: The Impact of Trade Liberalization on Consumer and Import Prices of Varieties
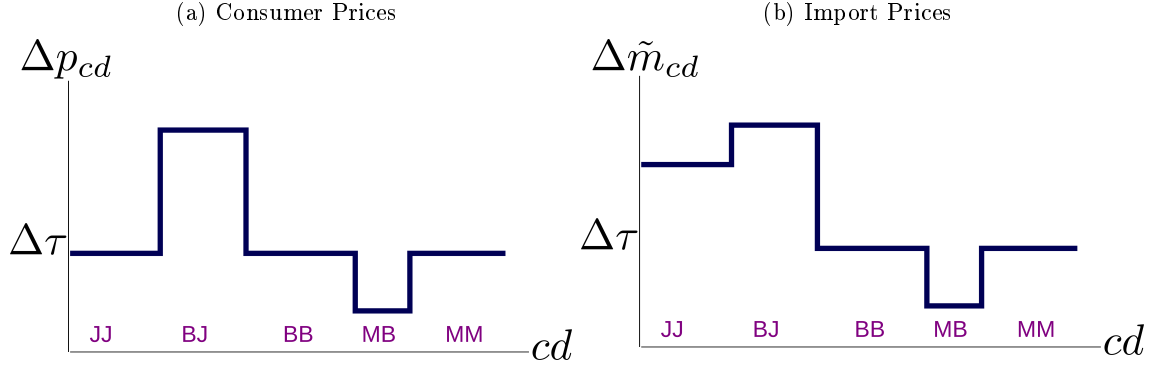
(a) Consumer Prices

(b) Import Prices

Note: VV' - V represents the pre-liberalization contracting relationship, V' represents the post-liberalization contracting relationship where $V \in \{M, B, J\}$ and M is anonymous market, B is bilateral private contract, and J is joint contract.

μ_{cd}^{x} is the markup accruing to exporters. The exporter's markup is $1/\rho$ in market transactions, $\beta/\eta + (1 - \beta)$ under bilateral contracts and $\beta_J/\rho + (1 - \beta_{JV})$ in joint contracts.

The change in the import price of variety cd is

$$\Delta \ln \tilde{m}_{cd} = \Delta \ln \tau + \Delta \ln \mu_{cd}^{x}.$$

Import prices fall due to lower trade costs. Netting out the trade costs, the FOB import price changes due to a change in the export markup paid by the importer. The export markup μ_{cd}^{x} changes for varieties that switch contracts. Moreover, the export markup also changes for varieties in joint contracts due to a rise in bargaining power of exporters. Figure 1b summarizes the difference-in-difference prediction for the change in import prices across different varieties.

3.2.3   Importer Cost Cutoffs for Exporters

Having incorporated the extensive margin of importers, we can determine the change in the range of importers chosen by each exporter as summarized in Figure 2a. Exporters that do not switch contracts still change their importer cost cutoffs on account of industry-wide changes and are denoted by the horizontal segments, JJ, BB, and MM in the Figure. Unlike exporters that switch from market to bilateral contracts, these non-switching exporters only experience a change in industry-wide conditions (from the direct effect of lower trade costs and the indirect effect of changes in the aggregate price index). Exporters that switch from market to bilateral contracts earn relatively higher variable profits and increase their importer range relative to non-switchers. Exporters that switch to joint contracts from bilateral contracts lower their importer range because they account for the business stealing across their importers.

20

Figure 2: The Impact of Trade Liberalization on Importer Cutoffs and Quantities of Exporters
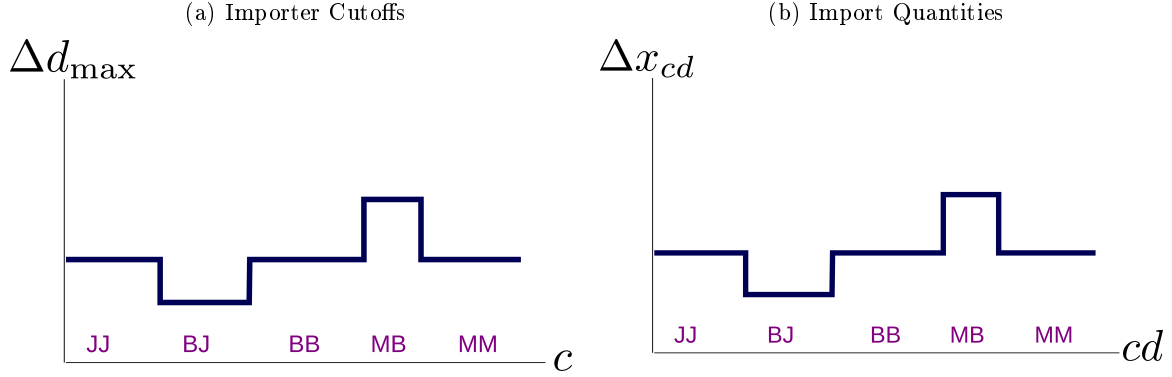
(a) Importer Cutoffs

(b) Import Quantities

Note: VV$'$ - V represents the pre-liberalization contracting relationship, V$'$ represents the post-liberalization contracting relationship where $V \in \{M, B, J\}$ and M is anonymous market, B is bilateral private contract, and J is joint contract.

3.2.4   Import Quantities of Imported Varieties

The change in export quantity is summarized in Figure 2b. Varieties that do not switch contracts experience a change in quantities purchased by importers only on account of industry-wide changes in direct trade costs and the indirect aggregate price effect, denoted by the horizontal segments, JJ, BB, and MM. Varieties that switch from market to bilateral contracts earn relatively higher variable profits and experience an increase in import quantity relative to non-switchers. Varieties that switch to joint contracts from bilateral contracts experience a relative drop in import quantity because business stealing is internalized across the importers of the product.

As import prices and quantities are routinely observed in customs data, we can use the above predictions to examine whether import prices rise after trade liberalization and whether prices rise for varieties whose exporters reduce their importer cost cutoffs and import quantities. This enables a test of the main mechanism in the theory. The prediction that trade liberalization induces exporters to simultaneously increase prices, reduce quantities and reduce importers does not arise in standard trade models. While the possibility of quality upgrading can lead to increased prices and reduced quantities after trade liberalization, the range of import partners would still rise rather than fall. It is therefore important that we test for the triple prediction of higher prices, lower quantities *and* fewer importers to isolate the quality upgrading effect from the contracting effect of trade liberalization. The triple prediction also distinguishes the contracting effect from recent models incorporating importer margins of trade as trade liberalization in these models induces exporters to increase their importer range as a result of higher export profitability. The subsequent section operationalizes the triple prediction by examining prices, quantities and importer matches following a major trade liberalization episode in Colombia.

21

Figure 3: Colombian Tariffs on US Products in 2011 (Pre-FTA) and 2012 (Post-FTA)
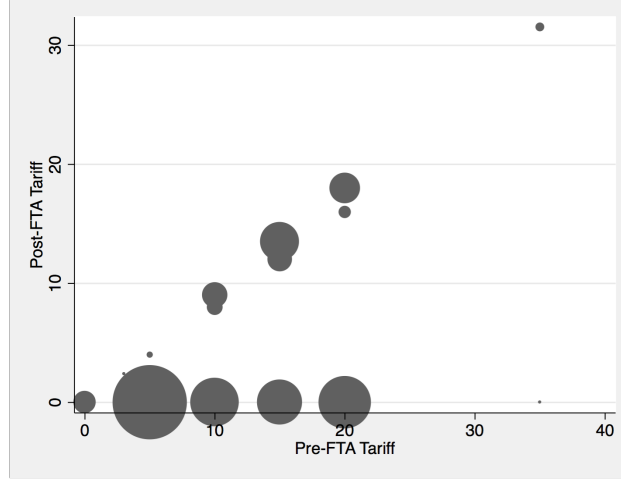
Note: Size of the marker indicates the number of HS8 products.

4   Empirics

The prediction of the contracting choice effect in Section 3 is that trade liberalization should increase the probability that an exporter switches from using bilateral contracts to joint contracts. As a result of such a change in contracting choice, an exporter, c, increases the import price of its product $(\tilde{m}_c)$, reduces its total quantity $(X_c \equiv \int x_{cd} dG_d)$ and reduces the number of importers $(d_c^{\max})$. We examine whether this triple prediction of increased price, reduced quantities and smaller importer range, $(\triangle \tilde{m}_{csht} > 0, X_{csht} < 0, d_{csht}^{\max} < 0)$, is more prevalent during an episode of substantial trade liberalization.

4.1   Data

We examine the joint prediction on prices, quantities and matches for imports into Colombia before and after the implementation of the US-Colombia Free Trade Agreement. Transaction-level import data for Colombia identifies the exporter and the importer for each import transaction as well as the total value, quantity, date and product. Aggregating the transaction-level import data to the exporter-product pair enables us to obtain the average import price of the product, $\tilde{m}_{csht}$, the total quantity of the product shipped by the exporter to Colombia, X_{csht}, and the number of Colombian importers per exporter-country-product $d_{csht}^{\max}$.

While matched exporter-importer data is available for other countries, the Colombian import data is unusual because it covers a major trade liberalization with the largest trading partner. The US-Colombia FTA was implemented on May 15, 2012. The agreement immediately eliminated duties on 80 percent of US exports of consumer and industrial products to Colombia. Figure 3

22

shows the Colombian tariff rates charged to the US before and after the US-Colombia FTA. Most US exports obtain duty-free status after the FTA. Table 1 provides summary statistics for Colombian tariffs before and after the FTA for the sample of exports that we use in our analysis. The pre-FTA tariff for 2011 fell from an average of 11 percentage points to an average of 4 percentage points in our sample. The tariff elimination was largely on the Colombian side because 90 percent of US imports from Colombia enjoyed duty free access before the FTA. The US is Colombia's leading trade partner and the FTA was a substantial step towards trade liberalization in Colombia. Between June 2012 and April 2013, US exports to Colombia increased by 14.2 percent over the same period a year earlier while total Colombian imports were up only 4.6 percent.

Table 1: Colombia Tariffs Before and After the FTA for Exporters in 2009

Variable	Obs.	Mean	S.D.	Min	Max
Tariffs Charged to US Exporters					
Pre-FTA Tariff in 2011	1,750	11.05	5.54	0	35
Post-FTA Tariff in 2012	1,750	4.27	6.37	0	31.5
Tariffs Charged to Non-US Developed Country Exporters					
Pre-FTA Tariff in 2011	1,747	6.57	3.52	0	30
Post-FTA Tariff in 2012	1,747	6.82	3.56	0	30

Note: Mean refers to an average across exporters in the sample, weighted by the initial value of Colombian imports from developed countries for each HS code in 2009.

The theoretical predictions of the model focus on the joint behavior of prices, quantities and import partners. Specifically, $\Delta\text{Triple}_{csht} = 1$ if exporter c from source country s selling product h at time t increases its average price across all its importers ($\triangle\tilde{m}_{csht} > 0$) *and* reduces the total quantity sold to all its importers ($X_{csht} < 0$) *and* reduces the number of importers of its product ($d_{csht}^{\max} < 0$). If any one of these events does not happen, then $\Delta\text{Triple}_{csht} = 0$.

To test the theoretical results, we need measures of $\Delta\text{Triple}_{csht}$ and the treatment variables. We use Colombian import transactions data recorded by its customs authority, which lists the name of the importer and the exporter for each import transaction.[11] We clean the names by harmonizing commonly occurring prefixes and suffixes and then aggregating imports to the exporter-country-product level in each time period (*csht*). A time period consists of the months from June to November for each year (2009-2012).[12] For each time period, import values and quantities are recorded at the 8-digit level under the Colombian implementation of Harmonized System (HS)

---

[11] The raw data come from www.importgenius.com.

[12] The interval starts in June since the FTA came into force in the middle of May 2012. The period ends in November since data for December 2011 are missing. We also do not have data for July 2009 and quantities have been appropriately scaled to account for this. Results are robust to using 2010 as the initial period (available upon request).

classification. We compute the average import price (unit value in USD), the total quantity, and the total number of importers for each exporter-country-product-year, $csht$. We then compute $\Delta\text{Triple}_{csht} = 1$ for exporter-country-products that have a higher average price, lower total quantity and fewer importers compared to the previous period.

As customs data are known to be noisy, we work with the set of exporter-country-products with initial sales of more than US\$10,000 and the set of country-product pairs with more than one exporter in 2009. The theory applies to incumbent exporters, so we focus on exporters who sell from 2009 to 2012. Pierce and Schott (2012) show that HS codes change over time and this can lead to estimation bias. To account for this, we work with the set of products with HS codes that are unchanged between 2009-2012. This covers 84 percent of all products in our sample, alleviating concerns regarding generality of the results.

To construct the treatment variables, tariff data for the US-Colombia FTA is obtained from the Office of the US Trade Representative. Tariffs were reduced from their initial levels by one of four FTA multipliers: 0% of the initial tariff, 80% of the initial tariff, 87% of the initial tariff or 90% of the initial tariff. Table 2 summarizes the distribution of HS-codes by the FTA tariff multiplier. We classify $\text{Treat}_h = 1$ for products with a FTA multiplier equal to zero.

Table 2: US-Colombia FTA Tariff Multipliers for Colombian Non-agricultural Tariffs

Tariff Multiplier	# of Products	% of Products
0	4,560	76.18
0.80	317	5.30
0.86	52	0.87
0.90	1,057	17.66

Note: Tariff Multiplier = Post-FTA Tariff/ Pre-FTA Tariff. Post-FTA Tariff is the tariff on a product from the US in the year after the implementation of the FTA

4.2 Baseline Empirical Specification

We examine whether the US-Colombia FTA induced US exporters to increase prices, reduce quantities and reduce the number of importers in Colombia. To control for underlying trends, we examine whether exporters from the US selling products that started to receive duty-free access into Colombia were more likely to increase their prices, reduce their quantities and reduce their number of importers relative to the previous period. In addition, we compare the probabilities for US exporters to a control group of exporters that did not experience the FTA tariff reduction. To classify exporters into the two groups, we define $\text{Post}_t = 1$ for the period after the FTA and 0 for the period before the FTA and $\text{Treat}_h = 1$ for product codes that received duty-free access from the FTA and 0 otherwise. We focus on exporters from developed countries to construct a suitable control group. Accordingly, $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from any other

developed country. The treatment group consists of exporter-products with $\text{Treat}_h \cdot \text{USA}_s = 1$ and the control group consists of exporter-products with $\text{Treat}_h \cdot \text{USA}_s = 0$.

Table 3 summarizes the triple dummy and exporter characteristics for exporters in the control and the treatment groups separately for 2012. The triple prediction is more prevalent for the treatment group, but this could be due to differences in product composition or due to other events specific to the post-FTA time period. In order to minimize these concerns, we proceed to a difference-in-difference estimation which accounts for product-specific and country-specific effects.

Table 3: Summary Statistics for Exporter-Products in 2012

Control Group: Exporter-Products with $\text{Treat}_h \cdot \text{USA}_s = 0$					
Variable	Obs ($csht$)	Mean	S.D.	Min	Max
$\Delta\text{Triple}_{csht} = 1$	5,279	0.047	0.212	0	1
Initial trade value$_{csh,2009}$ ($mn)	5,279	0.175	2.361	0.01	126
Initial number of importers$_{csh,2009}$	5,279	1.592	1.300	1	19
Size$_{csh}$	5,105	0.014	0.946	-1.593	6.522

Treatment Group: Exporter-Products with $\text{Treat}_h \cdot \text{USA}_s = 1$					
Variable	Obs ($csht$)	Mean	S.D.	Min	Max
$\Delta\text{Triple}_{csht} = 1$	2,593	0.079	0.270	0	1
Initial trade value$_{csh,2009}$ ($mn)	2,593	0.253	1.695	0.01	60.1
Initial number of importers$_{csh,2009}$	2,593	1.949	2.448	1	54
Size$_{csh}$	2,484	0.128	1.039	-1.485	5.911

Note: $\Delta\text{Triple}_{csht} = 1$ if $\Delta ImportPrice_{csht} > 0$ & $\Delta ImportQuantity_{csht} < 0$ & $\Delta\#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. Size$_{csh}$ is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product for all developed countries in 2009.

We examine the prevalence of simultaneous increases in prices, reductions in quantities and reductions in the number of importers of an exporter. The estimating equation for the triple prediction for exporter c from source country s selling product h at time t is a linear probability model,

$$\Delta\text{Triple}_{csht} = \beta \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s + \alpha_{st} + \alpha_{ht} + \varepsilon_{csht} \tag{20}$$

where ε_{csht} is a disturbance term while α_{st} and α_{ht} are source country-year and product-year fixed effects that account for changes such as exchange rate fluctuations and aggregate demand shocks. The coefficient of interest is β which we expect to be positive if the FTA led exporters to consolidate their import market resulting in higher import prices, lower import quantities and fewer importers.

From the theoretical results in Section 3, we expect the triple prediction to vary across exporters of different levels of productivity. High productivity exporters are expected to have already paid the costs of consolidating their import market, so bilateral trade liberalization is expected to lead

to consolidation in the import markets of less productive exporters from the US. To account for differences in responses across exporters, we allow the coefficient on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ to vary with exporter size. For each exporter-country-product observation, exporter size is measured by the z-score of the initial value of sales of the exporter in 2009, relative to all exporters of the product from developed countries in 2009. Let $e_{csh,2009}$ denote the initial value of sales of exporter c from country s of product h in 2009. The z-score of initial size is $\text{Size}_{csh} \equiv (e_{csh,2009} - \mu_{h,2009})/\sigma_{h,2009}$ which measures the initial sales of an exporter relative to exporters of that product from all developed countries.[13] Accounting for possible differential responses across firms, the estimating equation is

$$\Delta\text{Triple}_{csht} = \beta \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s + \beta_1 \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh} + \gamma X_{csht} + \alpha_{st} + \alpha_{ht} + \varepsilon_{csht} \tag{21}$$

where X_{csht} includes all interactions between Size_{csh}, Post_t, Treat_h, and USA_s, and other controls such as pre-trends and their interactions (where$\text{Pre}_t = 1$ for observations in 2011 and 0 otherwise). Coefficient β_1 allows the impact of the FTA liberalization to vary by initial size of the exporter. We cluster standard errors for each estimating equation by exporter-country pairs to account for correlation across time and products within an exporter-country pair.

4.3   Baseline Results

Table 4 summarizes the results from estimation of linear probability models in Equations 20 and 21. Column (1) shows that exporters who experienced duty-free access from the US-Colombia FTA are more likely to increase their average price, reduce their total quantities and sell through fewer importers, relative to a control group of developed country exporters who did not experience duty-free access for the product. The likelihood of a triple for the treated exporters rises 3.7 percentage points more after the FTA relative to the change for other exporters.

Column (2) adds the interaction with the initial size of the exporter. From the theory, the sign of the interaction term is expected to be negative as less productive exporters are more likely to consolidate their import market after the FTA. The results in Column (2) show that exporters with smaller initial size are indeed more likely to consolidate their import market. Figure 4 plots the histogram of the estimated impact of the FTA across all exporters, $\hat{\beta}_0 \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s + \hat{\beta}_1 \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$. Most of the exporters from the US have an increase in the probability of higher prices, lower quantities and fewer partners as a result of the liberalization.

One shortcoming of measuring consolidation in the import market through the $\Delta\text{Triple}_{csht}$ indicator is that it will always be zero for exporters that sell to only one importer in the previous period. This underestimates the relative prevalence of the triple prediction among the set of exporters that sell to more than one importer initially. Column (3) restricts the estimation sample to

---

[13]$\mu_{h,2009}$ is the mean of $e_{csh,2009}$ across all exporters of product h from developed countries and $\sigma_{h,2009}$ is the corresponding standard deviation.

Table 4: Baseline results: Triple Prediction

Dependent Variable: $\Delta\text{Triple}_{csht}$

Variable	(1) Coef. (S.E.)	(2) Coef. (S.E.)	(3) Coef. (S.E.)	(4) Coef. (S.E.)
$\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.037**	0.037**	0.097**	0.037**
	(0.016)	(0.016)	(0.049)	(0.016)
$\text{Pre}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.024	0.024	0.074	0.024
	(0.018)	(0.017)	(0.058)	(0.017)
$\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$		-0.039**	-0.093**	-0.039**
		(0.017)	(0.047)	(0.017)
$\text{Pre}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$		0.003	0.016	0.003
		(0.017)	(0.052)	(0.017)
$\text{Treat}_h \cdot \text{USA}_s$	-0.006	-0.005	-0.015	-0.005
	(0.011)	(0.011)	(0.037)	(0.011)
$\text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$		0.004	0.017	0.004
		(0.010)	(0.030)	(0.010)
$\text{Post}_t \cdot \text{Treat}_h \cdot \text{Size}_{csh}$		0.029**	0.081**	0.029**
		(0.012)	(0.038)	(0.012)
$\text{Post}_t \cdot \text{USA}_s \cdot \text{Size}_{csh}$		0.026**	0.057*	0.026**
		(0.013)	(0.034)	(0.013)
$\text{Post}_t \cdot \text{Size}_{csh}$		-0.007	-0.029	-0.007
		(0.009)	(0.027)	(0.009)
$\text{Treat}_h \cdot \text{Size}_{csh}$		-0.009	-0.036	-0.009
		(0.008)	(0.024)	(0.008)
$\text{USA}_s \cdot \text{Size}_{csh}$		-0.002	-0.011	-0.002
		(0.009)	(0.025)	(0.009)
$\text{Pre}_t \cdot \text{Treat}_h \cdot \text{Size}_{csh}$		0.0004	-0.004	0.001
		(0.012)	(0.040)	(0.013)
$\text{Pre}_t \cdot \text{USA}_s \cdot \text{Size}_{csh}$		-0.010	-0.016	-0.010
		(0.014)	(0.044)	(0.015)
$\text{Pre}_t \cdot \text{Size}_{csh}$		0.010	0.028	0.010
		(0.011)	(0.036)	(0.012)
Size_{csh}		0.005	0.009	0.005
		(0.007)	(0.021)	(0.007)
$\Delta\text{MFN}_{ht} \cdot \text{Size}_{csh}$				0.0001
				(0.001)
Product-Year FE α_{ht}	yes	yes	yes	yes
Country-Year FE α_{st}	yes	yes	yes	yes
N	23,616	22,943	7,659	22,922
R^2	0.236	0.220	0.355	0.220

Note: Note: $\Delta\text{Triple}_{csht} = 1$ if $\Delta ImportPrice_{csht} > 0$ & $\Delta ImportQuantity_{csht} < 0$ & $\Delta\#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. $\text{Treat}_h = 1$ for HS-Codes that received duty-free access from the US-Colombia FTA and 0 otherwise. The sample covers changes in import outcomes in 2010, 2011 and 2012. $\text{Post}_t = 1$ for 2012 and 0 otherwise while $\text{Pre}_t = 1$ for 2011 and 0 otherwise. $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from other developed countries. Size_{csh} is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product from developed countries in 2009. ΔMFN_{ht} is the change in MFN tariffs from period $t-1$ to t. Significance levels are indicated by ***, **, and * for 1, 5 and 10 percent respectively.

Figure 4: Distribution of Estimated Treatment Effects in 2012
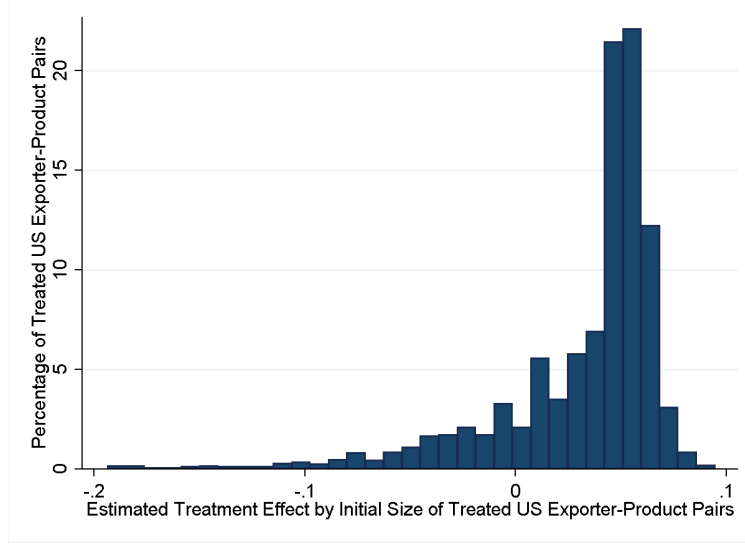
Note: Horizontal axis shows the magnitude of the estimated treatment effect.

exporter-country-products with more than one import partner initially. As expected, the coefficient on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ increases.[14]

Exporters who gained duty-free access from the FTA are more likely to increase prices, lower quantities and sell to fewer importers. This effect varies across exporters of different initial size with smaller exporters more likely to engage in consolidation of their import markets. To examine the robustness of these predictions, we conduct a series of checks on our results.

4.4 Robustness Checks

The robustness checks in this sub-section can be broadly divided into three types. First, we control for other explanations such as contemporaneous tariff cuts for trade partners to other developed countries and quality upgrading to minimize bias in the baseline estimates from omitted variables. Second, we look at a discrete measure of initial size and examine how key coefficients vary across exporters in different size categories. Finally, we examine whether the triple prediction continues to hold when we look within exporter-importer pairs.

---

[14]Another concern is that the higher prevalence of the triple prediction might be due to an increase in the variance of price changes, quantity changes and changes in the number of importers. While increases in the variances of these outcomes is consistent with the theory, we also re-estimated the regressions controlling for changes in the variances. The main results are unchanged but our sample is smaller because computing changes in variances for the US and other developed countries separately is more demanding on the data (available upon request).

4.4.1 Multilateral tariff cuts

The time period that we study also includes a unilateral tariff reform in Colombia that reduced the average tariff from 12.2 percent to 8.2 percent on November 5 2010 (WTO 2012). The stated aim of this tariff reform was to reduce the dispersion in tariffs and eliminate the negative effective protection that existed in some industries. The reform reduced most-favored-nation (MFN) tariffs on a subset of products. For products in our sample, the average MFN duty was 10.3 percentage points before the reform and dropped by 1.3 percentage points. To account for unilateral changes in Colombia's MFN tariffs, Column (4) of Table 4 includes an interaction between the change in MFN tariffs and initial size of the exporter. As the MFN tariff change applies to all trade partners with MFN status, the effect of ΔMFN_{ht} is subsumed in the product-time fixed effects α_{ht}. Column (3) shows that the main findings of Columns (1) and (2) are unaffected, and the interaction between MFN tariff changes and initial size is small and statistically insignificant for the triple prediction.

4.4.2 Revenue Predictions

Increases in unit values following a trade liberalization are often interpreted as quality upgrading by exporters (Verhoogen 2008; Khandelwal 2010). Colombia is a small country relative to other destinations of US exporters, making it less likely that the unit values pick up investments in quality upgrading of US exporters following duty-free access to the Colombian market. In fact, lower trade costs would make it more likely for lower quality US exporters to be able to sell to the Colombian market. To ensure however that our results are not driven by quality increases, we always examine the triple prediction where price rises are accompanied by a decline in total quantity and in the number of importers of the exporter (which is a direct measure of reduced competition among importers). There is no clear theoretical prediction in the quality literature on how quantity varies with changes in quality (e.g. Eckel et al. 2015). We therefore consider another triple prediction which looks at a decline in total revenue rather than total quantity of the exporter.[15]

The variety-level model of Section 3 predicts that exporters who switch from bilateral contracts to joint contracts increase their profits but sell lower quantities to fewer importers. An extreme prediction of the model is that these exporters might also lower their sales values to earn higher profit margins per unit. In the Appendix, we discuss that this arises under certain conditions on parameter values and therefore it is an extreme prediction of the model which need not arise for all the firms that switch from bilateral to joint contracts. The main intuition here is that under joint contracts, the firm need not sell many units of the product if the markup is large and the fixed costs of joint versus bilateral contracts are relatively low. So if we find that some US exporters are more likely to reduce revenues when they increase prices and sell to fewer importers, it would be another piece of evidence that duty-free access induced exporters to increase markups rather than quality.

---

[15]We are grateful to Penny Goldberg and Marc Melitz for pointing us in this direction.

Table 5: Estimation results: Revenue-Based Triple Prediction

	(1)	(2)
	Coef.	Coef.
Variable	**(S.E.)**	**(S.E.)**
$\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.029**	0.030**
	(0.014)	(0.014)
$\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$		-0.040**
		(0.014)
Controls	yes	yes
Product-Year FE α_{ht}	yes	yes
Country-Year FE α_{st}	yes	yes
N	23,616	22,943
R^2	0.245	0.228

Dependent Variable: $\Delta\text{Triple}_{csht}^{Revenue}$

Note: Note: $\Delta\text{Triple}_{csht}^{Revenue} = 1$ if $\triangle ImportPrice_{csht} > 0$ & $\triangle ImportRevenue_{csht} < 0$ & $\triangle\#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. $\text{Treat}_h = 1$ for HS-Codes that received duty-free access from the US-Colombia FTA and 0 otherwise. The sample covers changes in import outcomes in 2010, 2011 and 2012. $\text{Post}_t = 1$ for 2012 and 0 otherwise while $\text{Pre}_t = 1$ for 2011 and 0 otherwise. $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from other developed countries. Size_{csh} is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product from developed countries in 2009. Controls include all interactions between Post_t, Treat_h, USA_s, Size_{csh} and Pre_t. Significance levels are indicated by ***, **, and * for 1, 5 and 10 percent respectively.

We examine the revenue-based triple prediction of higher prices, lower revenues and fewer importers in a way similar to the baseline analysis. Specifically, $\Delta\text{Triple}_{csht}^{Revenue} = 1$ if exporter c from source country s selling product h at time t increases its average price across all its importers ($\triangle\tilde{m}_{csht} > 0$) *and* reduces the total revenue received from all its importers *and* reduces the number of importers of its product ($d_{csht}^{max} < 0$). If any one of these events does not happen, then $\Delta\text{Triple}_{csht}^{Revenue} = 0$. As in the baseline results, Table 5 shows US exporters who receive duty-free access are more likely to have higher prices, lower revenues and fewer importers, and these exporters tend to be the smaller exporters. As expected, the increased likelihood of the revenue-based triple prediction is 3%, which is smaller than the 4% increased likelihood of the quantity-based triple prediction in the baseline analysis.[16]

4.4.3 Size Bins

Instead of using a continuous measure of initial size, we can also estimate different coefficients for exporters by their size category. We divide all exporters of a product into three different terciles of Size_{csh} and estimate separate coefficients on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ for each tercile. $\text{Tercile}1_{csh} = 1$

---

[16]The main results are similar when we only use a double prediction of lower revenue and fewer importers on the LHS (available upon request).

if exporter c's initial size measured by Size_{csh} is below the 33rd percentile of all exporters of that product from developed countries, and 0 otherwise. Similarly, $\text{Tercile2}_{csh} = 1$ if c's initial size is between the 33rd and 66th percentile, and $\text{Tercile3}_{csh} = 1$ if c's initial size is greater than the 66th percentile for exporters of that product. Column (1) of Table 6 shows that the triple prediction continues to hold and it is the smaller exporters in the first and second terciles that increase their prices, reduce quantities and reduce their number of importers.

Table 6: Tercile results: Triple Prediction by Size Bins

Dependent Variable: $\Delta\text{Triple}_{csht}$		
	(1)	**(2)**
	Coef.	**Coef.**
Variable	**(S.E.)**	**(S.E.)**
$\text{Tercile3}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	-0.014	-0.021
	(0.026)	(0.022)
$\text{Tercile2}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.053*	0.043*
	(0.028)	(0.024)
$\text{Tercile1}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.086***	0.077***
	(0.029)	(0.027)
$\text{Tiny}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$		-0.067
		(0.028)
Controls	yes	yes
Product-Year FE α_{ht}	yes	yes
Country-Year FE α_{st}	yes	yes
N	23,616	71,316
R^2	0.238	0.121

Note: Note: $\Delta\text{Triple}_{csht} = 1$ if $\triangle ImportPrice_{csht} > 0$ & $\triangle ImportQuantity_{csht} < 0$ & $\triangle \#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. $\text{Treat}_h = 1$ for HS-Codes that received duty-free access from the US-Colombia FTA and 0 otherwise. The sample covers changes in import outcomes in 2010, 2011 and 2012. $\text{Post}_t = 1$ for 2012 and 0 otherwise while $\text{Pre}_t = 1$ for 2011 and 0 otherwise. $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from other developed countries. Size_{csh} is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product from developed countries in 2009. $\text{Tercile1}_{csh} = 1$ for the 33rd tercile of Size_{csh}, $\text{Tercile2}_{csh} = 1$ for the 66th tercile and $\text{Tercile3}_{csh} = 1$ for the top tercile. $\text{Tiny}_{csh} = 1$ for all exporters from developed countries with total sales of less than USD10,000 in 2009. Controls include all interactions between Post_t, Treat_h, USA_s, Pre_t and indicators for initial size tercile in Column (1) and also interactions with Tiny_{csh} in Column (2). Significance levels are indicated by ***, **, and * for 1, 5 and 10 percent respectively.

It should be noted however that the set of exporter-country-products that we considered throughout are those with initial sales greater than US\$10,000. The results are robust to inclusion of tiny exporters that earn below 10K in 2009 ($\text{Tiny}_{csh} = 1_{e_{csh,2009} \leq 10000}$). Column (2) adds in the tiny exporters. We continue to find that the medium-sized exporters in terciles 1 and 2 are the ones that are more likely to increase prices, lower quantities and reduce their number of importers. The coefficient on the second tercile is less precisely estimated, but we can be confident of the positive

coefficient on the first tercile. These findings suggest that the triple prediction holds precisely for the medium-sized US exporters, as expected from the theory.

4.4.4 Within-Exporter-Importer Pairs

While the baseline results examine the triple prediction at the level of the exporter, the model predicts that the results should also hold when we look within an exporter-importer pair. Let d denote a Colombian importer that imports from exporter c. The triple variable is now defined as $\Delta\text{Triple}_{cdsht} = 1$ for exporter-importer pairs cd that experience an increase in their bilateral price ($\Delta m_{cdsht} > 0$), a fall in their bilateral quantity ($\Delta x_{cdsht} < 0$) and a decrease in the importers that are connected to c ($\Delta d_{csht}^{\max} < 0$). If any one of these events does not happen, then $\Delta\text{Triple}_{cdsht} = 0$.

Table 7: Tercile results: Within Exporter-Importer Triple Prediction by Size Bins

	(1)	(2)
	Coef.	Coef.
Variable	(S.E.)	(S.E.)
$\text{Tercile3}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	-0.004	-0.005
	(0.028)	(0.025)
$\text{Tercile2}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.037	0.046*
	(0.030)	(0.028)
$\text{Tercile1}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.054*	0.053**
	(0.029)	(0.026)
$\text{Tiny}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$		-0.0414
		(0.028)
Controls	yes	yes
Product-Year FE α_{ht}	yes	yes
Country-Year FE α_{st}	yes	yes
N	32,158	82,130
R^2	0.183	0.110

Dependent Variable: $\Delta\text{Triple}_{cdsht}$

Note: Note: $\Delta\text{Triple}_{cdsht} = 1$ if $\triangle ImportPrice_{cdsht} > 0$ & $\triangle ImportQuantity_{cdsht} < 0$ & $\triangle \#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. $\text{Treat}_h = 1$ for HS-Codes that received duty-free access from the US-Colombia FTA and 0 otherwise. The sample covers changes in import outcomes in 2010, 2011 and 2012. $\text{Post}_t = 1$ for 2012 and 0 otherwise while $\text{Pre}_t = 1$ for 2011 and 0 otherwise. $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from other developed countries. Size_{csh} is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product from developed countries in 2009. $\text{Tercile1}_{csh} = 1$ for the 33rd tercile of Size_{csh}, $\text{Tercile2}_{csh} = 1$ for the 66th tercile and $\text{Tercile3}_{csh} = 1$ for the top tercile. $\text{Tiny}_{csh} = 1$ for all exporters from developed countries with total sales of less than USD10,000 in 2009. Controls include all interactions between Post_t, Treat_h, USA_s, Pre_t and indicators for initial size tercile in Column (1) and also interactions with Tiny_{csh} in Column (2). Significance levels are indicated by ***, **, and * for 1, 5 and 10 percent respectively.

Column (1) of Table 7 shows that the first tercile of exporters by initial size is more likely to see the triple prediction hold at the exporter-importer level. Adding the tiny exporters to the sample,

Column (2) shows the triple prediction continues to hold and the positive coefficient on the second tercile is more precisely estimated. The results of Table 7 which is at the exporter-importer level conform broadly with the results of Table 6 which is at the level of the exporter. US exporters in the first and second terciles (with initial revenues greater than USD10,000) are more likely to show higher prices, lower quantities and fewer importers.

4.5 Price Regressions

An advantage of testing the model with the triple prediction is that it lets us examine a unique prediction which does not arise in standard models. For instance, if instead we look only at a decline in quantities, it might reflect an increase in the quality of the product that entails fewer physical units to provide the same level of effective units of the product. A limitation of the triple prediction however is that it does not let us put a number on the price increases faced by the importers. To get a sense of the magnitude of the changes, we examine how unit values respond to duty-free access to the Colombian market.

Using a specification similar to the baseline, we regress changes in unit values to determine the coefficient on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ for each tercile of US exporters. The dependent variable in Column (1) of Table 8 is the change in the average price charged by exporter c for product h ($\Delta \ln \tilde{m}_{csht}$). We find that exporters in the first tercile of initial size increase their average unit value by 30% more when they experience duty-free access to the Colombian market, relative to the control group of exporters from developed countries that do not receive duty-free access. Column (2) reports the regression of changes in unit values with tiny exporters included in the sample to show that the result is not driven by selection that harms smaller exporters.

Columns (3) and (4) of Table 8 look even more closely at the change in unit values by conducting the analysis at the exporter-importer level. The dependent variable is the change in the price charged by exporter c to importer d for product h ($\Delta \ln m_{cdsht}$). The robust result here is that exporters in the first tercile that experience duty-free access to the Colombian market increase the unit value that they charge to an importer by 25% more. These estimates show that the price elasticities with respect to duty-free access are quantitatively important.

5 Conclusion

This paper examines how the behavior of importers and their interaction with exporters affect the division of the gains from trade among consumers, importers and exporters. When an exporter sells a product to importers through anonymous markets, double marginalization and business stealing among competing importers lead to lower profits. Exporters and importers can invest in richer contractual arrangements to overcome these externalities.

Table 8: Unit value results: Changes in Exporter-level Prices and Exporter-Importer-Level Prices

Variable	Exporter-level $\Delta \ln \tilde{m}_{csht}$		Exporter-Importer $\Delta \ln m_{cdsht}$	
	(1) Coef. (S.E.)	(2) Coef. (S.E.)	(3) Coef. (S.E.)	(4) Coef. (S.E.)
$\text{Tercile3}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	-0.114	-0.025	-0.154*	-0.124
	(0.121)	(0.104)	(0.091)	(0.080)
$\text{Tercile2}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.074	0.084*	-0.143	-0.130
	(0.148)	(0.133)	(0.118)	(0.112)
$\text{Tercile1}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$	0.303**	0.314**	0.228*	0.254**
	(0.152)	(0.139)	(0.123)	(0.115)
$\text{Tiny}_{csh} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$		-0.353**		-0.256**
		(0.149)		(0.123)
Controls	yes	yes	yes	yes
Product-Year FE α_{ht}	yes	yes	yes	yes
Country-Year FE α_{st}	yes	yes	yes	yes
N	23,616	71,316	32,158	82,130
R^2	0.189	0.089	0.162	0.084

Note: Note: $\Delta \ln \tilde{m}_{csht}$ is the log change in the exporter-level average unit value and $\Delta \ln m_{cdsht}$ is the log change in the exporter-importer-level unit value. $\text{Treat}_h = 1$ for HS-Codes that received duty-free access from the US-Colombia FTA and 0 otherwise. The sample covers changes in import outcomes in 2010, 2011 and 2012. $\text{Post}_t = 1$ for 2012 and 0 otherwise while $\text{Pre}_t = 1$ for 2011 and 0 otherwise. $\text{USA}_s = 1$ for exporters from the United States and 0 for exporters from other developed countries. Size_{csh} is the z-score of initial export value $e_{csh,2009}$ in 2009 relative to all exporters of the product from developed countries in 2009. $\text{Tercile1}_{csh} = 1$ for the 33rd tercile of Size_{csh}, $\text{Tercile2}_{csh} = 1$ for the 66th tercile and $\text{Tercile3}_{csh} = 1$ for the top tercile. $\text{Tiny}_{csh} = 1$ for all exporters from developed countries with total sales of less than USD10,000 in 2009. Controls include all interactions between Post_t, Treat_h, USA_s, Pre_t and indicators for initial size tercile in Column (1) and also interactions with Tiny_{csh} in Column (2). Significance levels are indicated by ***, **, and * for 1, 5 and 10 percent respectively.

We embed the choice of contracts between exporters and importers into a trade model with heterogeneous exporters and importers. Exporters can offer bilateral contracts that eliminate double marginalization, leading to higher profits and lower consumer prices. Exporters can internalize business stealing across importers by investing in joint contracts. This enables an exporter to commit to mitigating competition among its importers allowing total profit from the product to rise at the expense of consumer welfare. When investments in joint contracts embody knowledge of the exporter's product, trade liberalization changes the relative incentives to engage in bilateral contracts and joint contracts. Lower trade costs strengthen the bargaining power of exporters and make them more likely to offer joint contracts. We show that the price increase from this move towards joint contracts can dominate the standard consumer gains from trade, leading to a rise in the consumer price index after trade liberalization.

The model enables us to derive unique difference-in-difference predictions for changes in import prices, quantities and number of importers per exporter. Testing these implications empirically, we show that bilateral trade liberalization between Colombia and the US induced US exporters to consolidate their import market, increasing the probability of higher prices, reduced quantity and fewer Colombian importers per exporter. These observable predictions suggest that the actions of exporters and importers affect the ability of consumers to gain from trade. The estimated elasticity of import prices with respect to trade costs shows substantial increases in prices from trade liberalization. Future work can shed more light on how this translates into consumer price changes and its contribution to the aggregate pass-through of reduction in trade barriers into consumer prices.

References

Aghion, P., R. Griffith, and P. Howitt (2006). Vertical integration and competition. *The American Economic Review 96*(2), 97–102. 1

Ahn, J., A. K. Khandelwal, and S.-J. Wei (2011). The role of intermediaries in facilitating trade. *Journal of International Economics 84*(1), 73–85. 1

Akerman, A. (2010). A theory on the role of wholesalers in international trade based on economies of scope. Research papers in economics, Stockholm University, Department of Economics. 1

Amiti, M. and J. Konings (2007). Trade liberalization, intermediate inputs and productivity: Evidence from indonesia. *American Economic Review 97*(5), 1611–1638. 1

Antràs, P. and A. Costinot (2011). Intermediated trade. *The Quarterly Journal of Economics 126*(3), 1319–1374. 1

Antràs, P. and E. Helpman (2004). Global sourcing. *Journal of Political Economy 112*(3), 552–580. 1

Atkin, D. and D. Donaldson (2012). Who's getting globalized? the size and nature of intranational trade costs. *Working Paper*. 1

Badinger, H. (2007). Has the EU's single market programme fostered competition? testing for a decrease in mark-up ratios in EU industries. *Oxford Bulletin of Economics and Statistics 69*(4), 497–519. 1, 1

Bagwell, K. and S. H. Lee (2015). Trade policy under monopolistic competition with firm selection. *Wokirng Paper, Stanford University*. 1

Bagwell, K. and R. W. Staiger (2012). The economics of trade agreements in the linear cournot delocation model. *Journal of International Economics 88*(1), 32–46. 1

Bernard, A. B., J. Eaton, J. B. Jensen, and S. Kortum (2003). Plants and productivity in international trade. *American Economic Review*. 2.2

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott (2010). Wholesalers and retailers in US trade. *The American Economic Review 100*(2), 408–413. 1

Bernard, A. B., J. B. Jensen, and P. K. Schott (2009). Importers, exporters, and multinationals: A portrait of firms in the U.S. that trade goods. In T. Dunne, J. Jensen, and M. Roberts (Eds.), *Producer dynamics: New Evidence from Micro Data*. University of Chicago Press. 1

Bernard, A. B., A. Moxnes, and K. H. Ulltveit-Moe (2014). Two-sided heterogeneity and trade. Working Paper 20136, NBER. 1, 9

Blanchard, E., T. Chesnokova, and G. Willmann (2013). Private labels and international trade: Trading variety for volume. Technical report, Kiel Working Paper. 1

Blum, B. S., S. Claro, and I. Horstmann (2010). Facts and figures on intermediated trade. *The American Economic Review 100*(2), 419–423. 1

Blum, B. S., S. Claro, and I. J. Horstmann (2012). Import intermediaries and trade costs: Theory and evidence. mimeo, University of Toronto. 1

Boler, E. A., A. Moxnes, and K. H. Ulltveit-Moe (forthcoming). Technological change, international sourcing and the joint impact on productivity. *American Economic Review*. 1

Burstein, A. T., J. C. Neves, and S. Rebelo (2003). Distribution costs and real exchange rate dynamics during exchange-rate-based stabilizations. *Journal of monetary Economics 50*(6), 1189–1214. 1

Campa, J. M. and L. S. Goldberg (2005, November). Exchange rate pass-through into import prices. *The Review of Economics and Statistics 87*(4), 679–690. 1

Carballo, J., G. I. Ottavianio, and C. V. Martincus (2013). The buyer margins of firms' exports. Technical report, LSE. 1

Castellani, D., F. Serti, and C. Tomasi (2010, March). Firms in international trade: Importers' and exporters' heterogeneity in italian manufacturing industry. *The World Economy 33*(3), 424–457. 1

Chaney, T. (2008). Distorted gravity: the intensive and extensive margins of international trade. *American Economic Review 98*(4), 1707–1721. 2

Chaney, T. (2014). The network structure of international trade. *American Economic Review 104 (11)*, 3600–3634. 1

Conconi, P., P. Legros, and A. F. Newman (2012). Trade liberalization and organizational change. *Journal of international economics 86*(2), 197–208. 1

De Loecker, J., P. K. Goldberg, A. K. Khandelwal, and N. Pavcnik (2012). Prices, markups and trade reform. Technical report, National Bureau of Economic Research. 1, 1

Dhingra, S. (2013, February). Trading away wide brands for cheap brands. *American Economic Review 103(6)*, 2554–2584. 2.7

Eaton, J., M. Eslava, D. Jinkins, C. J. Krizan, and J. Tybout (2012). A search and learning model of export dynamics. working paper. 1

Eckel, C. (2009). International trade and retailing. Working Paper 2597, CESIfo. 1

Eckel, C., L. Iacovone, B. Javorcik, and J. P. Neary (2015). Multi-product firms at home and away: Cost-versus quality-based competence. *Journal of International Economics 95*(2), 216–232. 4.4.2

Engel, C. and J. H. Rogers (1996, December). How wide is the border? *American Economic Review 86*(5), 1112–25. 1

Evenett, S. J. and R. M. Stern (2011). *Systemic implications of transatlantic regulatory cooperation and competition*, Volume 15. World Scientific. 1

Feenstra, R. C., D.-S. Huang, and G. G. Hamilton (2003). A market-power based model of business groups. *Journal of Economic Behavior & Organization 51*(4), 459–485. 1

Ganslandt, M. and K. E. Maskus (2004). Parallel imports and the pricing of pharmaceutical products: evidence from the european union. *Journal of health economics 23*(5), 1035–1058. 1

Halpern, L., M. Koren, and A. Szeidl (2011). Imported inputs and productivity. Cefig working paper, Central European University. 1

Harrison, A. E. (1994). Productivity, imperfect competition, and trade reform: Theory and evidence. *Journal of International Economics 36 (1-2)*, 53–73. 1

Harrison, R., J. Jaumandreu, J. Mairesse, and B. Peters (2005). Does innovation stimulate employment? a firm-level analysis using comparable micro data on four european countries. *European research project Innovation and Employment in European Firms: Microeconometric Evidence (IEEF)*. 1

Hart, O. and J. Tirole (1990). Vertical integration and market foreclosure. *Brookings papers on economic activity. Microeconomics 1990*, 205–286. 1, 2.5

Horn, H. and A. Wolinsky (1988). Bilateral monopolies and incentives for merger. *The RAND Journal of Economics*, 408–419. 2.5, 2.6

Khandelwal, A. K. (2010). The long and short (of) quality ladders. *Review of Economic Studies 77*, 1450–1476. 4.4.2

Konings, J., P. Van Cayseele, and F. Warzynski (2005). The effects of privatization and competitive pressure on firms' price-cost margins: Micro evidence from emerging economies. *Review of Economics and Statistics 87*(1), 124–134. 1

Krugman, P. R. (1980). Scale Economies, Product Differentiation, and the Pattern of Trade. *American Economic Review 70*(5), 950–959. 2.2

Lawrence, R. Z. (1991). How open is japan? In *Trade with Japan: has the door opened wider?*, pp. 9–50. University of Chicago Press, 1991. 1

Lawrence, R. Z. and G. R. Saxonhouse (1991). Efficient or exclusionist? the import behavior of japanese corporate groups. *Brookings Papers on Economic Activity 1991*(1). 1

Levinsohn, J. (1993). Testing the imports-as-market-discipline hypothesis. *Journal of International Economics 35*(1), 1–22. 1

Mallick, S. and H. Marques (2008). Passthrough of exchange rate and tariffs into import prices of india: Currency depreciation versus import liberalization*. *Review of International Economics 16*(4), 765–782. 1, 1

Martin, S., H.-T. Normann, and C. M. Snyder (2001). Vertical foreclosure in experimental markets. *RAND Journal of Economics*, 466–496. 5, 2.6

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica 71*(6), 1695–1725. 2, 2.2

Miklos-Thal, J., P. Rey, and T. Verge (2010). Vertical relations. *International Journal of Industrial Organization 28*, 345–349. 4

Mollers, C., H.-T. Normann, and C. M. Snyder (2014, October). Communication in vertical markets: Experimental evidence. *Dartmouth College Working Paper*. 5

Muuls, M. and M. Pisu (2009, May). Imports and exports at the level of the firm: Evidence from belgium. *The World Economy 32*(5), 692–734. 1

Neary, J. P. (2003). The road less traveled: Oligopoly and competition policy in general equilibrium. *Economics for an Imperfect World: Essays in Honor of Joseph E. Stiglitz*, 485. 1

Petropoulou, D. (2011). Information costs, networks and intermediation in international trade. Globalization and Monetary Policy Institute Working Paper 76, Federal Reserve Bank of Dallas. 1

Pierce, J. R. and P. K. Schott (2012). Concording us harmonized system categories over time. *Journal of Official Statistics 28*(1), 53–68. 4.1

Raff, H. and N. Schmitt (2005). Endogenous vertical restraints in international trade. *European Economic Review 49*(7), 1877–1889. 1

Raff, H. and N. Schmitt (2009). Buyer power in international markets. *Journal of International Economics 79(2)*, 222–229. 1

Raff, H. and N. Schmitt (2012). Imports and the structure of retail markets. *Canadian Journal of Economics 45(4)*, 1431–1455. 1

Rauch, J. E. (1999, June). Networks versus markets in international trade. *Journal of International Economics 48*(1), 7–35. 1

Rauch, J. E. and J. Watson (2004). Network intermediaries in international trade. *Journal of Economics & Management Strategy 13*(1), 69–93. 1

Rey, P. and J. Tirole (2007). A primer on foreclosure. *Handbook of industrial organization 3*, 2145–2220. 2.5

Tybout, J. R. (2003). Plant-and firm-level evidence on "new" trade theories. *Handbook of International Trade 1*, 388–415. 1

Venables, A. J. (1985). Trade and trade policy with imperfect competition: The case of identical products and free entry. *Journal of International Economics 19*(1-2), 1–19. 1

Verhoogen, E. A. (2008). Trade, quality upgrading, and wage inequality in the mexican manufacturing sector*. *The Quarterly Journal of Economics 123*(2), 489–530. 4.4.2

WTO (2012, June). Trade policy review: Colombia. *WT/TPR/S/265*. 4.4.1

Appendix

A Price Index Derivation

The aggregate price index faced by consumers is $P^{\rho/(\rho-1)} = \int \int p_{ij}^{\rho/(\rho-1)} di\,dj$. Substituting for optimal prices, the price index is

$$P^{\rho/(\rho-1)} = \sum_V \int 1_V (\mu_V c\bar{d})^{\rho/(\rho-1)} dG + \tau^{\rho/(\rho-1)} \sum_{Vx} \int 1_{Vx} (\mu_{Vx} c\bar{d})^{\rho/(\rho-1)} dG \qquad V \in \{M, B, J\}$$

where 1_V is an indicator for vertical contract V. Assuming $z \equiv c\bar{d}$ follows a Pareto distribution $G(z) = (z/z_{\max})^k$ for $k(1-\rho)/\rho < 2$ and defining $\varepsilon(k, \rho, \theta) \equiv -k/\left(k(\rho-\theta)/\rho(\theta-1) + \theta/(\theta-1)\right)$, the price index can be broken up into its components as follows:

$$\begin{aligned}
P^{-k/\varepsilon} &\equiv P_{home}^{-k/\varepsilon} + P_{import}^{-k/\varepsilon} \\
&\equiv \left[P_M^{-k/\varepsilon} + P_B^{-k/\varepsilon} + P_J^{-k/\varepsilon} \right] + \left[P_{Mx}^{-k/\varepsilon} + P_{Bx}^{-k/\varepsilon} + P_{Jx}^{-k/\varepsilon} \right].
\end{aligned}$$

The import price index for each contract is

$$P_{Mx}^{-k/\varepsilon} \equiv \tau^{-k} (f_x/f)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Mx}^{\rho/(\rho-1)} \left(1 - (z_{Bx}/z_{Mx})^{k+\rho/(\rho-1)} \right)$$

$$P_{Bx}^{-k/\varepsilon} \equiv \tau^{-k} (f_x/f)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Bx}^{\rho/(\rho-1)} \left((z_{Bx}/z_{Mx})^{k+\rho/(\rho-1)} - (z_{Jx}/z_{Mx})^{k+\rho/(\rho-1)} \right)$$

$$P_{Jx}^{-k/\varepsilon} \equiv \tau^{-k} (f_x/f)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \mu_{Jx}^{\rho/(\rho-1)} (z_{Jx}/z_{Mx})^{k+\rho/(\rho-1)}$$

where $\kappa_1 \equiv k z_{\max}^{-k}/2 (k + \rho/(\rho-1))$ and $\kappa_2 \equiv \left(\rho\eta (f/\eta(1-\rho))^{(\rho-1)/\rho} \right)^{k+\rho/(\rho-1)}$ for brevity. Substituting for the optimal markups,

$$\begin{aligned}
P_{import}^{-k/\varepsilon}/\kappa_1 \kappa_2 = \tau^{-k} (f_x/f)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} &\left[(\rho\eta)^{\rho/(1-\rho)} + \left(\eta^{\rho/(1-\rho)} - (\rho\eta)^{\rho/(1-\rho)} \right) \left(\frac{z_{Bx}}{z_{Mx}} \right)^{k+\rho/(\rho-1)} \right. \\
&\left. + \left(\rho^{\rho/(1-\rho)} - \eta^{\rho/(1-\rho)} \right) \left(\frac{z_{Jx}}{z_{Mx}} \right)^{k+\rho/(\rho-1)} \right].
\end{aligned}$$

The Impact of Trade Liberalization on the Price Index

We are interested in understanding how the price index changes with trade liberalization. Differentiating the price index with respect to trade cost τ, the import price index elasticity is

$$\frac{d\ln P_{import}}{d\ln \tau} = \varepsilon \left[1 + \underbrace{\frac{k + \rho/(\rho-1)}{k} \frac{\left((\eta/\rho)^{\rho/(1-\rho)} - 1 \right) P_{Jx}^{-k/\varepsilon}}{P_{Mx}^{-k/\varepsilon} + P_{Bx}^{-k/\varepsilon} + P_{Jx}^{-k/\varepsilon}} \frac{d\ln(z_{Jx}/z_{Mx})}{d\ln \tau}}_{\text{Contracting Choice Effect}} \right]$$

$$= \varepsilon \left[1 - \frac{k + \frac{\rho}{\rho-1}}{k} \frac{\left(\eta^{\frac{\rho}{1-\rho}} - \rho^{\frac{\rho}{1-\rho}} \right) \left(\frac{z_{Jx}}{z_{Mx}} \right)^{k+\frac{\rho}{\rho-1}} \frac{\frac{1-\rho}{1-\eta}(1-\beta)\left(\frac{v_c}{\tau} \right)^{\frac{\rho}{\rho-1}}}{\frac{\beta_{JV}}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho} \right)^{\rho/(\rho-1)} - 1}}{(\rho\eta)^{\frac{\rho}{1-\rho}} + \left(\eta^{\frac{\rho}{1-\rho}} - (\rho\eta)^{\frac{\rho}{1-\rho}} \right) \left(\frac{z_{Bx}}{z_{Mx}} \right)^{k+\frac{\rho}{\rho-1}} + \left(\rho^{\frac{\rho}{1-\rho}} - \eta^{\frac{\rho}{1-\rho}} \right) \left(\frac{z_{Jx}}{z_{Mx}} \right)^{k+\frac{\rho}{\rho-1}}} \right]$$

The direct cost effect and the indirect contracting choice effect move in opposite directions. We therefore need to determine the relative magnitude of the contracting choice effect, and will show that it can overwhelm the cost effect for appropriate parameter values.

To show that the import price index change can be negative, consider the simple case where the fixed costs of anonymous market transactions are similar to those of bilateral contracts. In this case (e.g. $f_x = f_{bx}$), the profit from anonymous transactions is smaller than from bilateral contracts and no exporter-importer pair chooses to operate through anonymous transactions. The price index is

$$P^{-k/\varepsilon} \equiv P_{home}^{-k/\varepsilon} + P_{import}^{-k/\varepsilon}$$
$$\equiv \left[P_B^{-k/\varepsilon} + P_J^{-k/\varepsilon} \right] + \left[P_{Bx}^{-k/\varepsilon} + P_{Jx}^{-k/\varepsilon} \right]$$

where the components are

$$P_{Bx}^{-k/\varepsilon} \equiv \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \eta^{\rho/(1-\rho)} \left(1 - \left(z_{Jx}/z_{Bx} \right)^{k+\rho/(\rho-1)} \right)$$
$$P_{Jx}^{-k/\varepsilon} \equiv \tau^{-k} \left(f_x/f \right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \kappa_1 \kappa_2 \rho^{\rho/(1-\rho)} \left(z_{Jx}/z_{Bx} \right)^{k+\rho/(\rho-1)}$$

for $\kappa_1 \equiv k z_{\max}^{-k} / 2 \left(k + \rho/(\rho - 1) \right)$ and $\kappa_2 \equiv \left(\eta \left(f_b/\beta(1 - \eta) \right)^{(\rho-1)/\rho} \right)^{k+\rho/(\rho-1)}$.

The cutoffs for joint contracts and bilateral contracts are:

$$f_{bx} = P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau z_{Bx} \right)^{\rho/(\rho-1)} \left[\beta(1-\eta)\eta^{\rho/(1-\rho)} \right]$$
$$f_{jx} - f_{bx} = P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau z_J \right)^{\rho/(\rho-1)} \left[\beta(1-\eta)\eta^{\rho/(1-\rho)} \right] \left[\frac{\beta_J}{\beta} \frac{1-\rho}{1-\eta} \left(\frac{\rho}{\eta} \right)^{\rho/(1-\rho)} - 1 \right].$$

From these zero profit conditions, the relative cutoff for joint contracts versus bilateral contracts is

$$\left(z_{Jx}/z_{Bx} \right)^{\rho/(\rho-1)} = \frac{f_{jx} - f_{bx}}{f_{bx}} \left[\frac{\beta_J}{\beta} \frac{1-\rho}{1-\eta} \left(\frac{\rho}{\eta} \right)^{\rho/(1-\rho)} - 1 \right]^{-1} \geq 1.$$

Differentiating with respect to trade costs,

$$\frac{d\ln \left(z_{Jx}/z_{Bx} \right)}{d\ln \tau} = -\frac{1-\rho}{\rho} \frac{\eta}{1-\eta} \frac{\frac{\beta_J}{\beta} \frac{1-\rho}{1-\eta} \left(\frac{\eta}{\rho} \right)^{\rho/(\rho-1)}}{\frac{\beta_J}{\beta} \frac{1-\rho}{1-\eta} \left(\frac{\eta}{\rho} \right)^{\rho/(\rho-1)} - 1} \frac{1-\eta}{1-\rho} \frac{(1-\beta)(v_c \rho/\eta\tau)^{\eta/(\eta-1)}}{\beta_J}.$$

We will show that the change in the price index can be negative for appropriate parameter values. Two key assumptions on parameter values are $\beta_J \in [0,1]$ and $z_{Jx}/z_{Bx} \leq 1$. As $\beta_J/\beta = 1 + (1-\beta)v_d^{\eta/(\eta-1)} \left[1 - ((1-\eta)/(1-\rho))(\rho v_c/\eta\tau v_d)^{\eta/(\eta-1)} \right]$, these assumptions imply the importing cost disadvantage of producers must satisfy:

$$v_d^{\frac{\eta}{\eta-1}} \in \left[\frac{1-\eta}{1-\rho} \left(\frac{\rho v_c}{\eta\tau} \right)^{\frac{\eta}{\eta-1}} - \left(1 - \frac{1-\eta}{1-\rho} \left(\frac{\eta}{\rho} \right)^{\frac{\rho}{1-\rho}} \right) / (1-\beta), \ \left(\frac{\rho v_c}{\eta\tau} \right)^{\frac{\eta}{\eta-1}} + 1/\beta \right]. \quad (22)$$

The upper bound follows from $\beta_J \leq 1$ and the lower bound follows from $z_{Jx}/z_{Bx} \leq 1$ (which ensures a stricter constraint than $\beta_J \geq 0$).[17]

With the parameter restrictions in hand, we can proceed to showing that the import price index can rise with trade liberalization. The import price index is

$$
P_{import}^{-k/\varepsilon}/\kappa_1\kappa_2 = \tau^{-k} \left(f_{bx}/f_b\right)^{\frac{k+\rho/(\rho-1)}{\rho/(\rho-1)}} \left[\eta^{\rho/(1-\rho)} - \left(\eta^{\rho/(1-\rho)} - \rho^{\rho/(1-\rho)}\right)\left(\frac{z_{Jx}}{z_{Bx}}\right)^{k+\rho/(\rho-1)}\right].
$$

Substituting for the price index and the change in z_{Jx}/z_{Bx}, the import price elasticity is

$$
\frac{d\ln P_{import}}{d\ln\tau} = \varepsilon\left[1 + \underbrace{\frac{k+\rho/(\rho-1)}{k}\frac{\left((\eta/\rho)^{\rho/(1-\rho)}-1\right)P_{Jx}^{-k/\varepsilon}}{P_{Mx}^{-k/\varepsilon}+P_{Bx}^{-k/\varepsilon}+P_{Jx}^{-k/\varepsilon}}\frac{d\ln\left(z_{Jx}/z_{Bx}\right)}{d\ln\tau}}_{\text{Contracting Choice Effect}}\right]
$$

$$
= \varepsilon\left[1 - \frac{\eta/(1-\eta)}{\rho/(1-\rho)}\frac{k+\frac{\rho}{\rho-1}}{k}\frac{\left(\eta^{\frac{\rho}{1-\rho}}-\rho^{\frac{\rho}{1-\rho}}\right)\left(\frac{z_{Jx}}{z_{Bx}}\right)^{k+\frac{\rho}{\rho-1}}}{\eta^{\frac{\rho}{1-\rho}}-\left(\eta^{\frac{\rho}{1-\rho}}-\rho^{\frac{\rho}{1-\rho}}\right)\left(\frac{z_{Jx}}{z_{Bx}}\right)^{k+\frac{\rho}{\rho-1}}}\frac{\frac{1-\beta}{\beta}\left(\frac{v_c\rho}{\tau\eta}\right)^{\frac{\eta}{\eta-1}}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{\rho-1}}}{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{\rho-1}}-1}\right]
$$

Let the inverse of the second term in square brackets be defined as

$$
S \equiv \left(\frac{\eta^{\frac{\rho}{1-\rho}}-\left(\eta^{\frac{\rho}{1-\rho}}-\rho^{\frac{\rho}{1-\rho}}\right)\left(\frac{z_{Jx}}{z_{Bx}}\right)^{k+\frac{\rho}{\rho-1}}}{\left(\eta^{\frac{\rho}{1-\rho}}-\rho^{\frac{\rho}{1-\rho}}\right)\left(\frac{z_{Jx}}{z_{Bx}}\right)^{k+\frac{\rho}{\rho-1}}}\right)\left(\frac{\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{1-\rho}}-1}{(1-\beta)\left(\frac{v_c}{\tau}\right)^{\frac{\eta}{\eta-1}}\left(\frac{\eta}{\rho}\right)^{\frac{\eta}{1-\eta}-\frac{\rho}{1-\rho}}/\beta}\right)
$$

where $z_{Jx}/z_{Bx} = \left(\frac{\frac{\beta_{JV}}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\rho}{\eta}\right)^{\frac{\rho}{1-\rho}}-1}{f_{jx}/f_{bx}-1}\right) \leq 1$. We will show that S can be zero for appropriate

parameter values. Suppose f_{jx}/f_{bx} takes a value such that $f_{jx}/f_{bx} - 1 = \alpha\left[\frac{\beta_J}{\beta}\frac{1-\rho}{1-\eta}\left(\frac{\rho}{\eta}\right)^{\frac{\rho}{1-\rho}}-1\right]$ for $\alpha \geq 1$. Then the relative cutoff is $z_{Jx}/z_{Bx} = 1/\alpha \leq 1$ and it stays the same as $v_d^{\eta/(\eta-1)}$ approaches its lower bound. Therefore, as $v_d^{\eta/(\eta-1)}$ approaches its lower bound, the first term of S is $\eta^{\frac{\rho}{1-\rho}}\alpha^{k+\frac{\rho}{\rho-1}}/\left(\eta^{\frac{\rho}{1-\rho}}-\rho^{\frac{\rho}{1-\rho}}\right)-1 > 0$ and the second term is zero.

Finally, we need to confirm that the disagreement payoffs are never chosen in equilibrium. These two conditions imply the importing cost disadvantage must satisfy:

$$
\beta v_d^{\frac{\eta}{\eta-1}} \leq 1 - (1-\beta)\frac{1-\eta}{1-\rho}\left(\frac{\rho v_c}{\eta\tau}\right)^{\frac{\eta}{\eta-1}} \tag{23}
$$

At the lower bound of $v_d^{\eta/(\eta-1)} = \frac{1-\eta}{1-\rho}\left(\frac{\rho v_c}{\eta\tau}\right)^{\frac{\eta}{\eta-1}} - \left(1 - \frac{1-\eta}{1-\rho}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{1-\rho}}\right)/(1-\beta)$, Condition (23) holds for

$$
\frac{1-\eta}{1-\rho}\left(\frac{\eta}{\rho}\right)^{\frac{\eta}{1-\eta}}(1-\beta)(v_c/\tau)^{\frac{\eta}{\eta-1}} \leq 1 - \beta\frac{1-\eta}{1-\rho}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{1-\rho}}
$$

---

[17]Note that $\frac{1-\eta}{1-\rho}\left(\frac{\eta}{\rho}\right)^{\frac{\rho}{1-\rho}} \leq 1$ for $\eta > \rho$ so the lower bound is strictly less than $(\rho v_c/\eta\tau)^{\eta/(\eta-1)}$.

Therefore, S goes to zero and the contracting choice effect gets arbitrarily large, ensuring the import price elasticity is negative.

Monotonicity of the Contracting Choice Effect

From the expression for the contracting choice effect, we see that the magnitude rises with z_{Jx}/z_{Bx}. As the relative cutoff in turn falls with f_{jx}/f_{bx}, the magnitude of the contracting choice effect falls with f_{jx}/f_{bx}. On the other hand, the relative cutoff rises with β_J/β (or $v_d^{\eta/(\eta-1)}$). However, the elasticity of the relative cutoff falls with β_J/β and dominates the relative cutoff rise for $k(1-\rho)/\rho > 2$. Therefore, the magnitude of the contracting choice effect falls with f_{jx}/f_{bx} and rises with β_J/β.

B Incumbent Profit

The change in profit of cd is

$$\frac{d\ln\Pi(cd)}{d\ln\tau} = \underbrace{-\frac{\rho}{1-\rho}}_{\text{Direct Cost Effect}} + \underbrace{\frac{\rho-\theta}{(1-\rho)(1-\theta)}\frac{d\ln P}{d\ln\tau}}_{\text{Aggregate Price Effect}}$$

$$=\frac{\rho}{\rho-1}\left[1 - \frac{\rho-\theta}{\rho(1-\theta)}\frac{P_{import}^{-k/\varepsilon}}{P^{-k/\varepsilon}}\frac{d\ln P_{import}}{d\ln\tau}\right].$$

When import prices rise with trade liberalization ($d\ln P_{import}/d\ln\tau < 0$), the anti-competitive effect raises variety profits further and $d\ln\Pi(cd)/d\ln\tau < 0$. When import prices fall with trade liberalization ($d\ln P/d\ln\tau > 0$), the pro-competitive effect exerts downward pressure on profits. As the direct cost effect and the aggregate price effect move in opposite directions, we need to determine the relative magnitudes of these two effects. Since the contracting choice effect is negative, $d\ln P_{import}/d\ln\tau \leq \varepsilon$ from the earlier derivation of the import price elasticity. The import price elasticity is $\varepsilon = k/\left(k\frac{\rho-\theta}{\rho(1-\theta)} + \frac{\theta}{1-\theta}\right)$. As $\frac{\rho-\theta}{\rho(1-\theta)}\varepsilon = \frac{k\frac{\rho-\theta}{\rho(1-\theta)}}{k\frac{\rho-\theta}{\rho(1-\theta)} + \frac{\theta}{1-\theta}} \leq 1$ and $P_{import}^{-k/\varepsilon}/P^{-k/\varepsilon} \leq 1$, we conclude that the aggregate price effect cannot exceed one and $d\ln\Pi(cd)/d\ln\tau$ is negative for $d\ln P/d\ln\tau > 0$. Further, $|d\ln\Pi/d\ln\tau|_{d\ln P/d\ln\tau<0} > |d\ln\Pi/d\ln\tau|_{d\ln P/d\ln\tau>0}$ and profits are more sensitive when the price index rises with trade liberalization.

C Variety-Level Model

This section explains the equilibrium outcomes in a model with relationship-specific cost $f_{dx} > 0$, ad-valorem trade costs $\tau_a > 1$ and importers who purchase products of many exporters. We start with determining the profits of exporters and importers under each vertical contract, and then determine the exporter cutoffs of importers.

Anonymous Market Transactions

Importer d chooses his quantity q_{cd} to maximize the following profit function:

$$\max_{q_{cd}} \pi_d^M = \left(p(q_{cd}, \hat{q}_c, \hat{Q}) - \tau_a \tau m_c d \right) q_{cd}.$$

The optimal price chosen by d is $p_{cd} = \tau_a \tau m_c d/\eta$. Exporter c observes her demand from all importers, and chooses the market price m_c and the importer cost cutoff to maximize profits

$$\max \pi_c^M = \int_{d_{\min}(c)}^{d_{\max}(c)} \left[(m_c - c) \, x_{cd} - f_{dx} \right] dG_d.$$

As earlier, the optimal import price is $m_c = c/\rho$ implying the final price is $p_{cd} = \tau_a \tau cd/\rho\eta$.

However, the exporter incurs relationship-specific fixed costs f_{dx} and must decide the cost cutoff for her importers. Substituting for the optimal import price, exporter c earns

$$\pi_c^M = \tau_a^{-1} \eta(1-\rho) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho\eta \right)^{\rho/(\rho-1)} - \int_{d_{\min}(c)}^{d_{\max}(c)} f_{dx} dG_d.$$

Under Pareto cost draws, $(\bar{d}/d_{\max})^{\eta/(\eta-1)} = \int_0^{d_{\max}^M(c)} d^{\eta/(\eta-1)} dG_d = \left(\frac{k_d}{k_d + \eta/(\eta-1)} \right) \left(d_{\max}^M(c)/d_{\max} \right)^{k_d + \eta/(\eta-1)}$. Exporter c supplies to all importers with $d \leq d_{\max}^M(c)$ where the cutoff at the optimal m_c is given by

$$(m_c - c) \, x_c \left[(k_d + \eta/(\eta-1)) \frac{1-\eta}{\eta} \frac{\rho}{1-\rho} \right] = f_{dx} k_d \left(d_{\max}^M(c)/d_{\max} \right)^{k_d}.$$

The cost cutoff of viable importers is

$$\left(\frac{d_{\max}^M(c)}{d_{\max}} \right)^{k_d - \frac{\rho}{1-\rho} \frac{1-\eta}{\eta} \left(k_d + \frac{\eta}{\eta-1} \right)} = \left(\frac{k_d}{k_d + \frac{\eta}{\eta-1}} \right)^{\frac{1-\eta}{\eta} \frac{\rho}{1-\rho} - 1} \frac{1-\eta}{\eta} \frac{\rho}{1-\rho} \frac{\eta(1-\rho)}{f_{dx}} \tau_a^{-1} P^{\frac{\rho-\theta}{(\rho-1)(\theta-1)}} \left(\frac{\tau_a \tau c d_{\max}}{\rho\eta} \right)^{\frac{\rho}{\rho-1}}.$$

The profit function of exporter c net of fixed costs is

$$\pi_c^M = \left(\frac{k_d}{k_d + \eta/(\eta-1)} \frac{1-\eta}{\eta} \frac{\rho}{1-\rho} - 1 \right) f_{dx} \left(d_{\max}^M(c)/d_{\max} \right)^{k_d}.$$

An exporter can operate in the market as long as $\pi_c^M \geq f_x$. For $d \ln P/d \ln \tau \leq 1$, the cost cutoff for exporters who prefer to operate rather than exit rises with trade liberalization because $d \ln c_{Mx}/d \ln \tau = -\frac{\rho}{1-\rho} \left[1 - \frac{\rho-\theta}{\rho(1-\theta)} d \ln P/d \ln \tau \right]$.

Bilateral Private Contracts

Under bilateral contracts, importer d's profit function from selling exporter c's variety is

$$\pi_{cd}(d) = p(q_{cd}, \hat{q}_c, \hat{Q}) q_{cd} - \tau_a T_{cd}.$$

The exporter's profit from selling to all importers is

$$\pi_c^B = \int_{d_{\min}(c)}^{d_{\max}(c)} \left[\pi_{cd}^B(c) - f_{dx} \right] dG_d = \int_{d_{\min}(c)}^{d_{\max}(c)} \left[T_{cd} - \tau cd q_{cd} - f_{dx} \right] dG_d.$$

Bilateral Nash bargaining implies the optimal payment is

$$\tau_a \hat{T}_{cd} = \left[\beta p(q_{cd}, \hat{q}_c, \hat{Q}) + (1 - \beta)\tau_a \tau cd\right] q_{cd} + \tau_a(1 - \beta)f_{dx}.$$

Substituting for the optimal payments into the exporter's problem, c chooses quantities to maximize:

$$\max_q \pi_c^B = \beta \int_{d_{\min}(c)}^{d_{\max}(c)} \left[\tau_a^{-1}\left(p(q_{cd}, \hat{q}_c, \hat{Q}) - \tau_a \tau cd\right)q_{cd} - f_{dx}\right] dG_d.$$

As earlier, $p_B = \tau_a \tau cd/\eta$ and the exporter finds it optimal to sell to all importers with $\tau_a^{-1}\left(p(q_{cd}, \hat{q}_c, \hat{Q}) - \tau_a \tau cd\right)q_{cd} \geq f_{dx}$. The cost cutoff for importers of exporter c is $d_{\max}^B(c)$ which is defined as

$$(1 - \eta)\tau_a^{-1}P^{\frac{\rho-\theta}{(\rho-1)(\theta-1)}}\left(\tau_a \tau c\bar{d}/\eta\right)^{\rho/(\rho-1)}\left(d_{\max}^B(c)/\bar{d}\right)^{\eta/(\eta-1)} = f_{dx}.$$

Under Pareto cost draws for importers, exporter c finds it viable to offer bilateral contracts to importers with cost draws below $d_{\max}^B(c)$ such that

$$\left(\frac{d_{\max}^B(c)}{d_{\max}}\right)^{k_d - \frac{\rho}{1-\rho}\frac{1-\eta}{\eta}\left(k_d + \frac{\eta}{\eta-1}\right)} = \left(\frac{k_d}{k_d + \frac{\eta}{\eta-1}}\right)^{\frac{1-\eta}{\eta}\frac{\rho}{1-\rho}-1}\frac{1-\eta}{f_{dx}}\tau_a^{-1}P^{\frac{\rho-\theta}{(\rho-1)(\theta-1)}}\left(\frac{\tau_a \tau cd_{\max}}{\eta}\right)^{\frac{\rho}{\rho-1}}.$$

Exporter c's profit under bilateral contracts is

$$\pi_c^B = \beta\left(\frac{k_d}{k_d + \eta/(\eta-1)} - 1\right)f_{dx}\left(d_{\max}^B(c)/d_{\max}\right)^{k_d}$$

Exporter prefers bilateral contracts to anonymous transactions as long as $\pi_c^B - \pi_c^M \geq f_{Bx} - f_x$. For $d\ln P/d\ln\tau \leq 1$, the cost cutoff for exporters who prefer bilateral contracts to anonymous markets rises with trade liberalization because $d\ln c_{Bx}/d\ln\tau = -\frac{\rho}{1-\rho}\left[1 - \frac{\rho-\theta}{\rho(1-\theta)}d\ln P/d\ln\tau\right]$.

Joint Contracts

The profit function of importer d from selling the product of exporter c in a joint contract is

$$\pi_{cd}^J(d) = p(q_{cd}, q_c, \hat{Q})q_{cd} - \tau_a T_{cd}.$$

The exporter's profit from selling to importers is

$$\pi_c = \int_{d_{\min}(c)}^{d_{\max}(c)}\left[T_{cd} - \tau cdq_{cd} - f_{dx}\right]dG_d.$$

Under bilateral Nash bargaining, the optimal payment is

$$\tau_a \hat{T}_{cd} = \left[\beta p_{cd} + (1 - \beta)\tau_a \tau cd\right]q_{cd} + (1 - \beta)\tau_a f_{dx} + (1 - \beta)\tau_a \pi_{cd}^{dis}(c) - \beta\pi_{cd}^{dis}(d).$$

The joint surplus from an exporter-importer transaction is $\pi_{cd}^J = \left[p(q_{cd}, q_c, \hat{Q}) - \tau_a \tau cd\right]q_{cd}$. The importer earns $\pi_{cd}^J(d) = (1 - \beta)\left(\pi_{cd}^J - \tau_a f_{dx}\right) - (1 - \beta)\tau_a \pi_c^{dis} + \beta\pi_d^{dis}$ and the exporter earns $\pi_{cd}^J(c) = T_{cd} - \tau cdq_{cd} - f_{dx} = \beta\left(\tau_a^{-1}\pi_{cd}^J - f_{dx}\right) + (1 - \beta)\pi_c^{dis} - \beta\tau_a^{-1}\pi_d^{dis}$.

Summing over all importers, the joint contract maximizes:

$$\max_{q_{cd}} \beta \int_{d_{\min}^J(c)}^{d_{\max}^J(c)} \left[\tau_a^{-1} \left(p(q_{cd}, q_c, \hat{Q}) - \tau_a \tau c d \right) q_{cd} - f_{dx} \right] dG_d.$$

The optimal final price is $p_{cd}^J = \tau_a \tau c d/\rho$ and the joint surplus is

$$\pi_{cd}^J = (1-\rho) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(d/\bar{d} \right)^{\eta/(\eta-1)}.$$

The disagreement payoffs of exporters and importers are

$$\pi_c^{dis} = \beta \left[\tau_a^{-1} (1-\rho) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(v_d d/\bar{d} \right)^{\eta/(\eta-1)} - f_{dx} \right]$$

$$\pi_d^{dis} = (1-\beta) \left[(1-\eta) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(\rho v_c d/\tau_a \tau \eta \bar{d} \right)^{\eta/(\eta-1)} - \tau_a f_{dx} \right]$$

Therefore, the exporters and importers earn the following equilibrium profits:

$$\pi_{cd}^J(c) = \beta_J (1-\rho) \tau_a^{-1} P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(d/\bar{d} \right)^{\eta/(\eta-1)} - \beta f_{dx}$$

$$\pi_{cd}^J(d) = (1-\beta_J)(1-\rho) P^{(\rho-\theta)/(\rho-1)(\theta-1)} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(d/\bar{d} \right)^{\eta/(\eta-1)} - (1-\beta)\tau_a f_{dx}$$

As earlier, lower trade costs (both iceberg and ad-valorem) make substitution through learning less viable for the importer. Lower trade costs therefore strengthen the bargaining power of exporters and increase their share of the joint surplus.

Exporter c finds it optimal to sell to importers with costs below $d_{\max}^J(c)$ which is defined as

$$\frac{\rho}{1-\rho} \frac{1-\eta}{\eta} \left[p_{cd_{\max}^J} - \tau_a \tau c d_{\max}^J \right] q_{cd_{\max}^J} = \tau_a f_{dx}.$$

Substituting for the optimal price,

$$\frac{\rho}{1-\rho} \frac{1-\eta}{\eta} (1-\rho) \tau_a^{-1} P^{\frac{\rho-\theta}{(\rho-1)(\theta-1)}} \left(\tau_a \tau c \bar{d}/\rho \right)^{\rho/(\rho-1)} \left(d_{\max}^J/\bar{d} \right)^{\eta/(\eta-1)} = f_{dx}.$$

Under Pareto cost draws, the importer cost cutoff for exporter c is

$$\left(\frac{d_{\max}^J}{d_{\max}} \right)^{k_d - \frac{\rho}{1-\rho} \frac{1-\eta}{\eta} \left(k_d + \frac{\eta}{\eta-1} \right)} = \left(\frac{k_d}{k_d + \frac{\eta}{\eta-1}} \right)^{\frac{1-\eta}{\eta} \frac{\rho}{1-\rho} - 1} \frac{(1-\eta)\rho}{\eta f_{dx}} \tau_a^{-1} P^{\frac{\rho-\theta}{(\rho-1)(\theta-1)}} \left(\frac{\tau_a \tau c d_{\max}}{\rho} \right)^{\frac{\rho}{\rho-1}}.$$

The total profit from all importers for exporter c is

$$\pi_c = \left(\frac{k_d}{k_d + \eta/(\eta-1)} \frac{\eta}{1-\eta} \frac{1-\rho}{\rho} \frac{\beta_J}{\beta} - 1 \right) \beta f_{dx} \left(d_{\max}^J(c)/d_{\max} \right)^{k_d}$$

Exporters prefer joint contracts over bilateral contracts as long as $\pi_c^J - \pi_c^B \geq f_{jx} - f_{bx}$. For $d \ln P/d \ln \tau \leq 1$, the cost cutoff for exporters who prefer joint contracts to bilateral contracts rises with trade liberalization because

$$\frac{\left(1 - \pi_c^B/\pi_c^J \right) k_d \rho/(1-\rho)}{k_d - (k_d + \eta/(\eta-1)) \frac{1-\eta}{\eta} \frac{\rho}{1-\rho}} \left[1 + \frac{\rho-\theta}{\rho(1-\theta)} \frac{d \ln P}{d \ln \tau} + \frac{d \ln c_{Jx}}{d \ln \tau} \right] = \frac{\frac{\beta_J}{\beta} \frac{\eta}{1-\eta} \frac{1-\rho}{\rho} \frac{k_d}{k_d + \eta/(\eta-1)}}{\frac{\beta_J}{\beta} \frac{\eta}{1-\eta} \frac{1-\rho}{\rho} \frac{k_d}{k_d + \eta/(\eta-1)} - 1} \frac{d \ln \beta_J}{d \ln \tau}.$$

As $d \ln \beta_J/d \ln \tau < 0$, more varieties move from bilateral contracts to joint contracts.

Prices of Imported Varieties

In anonymous markets, importer d pays exporter c a unit price of $\tau_a \tau m_c dq_{cd} = \tau_a \tau c dq_{cd}/\rho = \eta p_{cd} q_{cd}$. Under bilateral contracts, $\tau_a T_{cd} = [\beta + (1-\beta)\eta] p_{cd} q_{cd} + (1-\beta)\tau_a f_{dx}$ and in joint contracts, $\tau_a T_{cd} = [\beta_J + (1-\beta_J)\rho] p_{cd} q_{cd} + (1-\beta)\tau_a f_{dx}$. The "import price" can be defined as the variable component of the payments made to exporters. Then the import price under each vertical contract is $\tilde{m}_{cd}^V = \mu_{cd}^{xV} \tau_a \tau cd$ where $\mu_{cd}^{xV} \in \{1/\rho, \beta/\eta + (1-\beta), \beta_J/\rho + (1-\beta_J)\}$ for $V \in \{M, B, J\}$ respectively. The ranking of the import prices (and hence also the average FOB import price) is $\tilde{m}_{cd}^M > \tilde{m}_{cd}^J > \tilde{m}_{cd}^B$ where the second inequality is implied by .

Importer Cutoff of Exporters

The ratio of importer cutoffs under joint contracts and bilateral contracts for exporter c is

$$\left(d_{\max}^J(c)/d_{\max}^B(c)\right)^{k_d - \frac{\rho}{1-\rho}\frac{1-\eta}{\eta}\left(k_d + \frac{\eta}{\eta-1}\right)} = (\rho/\eta)^{1/(1-\rho)} < 1.$$

The ratio of importer cutoffs under bilateral contracts and anonymous markets for exporter c is

$$\left(d_{\max}^B(c)/d_{\max}^M(c)\right)^{k_d - \frac{\rho}{1-\rho}\frac{1-\eta}{\eta}\left(k_d + \frac{\eta}{\eta-1}\right)} = \rho^{-1/(1-\rho)} > 1.$$

Quantities of Imported Varieties

The optimal import quantity of a variety under vertical contract V is $x_{cd}^V = \tau d q_{cd}^V$ and the total quantity supplied by c is $x_c^V = \int_0^{d_{\max}^V(c)} \tau d q_{cd}^V dG_d = c^{-1}\frac{\eta}{1-\eta}\frac{k_d}{k_d + \eta/(\eta-1)} f_d \left(d_{\max}^V(c)/d_{\max}\right)^{k_d}$. Since $d_{\max}^M(c) < d_{\max}^B(c)$ and $d_{\max}^B(c) > d_{\max}^J(c)$, the total quantity for exporters follows the same ranking as their importer cost cutoffs.

Import Revenues of Exporters

The total revenue of exporter c under a contract V is the sum of its price times quantity across all importers, $r_c^V = \int_{d_{\min}^V(c)}^{d_{\max}^V(c)} m_{cd}^V x_{cd}^V dG_d$. The ratios of revenues earned by exporter c under bilateral contracts relative to the market and under joint contracts relative to bilateral contracts are as follows:

$$r_c^B/r_c^M = \underbrace{\frac{\beta(1-\eta)/\eta + 1}{1/\rho}}_{\geq 1} \underbrace{\left(\frac{d^B(c)}{d^M(c)}\right)^k}_{\geq 1} = \frac{\beta(1-\eta)/\eta + 1}{1/\rho} \rho^{-\frac{k_d/(1-\rho)}{k_d\left(1-\frac{1-\eta}{\eta}\frac{\rho}{1-\rho}\right) + \rho/(1-\rho)}} \geq 1$$

$$r_c^J/r_c^B = \underbrace{\frac{\beta^J(1-\rho)/\rho + 1}{\beta(1-\eta)/\eta + 1}}_{\geq 1} \underbrace{\left(\frac{d^J(c)}{d^B(c)}\right)^k}_{\leq 1} = \frac{\beta^J(1-\rho)/\rho + 1}{\beta(1-\eta)/\eta + 1} (\rho/\eta)^{\frac{k_d/(1-\rho)}{k_d\left(1-\frac{1-\eta}{\eta}\frac{\rho}{1-\rho}\right) + \rho/(1-\rho)}}$$

The inequality for the first ratio follows directly from the parameter values. Revenues under bilateral contracts are higher because of higher sales to more importers. The second ratio is ambiguous as

the first term is the markup ratio which is greater than one and the second term is the cutoff ratio which is less than one. The RHS of the second ratio however is constrained by the assumption of the viability of joint contracts. We show that even taking the underlying assumptions for viability into account, the revenue ratio can range from less than one to greater than one, so that an extreme result of the model is that exporters who switch from bilateral to joint contracts lower their sales values. This can be most clearly illustrated for the case of $k_d + \eta/(\eta - 1)$ close to zero which corresponds to the model of Section 2.

Then the revenue ratio is $r_c^J/r_c^B = \frac{\beta_J(1/\rho - 1) + 1}{\beta(1/\eta - 1) + 1} \left(\frac{\rho}{\eta}\right)^{1/(1-\rho)}$ and the viability condition for joint contracts is

$$\frac{\beta_J}{\beta} \frac{1/\rho - 1}{1/\eta - 1} \leq \left(\frac{\eta}{\rho}\right)^{1/(1-\rho)} \left[\left(\frac{f_{jx} - f_{bx}}{f_{bx} - f_x}\right)\left(1 - (1-\rho)\rho^{\rho/(1-\rho)}/\beta(1/\eta - 1)\right) + 1\right].$$

This condition implies

$$r_c^J/r_c^B \leq 1 + \frac{\left(\beta(1/\eta - 1) - (1-\rho)\rho^{\rho/(1-\rho)}\right)(f_{jx} - f_{bx})/(f_{bx} - f_x) + (\rho/\eta)^{1/(1-\rho)} - 1}{\beta(1/\eta - 1) + 1}$$

The second term on the RHS is increasing in $\beta(1/\eta - 1)$ and the upper bound for the second term is given by the viability condition for bilateral contracts versus markets, $\beta(1/\eta - 1) \leq f_{bx}(1 - \rho)\rho^{\rho/(1-\rho)}/f_x$. Substituting for this upper bound, the model constrains the revenue ratio to be

$$r_c^J/r_c^B \leq 1 + \frac{(1-\rho)\rho^{\rho/(1-\rho)}(f_{jx} - f_{bx})/f_x + (\rho/\eta)^{1/(1-\rho)} - 1}{f_{bx}(1 - \rho)\rho^{\rho/(1-\rho)}/f_x + 1}$$

which is less than one for small differences in the fixed costs of joint versus bilateral costs and greater than one otherwise.

C Alternative Nesting and Substitutability

The baseline model of Section 2 considers a nesting structure where consumers first choose the make of the product and then decide where to buy it. For example, a consumer purchasing a small car first decides on buying a Toyota and then decides which car dealer to go to. Toyotas are less substitutable for Hondas, and car dealers in the area are more substitutable for each other. This Section discusses how the impact of trade liberalization on consumer welfare works under alternative nesting and substitutability assumptions.

An alternative nesting structure would be where consumers first choose the distributor and they perceive products of different exporters to be more substitutable for each other. For example, consumers first walk into a Best Buy store rather than a Walmart store, and then decide on the computer that they want to buy. They find Acer and Asus to be more substitutable than buying from a Best Buy or a Walmart store, perhaps due to differences in after-sales services. In this case, the results of the baseline model of Section 2 hold as long as the contracting costs of exporters are binding.

Consumers choose the distributor they buy from and then decide on the manufacturers' products that the distributor stocks. The demand for variety c of distributor d is

$$q_{cd} = p_{cd}^{1/(\eta-1)} p_d^{(\eta-\rho)/(\eta-1)(\rho-1)} P^{(\rho-\theta)/(\rho-1)(\theta-1)}$$

for $p_d^{\eta/(\eta-1)} \equiv \int p_{cd}^{\eta/(\eta-1)} dG_c$ and $P^{\rho/(\rho-1)} \equiv \int p_d^{\rho/(\rho-1)} dG_d$. The exporter now charges $m_c = c/\eta$ under anonymous markets and the final price is $p_{cd}^M = \tau_a \tau cd/\rho\eta$ (even though the markups charged by the exporters and importers are different from Section 2). Moving to bilateral contracts wipes out double marginalization and the markups charged by importers fall because the bilateral contracts do not account for the aggregate price index of the importer. The final price is $p_{cd}^B = \tau_a \tau cd/\eta$ under bilateral contracts and $p_{cd}^J = \tau_a \tau cd/\rho$ under joint contracts. Assuming a Pareto distribution for exporter costs and relationship-specific costs $f_{cx} > 0$, the optimal manufacturer cost cutoff $c_{\max}(d)$ for distributor d and the profits can be derived in a manner similar to Section B. As long as the exporter's costs of joint contracts are binding, the reasoning for more joint contracts after trade liberalization is as before.