Importers, Exporters and the Division of the Gains from Trade*

Andrew B. Bernard†
Tuck School of Business at Dartmouth, CEP, CEPR & NBER

Swati Dhingra‡
LSE, CEP & CEPR

This Version: April, 2019

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 arrangements to ensure bilateral profit maximization that eliminates double marginalization and joint profit maximization that also internalizes business stealing. The introduction of endogenous microstructure of import markets in a trade model means that trade liberalization can increase the incentive to engage in joint profit maximization, thus raising the profits of exporters and importers at the expense of consumer welfare. Following the US-Colombia free trade agreement, US exporters that received tariff reductions were more likely to increase their average price, decrease their quantity exported and reduce the number of import partners. As predicted by the theory, this import market consolidation occurs for medium-sized US exporters, who increase their average tariff-inclusive price by as much as 6 per cent, leading to a shift in surplus from the liberalizing country to the exporting country.

Keywords: Heterogeneous firms, exporters, importers, pass through, microstructure, consumer welfare.
JEL codes: F10, F12, F14.

*We are grateful to Esther Ann Boler, John Morrow, Emanuel Ornelas, Gianmarco Ottaviano, Chris Snyder, Catherine Thomas, Dan Trefler, Tony Venables, Alwyn Young and seminar participants at Aarhus, Berkeley-Stanford, Bologna, ERWIT, FGV Sao Paulo, IIFT, KU Milan, Munich, Oslo, Oxford, LSE, NBER Winter Meetings, Paris, Princeton Summer Workshop, PSU, PUC, Salento, SED, Sussex, Toronto, Tuck (Dartmouth), World Bank and UEA for helpful comments. We thank Giovanni Maggi and Dan Trefler for detailed discussions and Josh De Lyon, Angela Gu and Yan Liang for excellent research assistance. A previous version of this paper circulated under the title "Contracting and the Divisions of the Gains from Trade".

†100 Tuck Hall, Hanover, NH 03755, USA, *tel:* +1 603 646 0302, *email:* andrew.b.bernard (at) 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 product variety, lower prices and the reallocation of resources from less to more efficient producers. Domestic consumers gain from easier access to imports, but they rarely have direct access to foreign products. Trade is typically between firms who exercise market power in buying and selling foreign products. This paper examines how the behavior of importers and their relationships with exporters affect the division of the gains from trade. Trading partners make endogenous choices among different vertical relations, which give them different degrees of market power in importing. Trade liberalization affects the incentives for different vertical relations. This leads to a change in the microstructure of import markets, which provides a qualitatively new channel for the division of the gains from trade. Foreign exporters and domestic importers potentially gain market power and can benefit at the expense of domestic consumers.

In line with the concerns of the European Commission and the Federal Trade Commission, market integration can induce firms to replace trade barriers with microstructures 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), 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 consolidation of import markets when exporters and importers internalize the business stealing that occurs among importers of an exporter.

Exporters and importers operate in thin markets, that do not reflect anonymous transactions. Anonymous transactions lead to two inefficiencies in profit maximization. First, when exporters and importers engage through anonymous market-clearing prices, market power of importers and exporters leads to double marginalization and lower profits. Exporters can overcome this inefficiency by moving away from unit prices and engaging in bilateral relations that specify total payments and quantities. Second, importers in an anonymous market are unable to internalize the business stealing effect of their sales on competing importers that sell varieties of the same foreign product. Total sales of its product in the foreign market are too high from the perspective of the exporter. The exporter can mitigate this externality by investing in joint profit maximization along with its competing importers. This leads to higher profits by restricting sales and driving up prices charged to consumers.

[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. (2016) 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.

We embed the microstructure of richer vertical relations into a standard trade model. The microstructure channel reinforces the gains from trade when firms enter into bilateral relations that mitigate double marginalization. However, as firms start to invest in internalizing business stealing, trade liberalization increases their market power and affects the division of the gains from trade.

Market expansion increases the returns to joint profit maximization, relative to bilateral relations. This is because market expansion enables firms to better amortize the higher fixed costs associated with joint profit maximization and because import competition does less damage to firms with greater market power. As firms switch to joint profit maximization, they internalize the business stealing effect of their sales. They raise consumer prices and get more of the surplus from consumers. Exporters gain from mitigation of the business stealing externality among their importers and this shifts surplus from the importing country to the exporting country. We show that the microstructure effect is a new channel for the welfare changes from trade that goes beyond the standard gains from variety expansion and pro-competitive effects, and that can increase foreign and domestic profits at the expense of consumer welfare in the liberalizing country.

To test for the microstructure effect, we build on the insight that many distinct firm strategies to ensure bilateral and joint profit maximization would yield the same observable implications for prices, quantities and exporter-importer matches. We examine a unique prediction of the model. If endogenous microstructure matters, trade liberalization will induce exporters to consolidate their import market. They will benefit from higher prices by scaling back on the quantity they sell and reducing 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. In keeping with the theory, we find that US exporters whose products started to enjoy tariff cuts through the FTA were more likely to simultaneously increase their import price, lower their quantity and reduce the number of their importer partners in Colombia. This confirms a version of the Metzler paradox where domestic prices rise in response to tariff reductions, even after adjusting for quality.

As expected from theory with heterogeneous firms, the import market consolidation occurs among US exporters in the middle of the size distribution as these are the firms that are likely to switch from bilateral to joint profit maximization. These exporters simultaneously raise their tariff-inclusive price, lower the total quantities they sell in the Colombian market and cut back on the number of importers that they sell to. Firms in the top and bottom of the size distribution do not show this pattern, and are more likely to engage in the standard response of raising their exports after the FTA. We show that the quality-adjusted price rises by 5.6 per cent more among the middle exporters, relative to other exporters from the US and developed countries.

The main theoretical contribution of the paper is to provide a model that embeds two-sided market power in a general equilibrium setting. We build on the vertical relations literature in

industrial organization to model the relationship between exporters and importers (Hart and Tirole 1990). While a large literature examines these relationships, its focus is on firm behavior, typically in a stylized setting of two buyers and sellers. We embed such firm behavior in a general equilibrium setting with multiple firms, which is important for understanding the gains from trade because they are also affected by labor market clearing and firm entry and exit. This is also useful in taking the theoretical predictions to trade data that is usually available through firm-level customs transactions.

Our focus on vertical relations is related to work in international trade on intermediation (Akerman 2018; Bernard et al. 2010; Blum et al. 2010; Ahn et al. 2011; Atkin and Donaldson 2012), retailing (Eckel 2009; Raff and Schmitt 2012; Blanchard et al. 2013) and vertical integration (Feenstra et al. 2003; Antràs and Helpman 2004; Conconi et al. 2012). As is well-known, two-sided market power in general equilibrium gives intractable models so many of these papers focus on firm characteristics and abstract from the market power of importers. Raff and Schmitt (2005, 2009) examine importer market power in a theoretical 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. We obtain tractability by using the tools developed in the literature on variable markups under monopolistic competition (Parenti et al. 2017; Neary and Mrazova 2017; Dhingra and Morrow forthcoming; Mayer et al. 2014). This enables us to generalize the results for firm behavior to a wide class of demand functions, which is important in revealing new gains from trade that do not arise under the knife-edge cases of standard demand systems.

The focus on profit shifting and consumption gains is 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, e.g. 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.[2] In early theoretical work, Venables (1985) shows unilateral reductions in trade barriers can increase consumer prices in the liberalizing country when entry and

[2]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. (2016) 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 at home 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. Yeats (1978) finds iron and steel prices are higher in more concentrated import markets.

exit induce profit shifting across countries. Our theoretical model also yields price increases in the liberalizing country, but these arise from exporter-importer market power rather than horizontal strategic interaction.

The pricing predictions provide systematic evidence for the Metzler paradox (Venables 1985; Bagwell and Staiger 2012; Bagwell and Lee 2015). A reduction in tariffs induces more consolidation in the import market of medium-sized US exporters in Colombia. Previous work has suggested that trade policy is a substitute for competition policy. Small open economies can increase competition in the domestic market by integrating with world markets and benefiting from import competition. Our results show that when exporters and importers operate in thin markets, trade policy and competition policy are complements. Trade liberalization would be most beneficial when competition policy is used in conjunction with trade policy to encourage firms to pass on the cost savings to consumers. In our setting, competition policy could reduce import prices by about 6 percent by disciplining exporters who consolidate their import market after trade liberalization. These exporters set prices outside of anonymous markets, so their actions result in shifting profits to the foreign country. This is consistent with the theory of Antràs and Staiger (2012), which examines differences in trade policy impacts based on the nature of price determination between firms.

We introduce vertical relations to see how market power in 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 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. Our paper is also closely related to the recent set of papers using matched exporter-importer data. Blum et al. (2010, 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. (2018) and Bernard et al. (2018a) use matched data to study the role of buyers in firm-level trade flows. We abstract from these mechanisms and focus on the microstructure of import markets to understand the resulting effects on prices, quantities and the division of the gains from trade. A growing literature also shows how imported inputs increase the productivity of importers, see Amiti and Konings (2007), Halpern et al. (2015) and Boler et al. (2015).

The rest of the paper is organized as follows: Section 2 introduces a model of the microstructure of import markets. 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 Model of Exporters and Importers

This section describes the economy which consists of consumers, exporters and importers. We work with a standard trade model akin to Krugman (1979), and introduce importers with market power. As is well-known, two-sided market power in an industry equilibrium often leads to intractable models. This is why several papers in intermediation abstract from market power at least on one side of the market. As our focus is on the division of the gains from trade, we model market power of exporters and importers in an industry equilibrium. For ease of exposition, we start with homogeneous firms in this section. The next section examines the testable variety-level predictions of the theory under firm heterogeneity.

In a standard setting, exporters sell to importers in anonymous markets which means they set a unit price at which any importer can buy from them. We first model the firm problem in an anonymous market with unit prices, and show that market power results in double marginalization and business stealing among importers of a product. When exporters are not constrained to set unit prices, exporters and importers choose payments and quantities that maximize their joint profits by overcoming the externalities induced by an anonymous market. We specify the simplest setting that departs from anonymous markets to provide a richer microstructure for the import market.

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 are 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. Market expansion increases the mass of workers L that firms can sell to. We specify the demand and supply of products in the next sub-sections, and then discuss firm decisions under anonymous markets.

2.1 Demand

Each worker has identical preferences over varieties of a differentiated good. Preferences for differentiated goods take the form of nested variable elasticity of substitution (VES) utility.

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:

$$U \equiv \int u(q_i)di, \qquad q_i = \int v(q_{ij})dj, \qquad u', v' > 0,\ u'', v'' < 0$$

where q_{ij} denotes consumption of variety ij and q_i is the composite bundle of j varieties of i. The sub-utility functions u and v are thrice continuously differentiable, strictly increasing, strictly concave on $(0, \infty)$, normalized to zero at zero quantities and satisfy Inada conditions. Concavity ensures that consumers purchase all available varieties and the inverse demand for variety ij is

$$p_{ij} = u'(q_i)v'(q_{ij})/\delta \tag{1}$$

where δ is the consumer's budget multiplier. For a worker with income I, the budget multiplier is

$$\delta = \int \int u'(q_i)v'(q_{ij})q_{ij}djdi/I.$$

A well-defined equilibrium will require conditions on the demand elasticities across the two nests of preferences. Following Dhingra and Morrow (forthcoming), the elasticity of utility is $\varepsilon_x(q) \equiv x'(q)q/x(q)$ for $x \in \{u, v\}$ and the elasticity of marginal utility is $\mu_x \equiv -x''(q)q/x'(q)$. These elasticities are bounded below by $b > 0$ and above by $1 - b < 1$, and are increasing in q. In particular, $\mu'(q) > 0$ ensures pro-competitive effects from market expansion in a standard Krugman (1979) economy, and this assumption is maintained in our setting. To fix ideas, CES demand is $x(q) = q^\rho$ which implies $\varepsilon_x(q) = \rho$ and $\mu_x(q) = 1 - \rho$ are between 0 and 1, and correspond to the special case with $\varepsilon'_x(q), \mu'_x(q) = 0$. Therefore, CES demand is nested in our framework, but we explore alternatives to CES to show the impact of trade liberalization on the market microstructure (which does not arise under constant elasticities).

2.2 Technology

There are M_c identical producers at home. Each producer supplies a unique differentiated product with a unit cost c. Producers are monopolistically competitive and pay fixed operation costs f_c. Producers cannot directly access final consumers. They must engage distributors to deliver their products to consumers.

There are M_d identical distributors at home. Producers at home and abroad must sell through these distributors to the consumers. Distributors are monopolistically competitive and transform the producer's product into a differentiated variety for final consumption. A distributor with unit cost d transforms producer c's product from $x(c)$ units of production into $y(c, d) = x(c)/d$ units of the final differentiated variety. If $p^x(c)$ is the unit price of variety c charged by the producer, then the unit cost of a distributor is $p^x(c)d$. Under this formulation, distributors perform the function of lowering the costs of delivery to consumers.

Before proceeding to the equilibrium, we need to specify where the producers and distributors fit into the nesting structure of demand. To capture rich substitutability patterns, we specify the upper nest quantity as $q_i = \theta q_c + (1 - \theta)q_d$ for $\theta \in \{0, 1\}$. When $\theta = 0$, $q_i = q_d$ and distributors are in the upper nest. We will show that trade liberalization in this case reinforces the standard gains to consumers, although for a new reason (firms switching to vertical relations that benefit consumers and firms). For $\theta = 1$, $q_i = q_c$ and producers are in the upper nest. We will show that $\theta = 1$ yields further results for firms choosing richer vertical relations, which can increase profits at the expense of consumer welfare after trade liberalization. This arises because the lower nest distributors do not internalize the impact of their sales on other distributors and there is a role for joint profit maximization which overturns the usual gains from trade to consumers. As we will

initially focus on a free trade equilibrium, all firms will engage in international trade and we will use the term exporters to denote c firms and importers to denote d firms.

2.3 Anonymous Market Equilibrium

A natural way of introducing importers into a standard trade model is through anonymous markets. An exporter chooses the market price for her product and then takes her product to an import market. The importers choose how much to buy. They further differentiate the product and supply final varieties to consumers. Then cd indexes a final variety exported by c and imported by d. We start with this benchmark case of anonymous markets to illustrate the inefficiencies that lead to richer relations between exporters and importers. To formalize the setting, the timing is as follows.

- Firms pay their fixed costs of operation (f_c,f_d).
- c chooses her market price $p^x(c)$.
- d buys x_{cd} units at price $p^x(c)$.
- Quantities q_{cd} are supplied to final consumers.

Markets are segmented and we solve for an equilibrium by first determining the final quantities sold to consumers. Then we derive the demand for the producer's product and determine the optimal price chosen by the producer. We abstract from variety-specific search costs f_{cd} until the Section with heterogeneous firms where they lead to selection effects.

2.3.1 Prices in Anonymous Markets

Importer d faces the inverse demand function $p_{cd} = v'(q_{cd})u'\left(\theta q_c + (1-\theta)q_d\right)/\delta$. He cannot influence the aggregate market conditions δ or the producer's total sales in the home country q_c. At unit price p_c^x for c's product, the importer chooses final quantities q_{cd} and his total quantity q_d to maximize profits. His variable profit is $\pi_d \equiv M_c\left(p_{cd}\left(q_{cd}, q_d, \hat{q}_c, \hat{\delta}\right) - p_c^x d\right) q_{cd} L$ where the hat denotes that the distributor takes these components of the inverse demand as given. Summing the demand of all importers in the home country $x_c \equiv M_d x_{cd} L = M_d d q_{cd}\left(p_c^x\right) L$, exporter c chooses p_c^x to maximize variable profits $\pi_c = M_d\left(p_c^x - c\right) d q_{cd}\left(p_c^x\right) L$.

To ensure a well-defined firm problem, we assume that marginal revenues are decreasing and that $\mu_v' q < (1-\mu_v)(1-\mu_v-\mu_u\varepsilon_v)$. We will also assume that $\mu_u\varepsilon_v \leq \min\mu_v \cdot \min(1-\mu_v)$ which ensures that the direct impact of own quantity on price is greater than the indirect impact of other varieties through the upper nest quantities. This condition is equivalent to the substitutability restriction of a nested CES demand system and later we will show that it ensures prices are higher under anonymous markets compared to bilateral and joint profit maximization among firms.

Under these conditions, d's optimal price sets the marginal cost of a variety equal to the marginal revenue from that variety and from other varieties sold by d. The optimal price chosen by d is $p_{cd} = p_c^x d/\left(1-\mu_v(q_{cd})-(1-\theta)\mu_u(q_i)\varepsilon_v(q_{cd})q_d/q_i\right)$. Using subscripts for brevity, the exporter's optimal price is $p_c^x = c/\left(1-\gamma_c\right)$ where $\gamma_c \equiv \mu_v + \mu_v' q_{cd}/\left(1-\mu_v-(1-\theta)\mu_u\varepsilon_v q_d/q_i\right)$.

Putting the two optimal price functions together, the final price of any variety under anonymous markets is

$$p_{cd} = cd/\left[\underbrace{(1-\gamma_c)}_{\text{Double Marginalization}} \cdot \left(1-\mu_v - \underbrace{(1-\theta)\,(q_d/q_i)}_{\text{Business Stealing}}\ \mu_u\varepsilon_v\right)\right]. \tag{2}$$

The first term in square brackets in Equation 2 is the markup charged by the exporter to the importer which reflects the classic double marginalization problem in anonymous markets. Exporters take into account the derived demand for their product and charge $p_c^x = c/\left(1-\gamma_c\right) > c$. Importers further mark up the price (with the term in parenthesis) and consumers end up with having to pay double markups. This double marginalization leads to lower bilateral profits for c and d due to reduced sales. If producers and distributors can engage outside of anonymous relations, then they need not set market-clearing unit prices. They can specify payments and quantities that get rid of double marginalization and increase the bilateral profits from their relationship. We will consider these bilateral relations in the next sub-section and show that trade liberalization has the usual effect of increasing sales and reducing prices when exporters and importers transact to maximize bilateral profits.

The term in parenthesis shows the markup charged by the importer. Importers account for the cannibalization of their own varieties on each other. This cannibalization translates into higher final markups through $(1-\theta)\,(q_d/q_i)\,\mu_u\varepsilon_v$. However, they do not account for the business stealing impact of their sales on competing distributors of an exporter's product. There is no $\theta\,(q_c/q_i)\,\mu_u\varepsilon_v$ in the optimal markup, and competition among distributors in the final goods market implies that the total profit from an exporter's product is not maximized. We will therefore consider joint profit maximization which maximizes the total profits of an exporter and her importers. While an importer can internalize cannibalization of his own varieties by virtue of being second in the chain of sales, exporters and importers are unable to overcome the business stealing externality through anonymous markets.

Anonymous markets therefore provide two reasons for firms to pay the costs to switch to richer microstructures. Unit pricing in anonymous markets leads to double marginalization which lowers the bilateral profit of an exporter and an importer. Bilateral profit maximization specifies payments and quantities and overcomes the double marginalization problem, which results in lower consumer prices. Importers internalize the cannibalization of their own sales, but not those of the exporter's sales to other importers. When exporters are in the upper nest ($\theta = 1$), there is an incentive for

an exporter and her importers to enter into joint profit maximization to get rid of business stealing among importers. Consumer prices are higher compared to bilateral profit maximization because competition among importers falls. We show these results for pricing in the next sub-section, and later move to the imapct of opening to trade on pricing behaviour.

2.4 Microstructure of Import Markets

Exporters and importers often have long-standing and complex relationships. It is therefore likely that they choose actions to overcome the inefficiencies from anonymous markets. Following the seminal work of Hart and Tirole (1990), we consider two distinct relationships that overcome these inefficiencies. The first type overcomes double marginalization by specifying quantities and payments that maximize bilateral profits of the exporter-importer pair. The second type overcomes double marginalization and business stealing by committing to all quantities and payments that maximize the joint profit of an exporter and her importers.

The main advantage of the Hart-Tirole approach is that we do not need to specify the methods through which firms maximize bilateral profits or joint profits, and instead can focus on the observable outcomes of quantities and payments that result from implementing bilateral and joint profit maximization. For instance, an exporter can maximize bilateral profits by setting a two-part tariff that charges the importer a price equal to her marginal cost ($p^x(c) = c$), and a fixed fee that recoups part or all of the bilateral profits without changing sales incentives. 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, the resulting quantity allocation is the same as the two-part tariff case and bilateral profits of the exporter-importer pair are maximized.

The industrial organization literature provides different methods through which firms avoid double marginalization and business stealing, such as fixed fees, quantity discounts and resale price maintenance.[3] These are rarely observable, and these methods can often take the form of informal practices or implicit arrangements that are sustained through repeated interaction. Following Hart and Tirole (1990), we therefore abstract from the methods used to implement bilateral or joint profit maximization, and focus instead on the implications for observable outcomes, such as quantity allocations and payments, 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 relations* with an importer. They specify a final quantity and a payment to be made to the exporter (q_{cd} and

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

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. Bilateral relations overcome double marginalization and result in higher quantities and lower prices for the final consumers.

However, bilateral relations 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 buyers and sell more to earn higher profits. Even though the exporter could offer to restrict its quantities, opportunism on the part of exporters prevents importers from entering into such arrangements because they know the exporter would find it more profitable to deviate from this restriction. The exporter's opportunism prevents maximization of joint profits.

To overcome business stealing, the exporter must commit to restricting the total sales of her product to induce higher consumer prices by forming *joint relations* with her importers. Under joint relations, firms maximize joint profits by specifying all bilateral quantities and payments. Importantly, they entail multilateral decisions on the total quantity of the exporter q_c and therefore overcome cannibalization across importers. Joint profit maximization 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 internalize business stealing to maximize joint profits, and consumers would end up with lower quantities and higher prices than under bilateral profit maximization. The exporter could also implement joint profit maximization through other methods that do not involve ownership. For instance, importers would internalize business stealing if the exporter assigns them exclusive territories. The outcomes of the joint profit maximization 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 methods through which joint profit maximization is implemented, and focus instead on observable outcomes such as prices and quantities.[4]

To formally model the different microstructures resulting from these relationships, we specify the timing as follows:

- Exporters and importers pay their sunk costs of operation (f_c, f_d)
- Exporters and importers meet each other.
- Exporters and importers decide whether to engage in bilateral or joint profit maximization

[4]Martin et al. (2001) and Mollers et al. (2017) use experimental data to show vertical restraints of various forms (that do not entail vertical integration of firms) are sufficient to maximize joint profits.

and pay the fixed costs associated with each.[5]

- Importers order quantities x_{cd} from the exporters and pay T_{cd}.
- Quantities q_{cd} are supplied to final consumers.

Exporters and importers need to pay fixed costs to invest in richer vertical relations. Both will decide whether it is worthwhile to engage in them, but only one of their conditions will typically be binding. We derive results in this section for both situations and show that similar results hold. For simplicity, we will later set the fixed costs incurred by importers to zero because this does not change the qualitative results from the model.

2.5 Bilateral Private Relations

To overcome double marginalization, an exporter can make fixed investments in bilateral relations that depart from unit pricing. After paying the fixed costs, an exporter engages in private decisions with each importer bilaterally. Importers hold passive beliefs which means that they expect the offers made to other importers to be fixed at their equilibrium values. We first discuss the surplus division, and then proceed to determining optimal prices and entry into bilateral relations.

2.5.1 Importer Payments

Under bilateral relations, the importer chooses quantities q_{cd} to maximize his profit:

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

where T_{cd} is the payment to exporter c for supplying $x_{cd} = dq_{cd}$ units of her product sent to d. The importer holds passive beliefs so he takes $(\hat{T}_{cd'}, \hat{q}_{cd'})$ for any other importer $d' \neq d$ as given. For flexibility, we follow Horn and Wolinsky (1988) and assume that the payments are set through bilateral Nash bargaining, with β denoting the bargaining weight of the exporter and with zero disagreement payoffs. The optimal payment is the solution to $\max_{T_{cd}} \left[\Big(p(q_{cd}, q_d, \hat{q}_c, \hat{\delta}) - cd\Big)\, q_{cd} - T_{cd}\right]^{1-\beta} T_{cd}^{\beta}$. As d takes offers made to other importers as given, the optimal payment to c from d is $\hat{T}_{cd} = \Big[\beta p(q_{cd}, q_d, \hat{q}_c, \hat{\delta}) + (1-\beta)cd\Big]\, q_{cd}$ which ensures the division of gross surplus is proportional to the bargaining weights.[6]

[5] No new information is revealed after the investments are made. If the investments of each party are sunk, then the opportunism problem remains and the qualitative results in the subsequent Sections are unaltered, but following the literature on boundaries of the firm, the division of surplus is over revenues, rather than profits net of fixed costs.

[6] 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 an alternative version of the model, we show that our results hold when the exporters and importers can replicate the other party's role in the relationship to some degree. This follows from the drop in delivered costs of exports after a trade liberalization which raise the ex-post bargaining share for exporters. We also find that the main predictions persist when disagreement payoffs are non-zero because the ex-post share of exporters under joint relations rises after trade liberalization.

Substituting for the optimal payments, d chooses to sell quantities that maximize

$$\max_{q_{cd},q_d} (1-\beta) \int_{c_{\min}(d)}^{c_{\max}(d)} \left[p(q_{cd}, q_d, \hat{q}_c, \hat{\delta}) - cd \right] q_{cd} dG_c.$$

The profit function shows that an importer ignores how his quantity affects the profit of other importers of exporter c's product (through q_c) but internalizes the cannibalization effect of his own quantities on each other (through q_d). The optimal final price of variety cd under bilateral profit maximization is

$$p_{cd}^B = cd / \left(1 - \mu_v - \underbrace{(1-\theta)(q_d/q_i)}_{\text{Business Stealing}} \mu_u \varepsilon_v \right). \tag{3}$$

This gets rid of the double marginalization problem because exporters do not charge unit prices that exceed their unit costs. In fact, optimal final quantities correspond to a two-part tariff where the exporters do not mark up their costs ($p_c^x = c$) and extract part of the surplus through payments T_{cd} from importers. However, the business stealing externality is not overcome, as shown in Equation 3 where the upper nest elasticity is internalized by a fraction $(1-\theta)q_d/q_i$. We summarize this result in Proposition 1, and the next sub-section discusses joint profit maximization that overcomes business stealing.

Proposition 1. *Bilateral profit maximization ensures lower prices than anonymous relations because it eliminates double marginalization.*

2.6 Joint Relations

By partnering with her importers, an exporter can ensure that profits from her product are maximized by internalizing the business stealing effect imposed by importers on each other. Joint profit maximization provides higher prices, but involves larger fixed investments in building a relationship with all importers. This is because exporters need to demonstrate that they are committed to restricting quantities to their importers. We start with a discussion of the surplus division within the joint relationship and then determine the optimal prices and the choice of vertical relations.

2.6.1 Importer Payments

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. The importer observes the exporter's quantity, and chooses q_{cd} to maximize $\pi_d^J = \int_{c_{\min}(d)}^{c_{\max}(d)} \left[\left(p(q_{cd}, q_d, q_c, \hat{\delta}) - cd \right) q_{cd} - T_{cd} \right] dG_c$. The split of profits and hence the payments T_{cd} are again determined by Nash bargaining where the exporter's bargaining weight is β and the disagreement payoffs are again zero. The optimal payment is once more $\hat{T}_{cd} = \left[\beta p_{cd}(q_{cd}, q_d, q_c, \hat{\delta}) + (1-\beta) cd \right] q_{cd}$.

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

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

Joint profit maximization enables importers to internalize the business stealing effect which implies the optimal price is

$$p_{cd}^J = cd/\left(1 - \mu_v - (1-\theta)\left(q_d/q_i\right)\mu_u\varepsilon_v - \theta\left(q_c/q_i\right)\mu_u\varepsilon_v\right). \tag{4}$$

Prices are set at the profit-maximizing "monopoly" levels. The exporter ensures prices are higher than under bilateral relations because importer competition is reduced. However, under the earlier condition on elasticities $\mu_u\varepsilon_v < \min\mu_v \cdot \min\left(1-\mu_v\right)$, prices are lower than under anonymous markets 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 relations where importers compete with each other. We summarize this result in Proposition 2.

Proposition 2. *Joint profit maximization eliminates double marginalization and business stealing in the final goods market, leading to* $p^M > p^J > p^B$.

2.7 Equilibrium

Having determined the optimal prices, the next sub-section specifies the closed economy equilibrium. As we are interested in the division of the gains from trade, the mass of firms is fixed so that they earn positive profits (later we discuss results with free entry of firms). Assuming a symmetric equilibrium, $p_{cd} = p$ and $q_{cd} = q$. Let $m_{cd} \equiv \mu_v + (1-\theta)\left(q_d/q_i\right)\mu_u\varepsilon_v + 1_J\theta\left(q_c/q_i\right)\mu_u\varepsilon_v$ denote the markup charged in the final goods market, where 1_J is 1 under joint profit maximization and 0 otherwise. From optimal pricing, $p = cd/\left(1-m\right)\left(1-1_A\gamma\right)$ where 1_A is 1 under anonymous relations and 0 otherwise.

Under anonymous relations, exporters earn profits of $\gamma^A q^A cdL/\left(1-\gamma^A\right)$ and importers earn $m^A q^A cdL/\left(1-m^A\right)\left(1-\gamma^A\right)$ where the superscript denotes optimal allocations under anonymous relations. Under bilateral and joint profit maximization, exporters earn $\beta m^V q^V cdL/\left(1-m^V\right)$ and importers earn $(1-\beta)\, m^V q^V cdL/\left(1-m^V\right)$ for $V \in \{B, J\}$. They choose the vertical relations that gives the highest profit net of relationship costs f_c^V and f_d^V. Combined with the inverse demand $p = u'v'/\delta$ and the budget constraint $M_c M_d pq = 1$, the optimal pricing and optimal vertical relations conditions determine the closed economy market equilibrium. In the next sub-section, we examine how these conditions change with market size to discuss the gains from trade in this setting.

2.8 Opening to International Trade

When the economy opens up to free trade, all producers and distributors engage in international trade. We show that looking at the microstructure of import markets reveals new sources of gains from trade, beyond the usual gains from variety and pro-competitive effects.

Opening to free trade increases the mass of consumers available to producers from L to sL where s is the scaling factor for the increase in consumers from trade. The equilibrium conditions for optimal pricing and inverse demand are unchanged. The budget constraint now accounts for the fact that consumers have access to $sM_c > M_c$ producers and their budget constraint is $sM_cM_dpq = 1$. Profits also account for the increase in market size and this changes the optimal vertical relations conditions by a factor of s in variable profits.[7] As long as profits are supermodular in markups and market size, international trade makes joint relations more likely than bilateral or anonymous relations, and makes bilateral relations more likely than anonymous relations. We specify the supermodularity condition in Assumption 1 below and provide conditions on primitives in the Appendix.

Assumption 1. Profits $\pi_c(m, s)$ are supermodular in markups m and market size s.

Assumption 1 states that the rate of change in markups is such that profits are supermodular in markups and market size. Then profits rise relatively more for higher markup firms as market size changes, as is standard in most trade models with variable markups. Assumption 1 ensures that markups do not change in ways that firms with lower profits see disproportionately smaller losses from market expansion. In principle, this could arise unless we put further structure on the concavity or convexity of markups μ. Building on the tools of recent work (example, Costinot 2009; Mrazova and Neary forthcoming), we find that supermodularity provides a sharp characterization of the change in vertical relations from opening to trade, summarized in Proposition 3.

Proposition 3. *Under Assumption 1, an increase in market size makes:*

1. *Joint relations more likely than bilateral or anonymous relations.*
2. *Bilateral relations more likely than anonymous relations.*

Proof. See Appendix. □

Proposition 3 states that firms will be more likely to switch to richer vertical relations after an expansion in market size. As market size expands, the direct impact is to increase profits which are greater under joint relations. The indirect impact is that profits earned from an individual consumer declines due to competition. This profit drop is smaller when markups are higher and firms have greater ability to absorb the negative profit effect of import competition. However, the

[7] The investment cost can also be flexibly specified as $f(s)$ such that $d\ln f(s)/d\ln s < 0$ so that there are some economies of scale in relationship investments.

rate of change in markups differs across vertical relations. Under joint relations, it includes the rate of change in own markups μ_v' and the rate of change in markups from internalizing business stealing $(\mu_u \varepsilon_v)'$. The supermodularity condition therefore ensures that the rate of change in markups from business stealing is small enough to not completely mitigate the direct impact of market expansion and the indirect impact of higher markups. Then a rise in market size is relatively more profitable for higher markup firms. The implied markups of exporters and the markups charged by importers are higher under richer vertical relations, implying the microstructure of the economy moves towards richer vertical relations.

The microstructure impact would not arise in the absence of increasing markups. Under the standard CES demand setting, Assumption 1 is weakly met. Profits are modular and we get the knife-edge case where they rise at the same rate for all profit levels. This implies opening to trade does not alter the incentives to enter into vertical relations (that provide higher profits).

The microstructure effect of moving into joint profit maximization is also absent when exporters are not in the upper nest. Joint relations yield no markup gain when there is no business externality from competing importers to internalize. For $\theta = 0$, exporters have no influence on the upper nest and market expansion gives no additional reason for joint relations to be more profitable than bilateral relations. We summarize these observations in Remark 1 below and proceed in the next sub-section to the impact of opening to trade on consumer welfare and profits.

Remark 1. Opening to trade does not make joint relations relatively more profitable when demand is CES or when exporters are not in the upper nest ($\theta = 0$).

2.8.1 The Division of the Gains from Trade

Opening to trade gives foreign exporters access to home consumers, so the size of the market expands. Consumers get access to imported varieties and the change in welfare is $\Delta \ln U = \Delta \ln M_i + \Delta \ln u(q_i)$ where Δ denotes changes. Under fixed entry, the change in variety is $(s-1) M_c M_d$ as there is no feedback effect into entry of firms. Quantities per variety q change due to the usual forces of import competition and the new source of changes in the microstructure of import markets. We decompose the change in consumer welfare into the standard gains from variety and pro-competitive effects, and the new gains from changes in the microstructure of import markets.

Let $\Delta_s x(s) \equiv x(s) - x(1)$ denote the change in outcome x when the market size rises from L to sL, under a fixed microstructure. Let $\Delta_V x^V(s) \equiv x^V(s) - x(s)$ denote the change in outcome x when firms move to vertical relation V for a fixed market size s. Then the change in consumer

welfare can be decomposed as:

$$\begin{aligned}\Delta \ln U = & \underbrace{\Delta_s \ln sM_i u\left(q_i(s)\right)}_{\text{Gain from Variety \& Pro-Competitive Effects}>0} \\ + & \underbrace{\Delta_V \ln u\left(q_i^V(s)\right)}_{\text{Gain from Change in Microstructure}}\end{aligned} \tag{5}$$

The first line of Equation 5 shows the standard gains from trade for consumers for a given microstructure. Entry of foreign varieties provides higher welfare through Gains from Imported Variety and Gains from Pro-Competitive Effects (lower q which implies higher markups). Prices fall due to foreign competition because firms scale back on the per capita quantity sold and hence on the markup charged to consumers. Consumers get access to foreign varieties so welfare increases by $d \ln sM_i u\left(q_i(s)\right)/d \ln s = 1 - \varepsilon_u \varepsilon_v / \left(1 + m_q q / \left(1 - m\right)\right) > 0$ where m_q summarizes the change in markups with quantity.[8]

The second line shows a new source of change in consumer welfare arising from changes in the microstructure of the import market. An increase in the market size available to producers makes richer vertical relations more likely. The possible switches are firms moving from bilateral to joint profit maximization and from anonymous relations to bilateral or joint profit maximization. The latter two types of microstructure impacts reinforce the usual pro-competitive effects of trade. Firms cut back on the prices charged to consumers by systematically getting rid of double marginalization, which reinforces the positive welfare gains to consumers.

The switch from bilateral to joint profit maximization however has the opposite effect on prices faced by consumers. As the business stealing externality is contained, consumers pay a higher price, which goes against the standard gains in consumer welfare. This can be seen from combining the budget constraint, the demand function and the pricing condition to arrive at the optimal quantity, which is given by $\left(1 - \mu_v - \left(1 - \theta\right)\left(q_d/q_i\right)\mu_u \varepsilon_v - 1_J \theta \left(q_c/q_i\right)\mu_u \varepsilon_v\right)/q = sM_c M_d cd$. The LHS of this equation is decreasing in quantity, and is smaller under joint profit maximization because firms account for the business stealing effect through $\theta\left(q_c/q_i\right)\mu_u \varepsilon_v$. Firms therefore reduce their quantities and raise their prices when they move from bilateral to joint profit maximization. The consolidation of the import market lowers the gains from trade that are passed on to consumers.

The change in profits of firms after opening to trade can also be decomposed into the standard pro-competitive effects from foreign varieties and the new gains from the change in the microstruc-

[8] $m^A = m + \gamma\left(1 - m\right)$ and $m^V = m$ as defined earlier.

ture of the import market as follows.

$$\Delta\Pi = \underbrace{\Delta_s \left(sM_c M_d \pi_{cd}(s) \right)}_{\text{Gain from Market Access and Pro-Competitive Effects}<0} + \underbrace{\Delta_V \left(sM_c M_d \pi^V_{cd}(s) - M_c f^V_c - M_d f^V_d \right)}_{\text{Gain from Change in Microstructure}}$$

The first line shows that firms gain access to more consumers but also face competition from imports which leads to lower profits. This follows from the usual pro-competitive effects which reduce per capita quantity and hence the markups charged by firms.[9] The second line is the rise in profits when firms move to vertical relation V for a fixed market size. Switches away from anonymous relations towards bilateral or joint relations raise profits without reducing consumer welfare. Prices fall and quantities sold to consumers rise. Switches from bilateral to joint profit maximization raise profits an the expense of consumer welfare. The second line is therefore negative when firms internalize business stealing by moving into joint relations.

We summarize the results for the division of the gains from trade in Proposition 4, and relegate details of the proof to the Appendix.

Proposition 4. *Under Assumption 1, the microstructure channel of opening to trade reinforces the standard gains from trade, except when $\theta > 0$. As firms switch from bilateral to joint profit maximization under $\theta > 0$, the microstructure channel goes against the standard gains from trade by increasing profits at the expense of consumer welfare.*

Before proceeding to testable predictions from the theory, the next sub-section illustrates the robustness of the unique prediction of the microstructure channel for the division of the gains from trade. To avoid a taxonomical analysis, we focus from now on firms switching from bilateral to joint relations. We first show that consumer losses hold under free entry of firms. Then we discuss the variety-level prediction when firms are heterogeneous. Full details of the results and the conditions on primitives are in the Appendix.

2.8.2 The Division of the Gains from Trade under Free Entry

We will show that the qualitative results for consumer welfare persist under free entry of firms when profits are wiped away. For simplicity, we specify a CES upper nest $u(q_c) = q_c^\rho$ and examine the free entry equilibrium. When firms can enter freely, there will be two additional conditions for equilibrium in the economy. Distributors can enter freely and this will drive down their profits net of entry costs to zero, $sM_c (1-\beta) \pi^V_{cd} = f_d$ for the chosen vertical relation $V \in \{B, J\}$. Likewise, producers enter till their profit margin net of entry costs is driven down to zero, $sM_d \beta \pi^V_{cd} = f_c + 1_J f^J_c$.

[9] The equilibrium quantity condition implies $sq/(1-m)$ is fixed while m has fallen with a rise in market size so profits fall.

Opening to trade increases the size of the market available to producers. As earlier, the change in consumer welfare can be decomposed into the standard gains from trade and the gains arising from the change in the microstructure of markets:

$$\begin{aligned}\Delta \ln U = & \underbrace{\Delta_s \ln s M_c u\left(M_d v(q^B(s))\right)}_{\text{Gain from Variety \& Pro-Competitive Effects}>0} \\ + & \underbrace{\Delta_V \ln u\left(M_d v(q^V(s))\right)}_{\text{Gain from Change in Microstructure}<0}\end{aligned} \tag{6}$$

The first line of Equation 6 shows the standard gains from trade for consumers for a given microstructure. Entry of foreign varieties provides higher welfare through Gains from Imported Variety and Gains from Pro-Competitive Effects. Although the mass of importers per market falls, consumers get access to new foreign varieties and firms charge lower markups. And the net effect is an increase in consumer welfare from the standard gains from trade. The second line, as earlier, is the impact of trade through the microstructure of the import market. Consumers lose out as firms switch from bilateral to joint profit maximization. Although more importers enter, there is a drop in the mass of producers because they need higher scale to justify the bigger fixed investments. The rise in markups from the switch to joint profit maximization and the fall in producer entry overwhelm the entry of importers, and consumer welfare falls because of the change in the microstructure. Market expansion makes joint relations more likely, under the supermodularity condition of Assumption 1. Firm profits are unchanged because of free entry. Therefore, the aggregate impact of opening to trade on welfare is positive through the standard channels of variety and pro-competitive effects, but negative through the new channel of market microstructure. Details are in the Appendix.

Having discussed the division of the gains from trade from changes in the microstructure of markets, we proceed to the observable implications of the model. As we will work with firm-level data during an episode of tariff cuts, the next Section will introduce firm heterogeneity and trade costs before proceeding to the empirical specifications with firm-level data.

3 Firm-Level Predictions

Section 2 highlights how the microstructure of importing affects the division of the gains from trade. Ideally we would test the model by examining the impact of the microstructure changes between exporters and importers on consumer prices in a period of falling trade costs. However, data on vertical relations and their link to consumer prices are not available in standard datasets. Further, informal arrangements can replicate vertical relations, as discussed earlier. We therefore focus on the most direct and unique predictions of the model for observable outcomes - import prices, total import quantities and importer-exporter matches. Specifically, we directly examine whether trade liberalization induced exporters to consolidate their import market by raising their prices, lowering

their total quantities sold and reducing the number of importers that they sell to. In this Section, we start by incorporating differences in importer cost cutoffs across exporters, which activates the third margin of fewer importers per exporter. We then provide "difference-in-difference" predictions for changes in prices, quantities and the number of importers per exporter as a result of tariff liberalization in the import market.

3.1 Microstructure of Import Markets

Continuing with the framework of Section 2, we introduce heterogeneous exporters and importers. We will look at the impact of reductions in tariffs and specify $\tau > 1$ as the ad valorem trade cost incurred on payments made to exporters. Specifically, importer d pays τT_{cd} to exporter c, who receives just T_{cd}.

For simplicity, we assume that there is an outside good q_0 that is freely traded and produced one for one with labor. As is well-known, the outside good mitigates income effects and we focus on the price effects arising from changes in the microstructure of the import market for differentiated varieties. The welfare function is $W = q_0 + Q^\eta$ for $0 < \eta < 1$, where the differentiated varieties are $Q = U = \int u(q_i)di$ and $q_i = \int v(q_{ij})dj$. As we are interested in the unique predictions of the theory, we assume exporters are in the upper nest and importers are in the lower nest. The inverse demand for a variety is $p_{cd} \equiv Q^{\eta-1}u'(q_c)\nu'(q_{cd})$ which is similar to Section 2.

Firms differ in the unit costs c and d which are drawn from cumulative densities $G_c(c)$ and $G_d(d)$. As earlier, firms specify quantities and payments and the surplus from a variety is split through bilateral Nash bargaining. Then the optimal final price for variety cd is $p_{cd} = cd/\left(\mu_v(q_{cd}) + 1_J\mu_u(q_c)\bar{\varepsilon}_{v_c}\right)$ where $\bar{\varepsilon}_{v_c} \equiv \int_0^{d_m} \varepsilon_v(q_{cd}) \frac{v(q_{cd})}{\int_0^{d_m} v(q_{cd})dG_d} dG_d$ now summarizes the average elasticity of utility of an exporter across its importers.

As firms differ in costs, we introduce matching costs because this will generate differences in the range of exporters and importers that transact with each other. Exporters and importers face a matching cost $f_{cd} > 0$.[10] So matches will need to be productive enough to justify transactions, and this leads to an endogenous cost cutoff for import partners of each exporter, which we can take to the data. Exporter c supplies to all importers with $d \leq d_m^V(c)$ for $V \in \{B, J\}$. The bilateral profit from a match is $\pi_{cd}\left(q_{cd}, \hat{q}_c, \hat{Q}\right) - f_{cd}$ so exporter c sells to all importers with variable profits greater than the fixed cost of matching. Importers in joint relations account for the business stealing effect of their actions, and this is reflected in the optimal importer range decision as $\pi_{cd_m}\left(q_{cd_m}, q_c, \hat{Q}\right) + \left(\partial\pi_{cd_m}/\partial q_c\right)\left(\partial q_c/\partial d_m\right) = f_{cd}$. Substituting for the change with respect to upper nest quantities, the optimal importer cost cutoff is given by $\left(p_{cd_m} - cd_m\right)q_{cd_m} - 1_J p_{cd_m} q_{cd_m} \mu_u(q_c)\bar{\varepsilon}_{v_c}/\varepsilon_v(q_{cd_m}) = f_{cd}/L$.

As firms move from bilateral to joint profit maximization, they extract a higher markup by

[10] Bernard et al. (2018a) 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 the microstructure of destination import markets.

selling fewer units. Consumer prices rise, total quantities of an exporter fall and the importer cost cutoff of exporters falls. Exporters switching from bilateral to joint relations therefore consolidate their import market to extract more of the consumer surplus. In models without microstructure changes, lower trade costs reduce prices directly. The new finding is that the price response to trade liberalization differs across the vertical relations chosen by exporters and importers. Exporters and importers that move from bilateral to joint relations increase the final markup charged to consumers by overcoming business stealing among importers.

From optimal prices, we can determine the import price paid by the importer to the exporter. In anonymous markets, there is a straightforward market-clearing price p^x_{cd} per unit paid by the importer. Under bilateral and joint relations, the "price" is the variable component of exporter earnings per unit of quantity, which is given by $(1 + \beta m/(1 - m))\,\tau cd$. As firms internalize the business stealing externality, markups rise and import prices rise.

Having incorporated the extensive margin of importers, we can also determine the change in the range of importers chosen across different vertical relations. Exporters that switch to joint profit maximization lower their importer range because this reduces business stealing and increases final prices. For the same reason, these exporters also scale back on their quantities. Therefore, moving to joint relations results in a consolidation of the import market for the product. The import price is increased, quantities are reduced and fewer importers carry the variety under joint relations.

Joint relations become more likely after trade liberalization when the profit function $(\pi_c\,(m, -\tau))$ is supermodular in markups and openness. This requires a condition similar to the one in Section 2 with modifications to reflect the cost distribution. We summarize this assumption and the comparison between bilateral and joint relations in Proposition 5 below and provide details in the Appendix.

Proposition 5. *When exporter profits are supermodular in markups and openness, exporters switching from bilateral to joint profit maximization increase their prices, reduce their sales, and sell to fewer importers.*

To understand the impact of trade liberalization through the microstructure, we examine these unique observable outcomes of higher import prices, lower imports and fewer import partners in response to a reduction in tariffs. Import prices and quantities are routinely observed in customs data, so we can use the above predictions to examine the main mechanism of the theory. The main prediction is that import prices rise after trade liberalization for varieties whose exporters reduce their importer cost cutoffs and import quantities. 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 after trade liberalization, there is no clear theoretical prediction in the quality literature on how quantity varies with changes

in quality (e.g. Eckel et al. 2015). Incorporating quality and quantity in different ways, Baller (2013) shows that standard trade models would predict a rise in quantities when there are economies of scale in quality upgrading. Therefore, our focus will be on testing for a simultaneous rise in prices and reduction in import quantities of exporters.

To directly test for the mechanism in Proposition 5, the reduction in the number of import partners will be important for the empirical application. Recent models incorporating importer margins of trade predict that trade liberalization induces exporters to increase their importer range as a result of higher export profitability, e.g. Bernard et al. (2018a). The range of import partners would rise rather than fall after trade liberalization in these models. Instead, we expect a fall in the number of importers, which is a direct measure of our theoretical mechanism that competition falls among importers carrying varieties of an exporter. We therefore test for the triple prediction of higher prices, lower quantities *and* fewer importers to isolate the microstructure effect of trade liberalization.

The microstructure effect arises for firms that switch from bilateral to joint profit maximization. Supermodularity of profits implies that joint relations are also more viable for lower cost exporters (for the same reason that joint relations become more attractive with a reduction in trade costs). Generally speaking, firms that switch from bilateral to joint profit maximization would lie in the middle of the cost distribution of exporters. Starting from an equilibrium with a firm that is indifferent between bilateral and joint relations, trade liberalization raises the profit for this firm under joint relations, relative to bilateral relations. Firms with lower costs than this marginal firm choose joint profit maximization before and after trade liberalization while firms with much higher costs choose bilateral relations. Firms close enough in costs to the indifferent firm respond to the trade liberalization by switching over from bilateral to joint profit maximization. We therefore expect to find import market consolidation in the middle of the cost distribution of exporters.

The subsequent section operationalizes the triple prediction by examining prices, quantities and importer matches following a major trade liberalization episode in Colombia.

4 Empirics

The microstructure effect of trade liberalization increases the probability that an exporter switches from bilateral to joint profit maximization. This implies an increase in the prevalence of the triple prediction of increased price, reduced quantities and fewer importers for exporters experiencing trade liberalization. We examine the empirical relevance of the triple prediction using data on Colombian imports after the implementation of the US-Colombia Free Trade Agreement (FTA). This section contains a discussion of the data, the baseline empirical specification, a series of robustness checks, and finally a quantification of the impact on the import price index.

4.1 Data

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 $P^X_{csht} = \sum_d P^X_{cdsht}/\#Importers_{csht}$ (where P^X_{cdsht} refers to the tariff-inclusive unit value paid by importer d to exporter c), the total quantity of the product shipped by the exporter to Colombia, X_{csht}, and the number of Colombian importers per exporter-country-product $d^{\max}_{csht}$. We define the triple prediction as $\Delta\text{Triple}_{csht} = 1$ if exporter c from source country s selling product h at time t increases its average price across all its importers ($\triangle P^X_{csht} > 0$) *and* reduces the total quantity sold to all its importers ($\Delta X_{csht} < 0$) *and* reduces the number of importers of its product ($\Delta d^{\max}_{csht} < 0$). If any one of these events does not happen, then $\Delta\text{Triple}_{csht} = 0$.

While matched exporter-importer data is available for other countries, the Colombian import data covers an episode of trade liberalization with its largest trading partner, the United States. The US-Colombia FTA was signed in November 2006 and approved by the US Congress on Oct 12, 2011 with a final implementation date of May 15, 2012. However, the Colombian government unilaterally adopted the lower import tariffs earlier in July 2011. We compute the average applied tariff rate charged by Colombia for each product-country pair. Figure 1 shows the evolution of tariffs charged by Colombia to the US. As we will compare the economic outcomes of US exporters to other developed country exporters, the Figure also plots the tariffs charged by Colombia in imports from the European Union.[11] We exploit this divergence in the trade policy changes arising from the enactment of just the US-Colombia FTA to examine whether US exporters consolidated their Colombian import market.

Panel (a) shows the mean Colombian tariff rate for products from the US and the EU. The weight for each product is its share in Colombia's imports from all developed countries in the pre-FTA period. Panel (b) shows the unweighted median of tariff rates while Panel (c) contains the weighted median of tariff rates. Due to the prevalence of tariff peaks in certain products, Panel (d) also plots the 90th percentile of tariff rates over time. Each panel shows that the Post period (from July 2011 onwards) saw a divergence in tariffs charged to US exporters compared to EU exporters. The tariff cuts of the US-Colombia FTA provided lower trade costs to US exporters to a much larger degree than for EU exporters. For completeness, we also mark the exact time of official implementation of the FTA, which is May 2012.

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. It includes a complete history of Colombian import and export transactions from 1995-2014. The data include all the available

[11] The Colombia-EU FTA was ratified in June 2012 and did not come into force until August 2013.

information on the customs forms. We focus on a subset of the data. On the import side this includes the name of foreign firm c in country s selling quantity q of product h to Colombian firm d for x USD on date d. Products are defined at the HS 10-digit level using the Colombian classification matching the tariff line for Colombian imports. Colombian importers are identified by their national identification number, NIT, while foreign firms have alphanumeric names in the data. The foreign firm name data are very noisy. Using the information on the customs forms with no cleaning results in 1,847,822 foreign firms. We clean the foreign firms' names first by dropping or correcting typical prefixes and suffixes (e.g. "inc", "co.", "spa" etc), dropping non alphanumeric characters and then employing machine learning algorithms to group likely common spelling variants or misspellings. We vary the parameters on the machine learning algorithms to create sets of firms' names that are likely over-matched and under-matched. Throughout this paper we use the under-matched set though results are qualitatively very similar for the over-matched sample.[12]

A time period consists of annual observations starting from July 2009 to June 2014. For each year, import values and quantities are recorded at Colombia's NANDINA product category (which consists of 4,147 different products in the data).[13] To construct the treatment variables, tariff data for the US-Colombia FTA is taken from the customs data. We classify $\text{Treat}_h = 1$ for product codes that saw a fall in tariff from the US-Colombia FTA. For all other product codes, $\text{Treat}_h = 0$.

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 tariff reductions as a result of the FTA were more likely to increase their prices, reduce their quantities and reduce their number of importers relative to the previous period. We define $\text{Post}_t = 1$ for the period after the FTA tariff cuts are applied (July 2011) and 0 for the period before. In addition, we compare the probabilities for US exporters to a control group of exporters that did not experience the FTA tariff reduction. 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 triple prediction applies to incumbent multi-importer exporters, so we focus on exporters who sell in the pre and post periods and have more than one importer.

Table 1 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.

[12]While there are also fields for foreign addresses and telephone numbers, the data are missing in many cases and subject to even more variation when present. See Bernard et al. (2018b) for further details.

[13]We use 6 digit products which correspond to HS product classifications. We ensure that the classifications are consistent throughout the change from HS 2007 to HS 2012. NANDINA products are available at the 10 digit level

Table 1: Summary Statistics for Exporter-Products in 2012

Full Sample					
	count	mean	sd	min	max
$\Delta Triple_{csht}$	275,807	0.140	0.347	0	1
$D\Delta\#Importers_{csht}$	275,807	0.336	0.472	0	1
$D\Delta Price_{csht}$	275,807	0.514	0.500	0	1
$D\Delta Quantity_{csht}$	275,807	0.409	0.492	0	1
Treatment Group: Exporter-Products with $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s = 1$					
	count	mean	sd	min	max
$\Delta Triple_{csht}$	105,446	0.149	0.356	0	1
$D\Delta\#Importers_{csht}$	105,446	0.346	0.476	0	1
$D\Delta Price_{csht}$	105,446	0.511	0.500	0	1
$D\Delta Quantity_{csht}$	105,446	0.432	0.495	0	1

Note: $\Delta Triple_{csht} = 1$ if $\triangle Price_{csht} > 0$ & $\triangle Quantity_{csht} < 0$ & $\triangle\#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. D denotes dummy variables for $\triangle Price_{csht} > 0$ & $\triangle Quantity_{csht} < 0$ & $\triangle\#Importers_{csht} < 0$.

4.2 Baseline Empirical Specification

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,

$$\Delta\text{Triple}_{csht} = \beta \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s + \gamma X_{csht} + \alpha_{st} + \alpha_{ht} + \alpha_{sh} + \varepsilon_{csht} \tag{7}$$

where ε_{csht} is an error term while α_{st}, α_{ht} and α_{sh} are source country-year, product-year and source country-product fixed effects that account for changes such as exchange rate fluctuations, aggregate demand shocks and unobservable product-country characteristics. X_{csht} includes all interactions between Post_t, Treat_h, and USA_s. 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 and the least productive exporters are likely to not have access to joint relations even after the FTA. The FTA would lead to consolidation in the import markets of medium productivity 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 initial value of sales of the exporter in 2009, relative to all exporters of the product from developed countries in 2009

for which there are 6,060 distinct products.

($Value_{csh,2009}$). We examine the difference in the likelihood of triples across three categories of exporters - those in the top and bottom 10 per cent of $Value_{csh,2009}$ and those in the middle. Accounting for possible differential responses across firms, the estimating equation is

$$\Delta\text{Triple}_{csht} = \sum_{\text{Size}} \beta_{\text{Size}} \cdot \text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh} + \gamma X_{csht} + \alpha_{st} + \alpha_{ht} + \alpha_{sh} + \varepsilon_{csht} \qquad (8)$$

where $\text{Size}_{csh} \in \{Bottom, Middle, Top\}$ and X_{csht} includes the full set of interactions between Size_{csh}, Post_t, Treat_h and USA_s. Coefficient β_{Size} allows the impact of the FTA liberalization to vary by initial size of the exporter.

4.3 Baseline Results

Table 2 summarizes the results from estimation of the linear probability models in Equations 7 and 8.

Column (1) shows results for equation (7). 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 by 2.5 percentage points more after the FTA relative to the likelihood for other exporters.

Column (2) splits the firms by their initial size to estimate equation (8) for three types of exporters - those in the Bottom 10th percentile of the size distribution, those in the Middle and those in the Top 90th percentile of the size distribution. As expected, the rise in triples occurs primarily among the middle-sized firms for whom the estimated effect is 3.6 percentage points.

Column (3) shows that the results are not sensitive to noisy data at the lower end of the distribution, where we exclude firms that sell less than USD 5,000 in 2009. Finally, Column (4) changes the threshold to top and bottom 20th percentile of the distribution, and finds that the results persist though some of the firms in the 80 to 90 percentiles seem to be experiencing an increases in the likelihood of triples.

4.3.1 Robustness

This sub-section contains a number of robustness checks. We start with looking into the heterogeneity of responses in the baseline specification. We then explore the single predictions and the occurrence of the opposite of the triple prediction. Finally, we look at the triple prediction at the level of the exporter-importer pair.

To further explore the heterogeneity across the firm size distribution, Figure 2 plots the estimated coefficient on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ across the distribution of Size_{csh}. This is obtained from first regressing the triple indicator on the fixed effects and the interactions between Size_{csh} (and its

Table 2: Baseline results: Triple Prediction

Dependent Variable: $\Delta\text{Triple}_{csht}$				
	(1) Average	(2) 90/10 percentile	(3) 90/10 percentile Imports> \$5k	(4) 80/20 percentile
$Treat_h \cdot Post_t \cdot USA_s$	0.0246***			
	(0.00572)			
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$		0.0252	0.0359	0.0147
		(0.0223)	(0.179)	(0.0192)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$		0.0364***	0.0592***	0.0321***
		(0.00844)	(0.0145)	(0.0118)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$		-0.0130	-0.0221	0.0143
		(0.0235)	(0.0235)	(0.0169)
Product-time FE	Yes	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes	Yes
Observations	270,907	270,907	178,042	270,907
R^2	0.082	0.090	0.112	0.092

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: $\Delta\text{Triple}_{csht} = 1$ if $\triangle Price_{csht} > 0$ & $\triangle Quantity_{csht} < 0$ & $\triangle \#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. Standard errors are clustered at the level of product-usa-post-sizebin.

squares) and each of the three RHS variables of interest - $\text{Post}_t, \text{Treat}_h, \text{USA}_s$ (all bilateral combinations but not $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s \cdot \text{Size}_{csh}$). Then the residuals from this regression are taken on the LHS of a local polynomial regression on Size_{csh} to determine the treatment effect across the exporter size distribution. As expected, the estimated coefficient is hump-shaped showing a larger likelihood of triples among the middle of the distribution.[14]

Table 3 separates out each component of the triple predictions to show how exporters alter their prices, quantities and number of importers in response to the FTA. Column (1) shows US exporters in the middle of the distribution became more likely to raise prices. As expected, these exporters also reduced their total quantities to Colombia and the number of importers that they sold to, as shown in Columns (2) and (3). The top US exporters reacted in the opposite way on the quantity margin. As is expected in many theories, the top US exporters became more likely to (weakly) expand quantities after the FTA.

One concern with the above results is that higher variance might be driving the triple prediction for the middle exporters. We also test for the opposite of the triple prediction, which is the standard result from trade liberalization, that it would reduce prices, increase quantities and increase the number of importers. Table 4 shows that the middle firms are less likely to do this. The top and

[14]Results are similar when we take cubic interactions instead in step 1. The non-parametric regression is executed in two steps for computational feasibility. The procedure was run on the LSE high performance computing cluster.

Table 3: Single components of Triple Prediction

	(1) $D\Delta Price_{csht}$	(2) $D\Delta Quantity_{csht}$	(3) $D\Delta \#Importers_{csht}$
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$	-0.0139	0.0166	0.0220
	(0.0645)	(0.0464)	(0.0325)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$	0.0314**	0.0433***	0.0374***
	(0.0158)	(0.0134)	(0.0123)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$	0.0524	-0.0548*	-0.0480
	(0.0357)	(0.0319)	(0.0331)
Product-time FE	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes
Observations	270,907	270,907	270,907
R^2	0.082	0.096	0.113

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: $D\Delta Quantity_{csht} = 1 \; if \; Quantity_{csht} < Quantity_{csht-1}$ and 0 otherwise, $D\Delta Price_{csht} = 1 \; if \; Price_{csht} > Price_{csht-1}$ and 0 otherwise, $D\Delta \#Importers_{csht} = 1 \; if \; \#Importers_{csht} < \#Importers_{csht-1}$ and 0 otherwise. Standard errors are clustered at the level of product-usa-post-sizebin.

bottom exporters show a positive propensity to reduce prices, raise quantities and sell to more importers, but the effects are imprecisely estimated.

While the theory provides stark predictions at the level of the exporters, it also predicts similar triple responses would occur at the level of the exporter-importer relationship. In particular, incumbent exporter-importer pairs would raise the pair-specific prices, raise the pair-specific quantities and reduce the total number of importers that the exporter deals with. Table 5 shows that the US exporters in the middle of the firm size distribution consolidate their import market, as seen in their higher prevalence of triple predictions after the FTA.

The robustness checks confirm the existence of the triple prediction for middle exporters. To examine the economic significance of these results, we turn in the next sub-section to a quantification of the extent to which the import prices rise as a result of the channel of import market consolidation.

4.3.2 Quantitative Interpretation

Import prices (inclusive of tariffs) fall directly as a result of the tariff reduction, but the markups rise as a result of some US exporters consolidating their import markets. We start with estimating the extent to which unit values change across different exporters. Then we adjust for potential increases in quality and determine the extent to which markups rise as a result of the US-Colombia FTA.

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. A limitation however is that it does not enable

Table 4: Opposite of Triple Prediction

Dependent Variable: ΔOpposite Triple$_{csht}$			
	(1)	(2)	(3)
	Average	90/10 percentile	90/10 percentile, Imports> \$5k
$Treat_h \cdot Post_t \cdot USA_s$	-0.0110		
	(0.0094)		
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$		0.0432	0.0268*
		(0.0606)	(0.146)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$		-0.0190	-0.0293*
		(0.0118)	(0.0175)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$		-0.0026	0.0121
		(0.0253)	(0.0262)
Product-time FE	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes
Observations	270,907	270,907	178,042
R^2	0.084	0.090	0.117

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: ΔOpposite Triple$_{cdsht}$ = 1 if $\Delta Quantity_{cdsht} > 0$ & $\Delta Price_{cdsht} < 0$ & $\Delta \#Importers_{csht} > 0$ from period $t-1$ to t and 0 otherwise. Standard errors are clustered at the level of product-usa-post-sizebin.

Table 5: Triple Prediction for Exporter-Importer Pairs

	ΔTriple$_{cdsht}$		ΔOpposite Triple$_{cdsht}$
	(1)	(2)	(3)
	Average	90/10 percentile	90/10 percentile
$Treat_h \cdot Post_t \cdot USA_s$	0.0130**		
	(0.0063)		
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$		0.0154	0.0750
		(0.0212)	(0.0501)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$		0.0188**	-0.0036
		(0.0083)	(0.0098)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$		-0.0094	0.0063
		(0.0213)	(0.0234)
Product-time FE	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes
Observations	310,727	310,727	310,727
R^2	0.078	0.083	0.084

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: ΔTriple$_{cdsht} = 1$ if $\triangle Price_{cdsht} > 0$ & $\triangle Quantity_{cdsht} < 0$ & $\triangle \#Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise. Standard errors are clustered at the level of product-usa-post-sizebin.

a quantification of the extent to which prices rise for importers after the FTA. To get a sense of the magnitude of the changes, we first 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 $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$. Column (1) of Table 6 reports the change in the average tariff-inclusive prices charged by exporters. As expected, prices fell for the top and bottom exporters, but middle exporters raised their prices by 6 percent more than all other exporters.

Table 6: Change in Prices and Quality-adjusted Prices

	$\Delta \ln \text{Price}_{csht}$	$\Delta \ln \text{Quality-adjusted Price}_{csht}$	
	(1)	(2)	(3)
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$	-0.122	-0.0233***	-0.0411
	(0.214)	(0.0083)	(0.0376)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$	0.0618*	-0.0006	0.0556***
	(0.0336)	(0.0010)	(0.0198)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$	-0.0162	-0.0056**	-0.0084
	(0.0587)	(0.0024)	(0.0152)
Product-time FE	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes
Observations	270, 907	187,065	187,065
R^2	0.052	0.382	0.382

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: $\triangle \ln Price_{cdsht}$ is the change in log price and $\Delta \ln \text{Quality-adjusted Price}_{csht} = \Delta \sum_d \hat{\kappa}_{csht}$ from period $t-1$ to t and 0 otherwise. Columns 1 and 2 are unweighted regressions. Column 3 reports regression results weighted by the initial sales share of exporters $Value_{csh,2009}$. Standard errors are clustered at the level of product-usa-post-sizebin.

One concern with the quantification above is that unit values could contain a component of quality, together with costs and markups. We therefore proceed in three steps to quantify the price increase from the middle exporters. First, we extend standard quality estimation methods to purge out quality changes arising in our setting. Then we quantify the extent to which markups inferred from the quality-adjusted prices change after the FTA. Results for the triple prediction using quality-adjusted prices (instead of unit values) are similar to the baseline results, so we relegate them to the Appendix.

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 tariff cuts from the FTA. In fact, lower trade costs would make it more likely for lower quality US exporters to be able to sell to the Colombian market, because the exporting cost cutoff typically rises after trade liberalization in heterogeneous firm trade models.

Empirically, higher quality products are more likely to be shipped out when trade barriers are higher (Hummels and Skiba 2004).

To look further into the quality explanation, we estimate quality based on standard methods and a flexible approach that is consistent with our theory. Let λ_c denote the quality of exporter c's variety. Then λ_c is an exporter-specific demand shifter that needs to be net out from changes in unit values before and after the trade liberalization. For an exporter c that sells to more than one importer, the per unit value paid by importer d to exporter c is

$$\ln UV_{cd} = \ln \beta - \ln \tau + \ln cd + \ln \lambda_c + \ln m_{cd}/\left(1 - m_{cd}\right) \tag{9}$$

where m_{cd} is the markup which depends on quantity q_{cd} through the direct markup effect of μ_v (the lower tier utility) and the indirect markup effect of $\mu_u \varepsilon_v$ (from the upper tier utility across exporters).

We augment the approach of Khandelwal et al. (2013) to recover quality-adjusted prices and markups. In the first step, we estimate the markup function using the following regression with exporter-importer cd data on unit values and quantities of product h from source country s in each time period t:

$$\ln UV_{cdsht} = \alpha_{cdsh} + \alpha_{dht} + \alpha_{csht} + \epsilon_{cdsht}.$$

Having taken out the match fixed effect and the time-varying exporter and importer fixed effects (which purge out quality shifters for them), we proceed to a local polynomial regression of the residuals ϵ_{cdsht} on quantities to arrive at the markup function f:

$$\epsilon_{cdsht} = f\left(\ln q_{cdsht}\right) + \eta_{cdsht}.$$

The predicted markup function is $\kappa_{cdsht} \equiv \hat{f}\left(\ln q_{cdsht}\right)$ which we aggregate to the exporter level to arrive at the exporter-specific markup across all sales. Then the total markup of the exporter is $\hat{\kappa}_{csht} = \sum_d \kappa_{cdsht}$ which can be used instead of unit values to quantify the extent to which the aggregate import price index rises on account of the theoretical channel.[15]

Column (2) of Table 6 shows results with the change in log of the quality adjusted prices on the LHS. US exporters in the top and bottom of the firm size distribution lower their prices, while the exporters in the middle of the firm size distribution barely show any change in quality-adjusted prices after the FTA. Using initial trade shares to weight the regression, Column (3) quantifies the estimated increase in the price index on account of the rise in markups of the middle sized exporters. The estimated impact is a 5.6 per cent rise in the quality-adjused price for these exporters. This

[15] In the Appendix, we use an indicator for the rise in quality-adjusted prices, $\Delta\hat{\kappa}_{csht} > 0$, (instead of simple unit value increases) in the baseline triple prediction and show that the triple prediction continues to hold. As expected, the middle US exporters are again more likely to have triple predictions using the estimated change in κ or the change in the component of κ that varies systematically with the quantities sold by the exporter to other Colombian importers.

suggests a substantive increase in prices, especially when compared to the average pass through rate of other US exporters which are estimated to be negative, albeit imprecisely in the initial value-weighted specification.

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 relationships that overcome these sources of lower profits.

We embed the choice of the microstructure of import markets into a trade model with heterogeneous exporters and importers. Exporters can eliminate double marginalization by engaging in bilateral profit maximization with their importers, leading to higher profits and lower prices. Exporters can internalize business stealing across importers by investing in joint profit maximization with all its importers. 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 profits are supermodular in markups and market size, trade liberalization changes the relative incentives in favor of higher profit vertical relations. Lower trade costs increase the surplus from joint profit maximization relative to bilateral profit maximization (which yields lower profits). This change in the microstructure of import markets raises firm profits at the expense of consumer welfare.

The model enables us to derive unique predictions for changes in import prices, quantities and the number of importers per exporter. Testing these implications empirically, we show that the US-Colombia free trade agreement induced medium-sized US exporters to consolidate their import market, increasing the probability of higher prices, reduced quantity and fewer Colombian importers per exporter. These observable outcomes show that the actions of exporters and importers shift profits across countries and suggest that market power affects the ability of consumers to gain from trade. The estimated elasticity of import prices with respect to trade costs shows substantial increases in prices for certain products 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

Ahn, J., Amit K. Khandelwal, and Shangjin Wei, "The role of intermediaries in facilitating trade," *Journal of International Economics*, 2011, *84(1)* (15706), 73–85. 1

Akerman, Anders, "Wholesalers and Economies of Scope in International Trade," *Canadian Journal of Economics*, 2018, *51* (1), 156–185. 1

Amiti, Mary and Jozef Konings, "Trade Liberalization, Intermediate Inputs and Productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638. 1

Antràs, Pol and Arnaud Costinot, "Intermediated Trade," *The Quarterly Journal of Economics*, 2011, *126* (3), 1319–1374. 1

_ **and Elhanan Helpman**, "Global Sourcing," *Journal of Political Economy*, 2004, *112* (31), 552–580. 1

Antràs, Pol and Robert W. Staiger, "Trade agreements and the nature of price determination," *American Economic Review*, 2012, *102* (3), 470–76. 1

Atkin, David and Dave Donaldson, "Who's Getting Globalized? The Size and Nature of Intranational Trade Costs," *Working Paper*, 2012. 1

Badinger, Harald, "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*, 2007, *69* (4), 497–519. 1, 2

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

_ **and Seung H. Lee**, "Trade Policy under Monopolistic Competition with Firm Selection," *Working Paper, Stanford University*, 2015. 1

Baller, Silja, "Product quality, market size and welfare: theory and evidence from French exporters," *Working Paper University of Oxford*, 2013. 3.1

Bernard, Andrew B., Andreas Moxnes, and Karen Helene Ulltveit-Moe, "Two-sided Heterogeneity and Trade," *Review of Economics and Statistics*, July 2018, *100* (3), 424Ã439. 1, 10, 3.1

_ **, Esther A. Bøler, and Swati Dhingra**, "Firm-to-firm Connections in Colombian Imports," in Lili Yan Ing and Miaojie Yu, eds., *World Trade Evolution*, Routledge, 2018. 12

_ , **J. Bradford Jensen, and Peter K. Schott**, "Importers, Exporters, and Multinationals: A Portrait of Firms in the U.S. that Trade Goods," in T. Dunne, J.B. Jensen, and M. Roberts, eds., *Producer dynamics: New Evidence from Micro Data*, University of Chicago Press, 2009. 1

_ , _ , **Stephen J. Redding, and Peter K. Schott**, "Wholesalers and Retailers in US Trade," *The American Economic Review*, 2010, *100* (2), 408–413. 1

Blanchard, Emily, Tatyana Chesnokova, and Gerald Willmann, "Private labels and international trade: Trading variety for volume," Technical Report, Kiel Working Paper 2013. 1

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

_ , _ , **and Ignatius J. Horstmann**, "Import Intermediaries and Trade Costs: Theory and Evidence," mimeo, University of Toronto 2012. 1

Boler, Esther Ann, Andreas Moxnes, and Karen Helene Ulltveit-Moe, "Technological Change, International Sourcing and the Joint Impact on Productivity," *American Economic Review*, December 2015, *105* (12), 3704–39. 1

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

Campa, Josè Manuel and Linda S. Goldberg, "Exchange Rate Pass-Through into Import Prices," *The Review of Economics and Statistics*, November 2005, *87* (4), 679–690. 1

Carballo, Jeronimo, Gianmarco I.P. Ottavianio, and Christian Volpe Martincus, "The Buyer Margins of Firms' Exports," *Journal of International Economics*, 2018, *112*, 33–49. 1

Castellani, Davide, Francesco Serti, and Chiara Tomasi, "Firms in international trade: Importers' and exporters' heterogeneity in Italian manufacturing industry," *The World Economy*, March 2010, *33* (3), 424–457. 1

Chaney, Thomas, "The Network Structure of International Trade," *American Economic Review*, November 2014, *104* (11), 3600–34. 1

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

Costinot, Arnaud, "An elementary theory of comparative advantage," *Econometrica*, 2009, *77* (4), 1165–1192. 2.8

Dhingra, Swati and John M. Morrow, "Monopolistic Competition and Optimum Product Diversity under Firm Heterogeneity," *Journal of Political Economy*, November forthcoming. 1, 2.1

Eaton, Jonathan, Marcela Eslava, David Jinkins, C. J. Krizan, and James Tybout, "A Search and Learning Model of Export Dynamics," working paper 2012. 1

Eckel, Carsten, "International trade and retailing," Technical Report, LMU 2009. 1

_ , Leonardo Iacovone, Beata Javorcik, and J. Peter Neary, "Multi-product firms at home and away: Cost-versus quality-based competence," *Journal of International Economics*, 2015, *95* (2), 216–232. 3.1

Engel, Charles and John H. Rogers, "How Wide Is the Border?," *American Economic Review*, December 1996, *86* (5), 1112–25. 1

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

Ganslandt, Mattias and Keith E. Maskus, "Parallel imports and the pricing of pharmaceutical products: evidence from the European Union," *Journal of health economics*, 2004, *23* (5), 1035–1058. 1

Halpern, László, Miklós Koren, and Adam Szeidl, "Imported inputs and productivity," *American Economic Review*, 2015, *105* (12), 3660–3703. 1

Harrison, R., J. Jaumandreu, J. Mairesse, and B. Peters, "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)*, 2005. 1

Hart, Oliver and Jean Tirole, "Vertical integration and market foreclosure," *Brookings papers on economic activity. Microeconomics*, 1990, *1990*, 205–286. 1, 2.4

Horn, Henrick and Asher Wolinsky, "Bilateral monopolies and incentives for merger," *The RAND Journal of Economics*, 1988, pp. 408–419. 2.4, 2.5.1

Hummels, David and Alexandre Skiba, "Shipping the Good Apples Out? An Empirical Confirmation of the Alchian-Allen Conjecture," *Journal of Political Economy*, 2004, *112* (6), 1384–1402. 4.3.2

Khandelwal, Amit K., Peter K. Schott, and Shang-Jin Wei, "Trade Liberalization and Embedded Institutional Reform: Evidence from Chinese Exporters," *The American Economic Review*, 2013, *103* (6), 2169–2195. 4.3.2

Khandelwal, Amit Kumar, "The Long and Short (of) Quality Ladders," *Review of Economic Studies*, 2010, *77*, 1450–1476. 4.3.2

Konings, Jozef, Patrick V. Cayseele, and Frederic Warzynski, "The Effects of Privatization and Competitive Pressure on Firms' Price-Cost Margins: Micro Evidence from Emerging Economies," *The Review of Economics and Statistics*, February 2005, *87* (1), 124–134. 1

Krugman, P., "Increasing Returns, Monopolistic Competition, and International Trade," *Journal of International Economics*, 1979, *9* (4), 469–479. 2, 2.1

Lawrence, Robert Z., "How open is Japan?," in "Trade with Japan: has the door opened wider?," University of Chicago Press, 1991, 1991, pp. 9–50. 2

_ **and Gary R. Saxonhouse**, "Efficient or exclusionist? The import behavior of Japanese corporate groups," *Brookings Papers on Economic Activity*, 1991, pp. 311–341. 2

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

Loecker, Jan De, Pinelopi K. Goldberg, Amit K. Khandelwal, and Nina Pavcnik, "Prices, markups and trade reform," *Econometrica*, March 2016, *84* (2), 445–510. 1, 2

Mallick, Sushanta and Helena Marques, "Passthrough of Exchange Rate and Tariffs into Import Prices of India: Currency Depreciation versus Import Liberalization*," *Review of International Economics*, 2008, *16* (4), 765–782. 1, 2

Martin, Stephen, Hans-Theo Normann, and Christopher M. Snyder, "Vertical foreclosure in experimental markets," *RAND Journal of Economics*, 2001, pp. 466–496. 4, 6

Mayer, Thierry, Marc J. Melitz, and Gianmarco I.P. Ottaviano, "Market Size, Competition, and the Product Mix of Exporters," *American Economic Review*, April 2014, *104(2)* (16959). 1

Miklos-Thal, Jeanine, Patrick Rey, and Thibaud Verge, "Vertical relations," *International Journal of Industrial Organization*, 2010, *28* (4), 345–349. 3

Mollers, Claudia, Hans-Theo Normann, and Christopher M. Snyder, "Communication in Vertical Markets: Experimental Evidence," *International Journal of Industrial Organization*, January 2017, *50*, 214–258. 4

Mrazova, M. and J. P. Neary, "Selection effects with heterogeneous firms," *Journal of the European Economic Association*, forthcoming. 2.8

Muuls, Mirabelle and Mauro Pisu, "Imports and Exports at the Level of the Firm: Evidence from Belgium," *The World Economy*, May 2009, *32* (5), 692–734. 1

Neary, J. Peter and Monika Mrazova, "Not so demanding: Preference structure, firm behavior, and welfare," *American Economic Review*, December 2017, *107* (12), 3835–3874. 1

Parenti, Mathieu, Philip Ushchev, and Jacques-François Thisse, "Toward a theory of monopolistic competition," *Journal of Economic Theory*, January 2017, *167*, 86–115. 1

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

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

_ **and** _ , "Buyer Power in International Markets," *Journal of International Economics*, 2009, *79(2)*, 222–229. 1

_ **and** _ , "Imports and the Structure of Retail Markets," *Canadian Journal of Economics*, 2012, *45(4)*, 1431–1455. 1

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

_ **and Joel Watson**, "Network Intermediaries in International Trade," *Journal of Economics & Management Strategy*, 2004, *13* (1), 69–93. 1

Rey, Patrick and Jean Tirole, "A primer on foreclosure," *Handbook of industrial organization*, 2007, *3*, 2145–2220. 2.4

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

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

Verhoogen, Eric A., "Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector*," *The Quarterly Journal of Economics*, 2008, *123* (2), 489–530. 4.3.2

Yeats, Alexander J., "Monopoly power, barriers to competition and the pattern of price differentials in international trade," *Journal of Development Economics*, 1978, *5* (2), 167–180. 2

Appendix

Vertical Relations and Market Size

Exporter c's optimal profit from her relationship with importer d is $\beta\pi_{cd} = s\left(m(q)q/(1-m(q))\right)\beta cdL$ where the markup is $m(q) \equiv \mu_v + \mu_u\varepsilon_v\left(1-\theta\right)q_d/q_i + 1_J\mu_u\varepsilon_v\theta q_c/q_i$ at the optimally chosen quantity q under bilateral relations and joint relations ($1_J = 1$). Similarly, the distributor's profit is $(1-\beta)\,\pi_{cd}$. Under anonymous markets, the exporter receives $s\left(\gamma(q)q/(1-\gamma(q))\right)cdL$ and the importer receives $s\left(m(q)q/(1-m(q))(1-\gamma(q))\right)cdL$. From the quantity FOC and the budget constraint, optimal quantity is determined by $sq^V/\left(1-m^V(q^V)\right) = \left(1-1_A\gamma(q^A)\right)/M_cM_dcd$ where $1_A = 1$ under anonymous relations and $V \in \{A, B, J\}$. The LHS of the quantity solution is increasing in quantity (due to increasing markups). The markup term under joint relations contains $\mu_u\varepsilon_v\theta q_c/q_i$ which increases the LHS and therefore $q^J < q^B$. Under anonymous relations, the RHS is lower because of the exporter's markup, so $q^A < q^B$. Further, prices under anonymous relations are higher than under joint relations (under earlier assumptions on demand), so $m^A + \gamma(1-m^A) > m^J$ and therefore $q^A < q^J$. Similarly, for higher prices under joint relations compared to bilateral relations, $m^B < m^J$. Finally, these relationships give $m^A < m^B < m^J$ so that Assumption 1 then gives the result that a rise in market size leads to lower losses in importer profits under joint relations compared to bilateral relations. Profits under anonymous relations fall the most, on account of the importer markups m as well as the rise in exporter markup γ_c. The latter follows from increasing markups and the drop in quantity q resulting from a rise in market size ($d\ln q/d\ln s = -1/\left(1+\frac{m_qq}{1-m}+\frac{\gamma_qq}{1-\gamma}\right) < 0$). For the exporter, vertical relations are viable only when $\gamma(q) < m(q)$. Proceeding as for importers, Assumption 1 therefore implies that lossses in exporter profits from a rise in market size are lowest under joint relations and lower under bilateral relations compared to anonymous relations.

Fixed Entry

The exporter's optimal profit is $\pi_c = s\left(m(q)q/(1-m(q))\right)M_d\beta cdL$ where the markup is $m(q) \equiv \mu_v(q) + z\mu_u\left(M_dv(q)\right)\varepsilon_v(q)$ for $z \in \{0,1\}$ at the optimally chosen quantity q. This formulation lets us specify the different vertical relations through z. Profits under bilateral relations correspond to $z = 0$ and profits under joint relations correspond to $z = 1$. The optimal quantity is determined by $u'\left(M_dv(q)\right)v'(q)\left(1-m\right) = \delta cd$. The consumer budget multiplier is taken as fixed by the firm and is given by $\delta = sM_cM_du'\left(M_dv(q)\right)v'(q)$ in equilibrium. As z rises, the profit function changes by $\frac{d\ln\pi}{d\ln z} = \left(1+\frac{m_qq}{m(1-m)}\right)\frac{d\ln q}{d\ln z} + \frac{z\mu_u\varepsilon_v}{m(1-m)}$. From the optimal pricing condition, $\ln\delta + \ln u'\left(M_dv(q)\right)v'(q)\left(1-\mu_v-z\mu_u\varepsilon_v\right) = cd$ so that $-\left(\mu+\mu_u\varepsilon+\frac{m_qq}{1-m}\right)\frac{d\ln q}{d\ln z} = \frac{z\mu_u\varepsilon_v}{1-m}$ and quantities fall under joint relations. Substituting in the profit derivative, $\pi_z = \beta L\tau cd\frac{(1-z)q}{(1-m)^2}\frac{sM_d(\mu_u\varepsilon_v)^2}{\mu_v+\mu_u\varepsilon_v+\frac{m_qq}{1-m}}$ so $s\pi_{zs}/\pi_z = 1 + \frac{d\ln q}{d\ln s}\left(1+2\frac{d\ln\mu_u\varepsilon_v}{d\ln q}+\frac{2m_qq}{1-m}-\frac{d\ln\left(\mu_v+\mu_u\varepsilon_v+\frac{m_qq}{1-m}\right)}{d\ln q}\right) \equiv 1 + (1+A_q)\frac{d\ln q}{d\ln s}$.

From optimal vertical relation choice, $\pi_z = \beta L \tau c d \frac{(1-z)q}{(1-m)^2} \frac{x M_d (\mu_u \varepsilon_v)^2}{\mu_v + \mu_u \varepsilon_v + \frac{m_q q}{1-m}} = f_c^J$ so that differentiating with respect to market size gives $1 + (1+A_q)\frac{d\ln q}{d\ln s} + (A_z - z/(1-z))\frac{d\ln z}{ds} = 0$ for $A_z \equiv \frac{2z\mu_u\varepsilon}{1-m} - \frac{d\ln\left(\frac{m_q q}{1-m}\right)}{d\ln z}$. From optimal pricing and the budget multiplier, $1-m = sqM_cM_dcd$ implying $-\left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln s} - \frac{z\mu_u\varepsilon_v}{1-m}\frac{d\ln z}{d\ln s} = 1$. Putting the two together, $-\left(1+\frac{m_q q}{1-m} + \frac{\frac{z\mu_u\varepsilon_v}{1-m}(1+A_q)}{\frac{z}{1-z}-A_z}\right)(d\ln q/d\ln s) = 1 + \frac{\frac{z\mu_u\varepsilon_v}{1-m}}{z/(1-z)-A_z}$. Substituting for this, $d\ln\pi_z/d\ln s = \left(\frac{m_q q}{1-m} - A_q\right)/\left(1+\frac{m_q q}{1-m} + \frac{\frac{z\mu_u\varepsilon_v}{1-m}(1+A_q)}{\frac{z}{1-z}-A_z}\right)$. So as long as $-1 \le A_q \le 0$ and $A_z \le 0$,, $d^2\pi_c/dzds > 0$ and market expansion makes higher values of z more desirable.

Free Entry

To examine the robustness of the qualitative predictions, we specify the upper nest as CES ($u(q_c) = q_c^\rho$). Under free entry, the additional conditions are $sM_c(1-\beta)\left[\frac{m}{1-m}\tau c d q L - f_{cd}\right] = f_d$ and $sM_d\beta\left[\frac{m}{1-m}\tau c d q L - f_{cd}\right] = f_c + z f_c^J$. Differentiating π_z with respect to market size, $d\ln\pi_z/d\ln s = 1 + \frac{d\ln M_d}{d\ln s} + (1+A_q)\frac{d\ln q}{d\ln s}$. As z is chosen optimally, the free entry conditions imply $\frac{d\ln M_c}{d\ln s} = -1 - \left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln s} = \frac{d\ln M_d}{d\ln s}$. From optimal pricing and optimal vertical relation choice, $-\left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln s} - \frac{z\mu_u\varepsilon}{1-m}\frac{d\ln z}{d\ln s} - \frac{d\ln M_c}{d\ln s} - \frac{d\ln M_d}{d\ln s} = 1$ and $1 + (1+A_q)\frac{d\ln q}{d\ln s} + \frac{d\ln M_d}{d\ln s} + (A_z - z/(1-z))\frac{d\ln z}{d\ln s} = 0$. Solving for quantity changes using free entry, $-\left(1+\frac{m_q q}{1-m}\left(1+\frac{\frac{z\mu_u\varepsilon_v}{1-m}}{\frac{z}{1-z}-A_z}\right) - \frac{\frac{z\mu_u\varepsilon_v}{1-m}A_q}{\frac{z}{1-z}-A_z}\right)\frac{d\ln q}{d\ln s} = 1$. Then $d\ln\pi_z/d\ln s = 1 + \frac{d\ln M_d}{d\ln s} + (1+A_q)\frac{d\ln q}{d\ln s} = -\left(\frac{m_q q}{1-m} - A_q\right)\frac{d\ln q}{d\ln s} > 0$.

Welfare

Welfare is $U = sM_c u(M_d v(q))$ so that $\frac{d\ln U}{d\ln z} = \frac{d\ln M_c}{d\ln z} + \varepsilon_u\frac{d\ln M_d}{d\ln z} + \varepsilon_u\varepsilon_v\frac{d\ln q}{d\ln z}$. Under fixed entry, $d\ln U/d\ln z = \varepsilon_u\varepsilon(d\ln q/d\ln z)$ which is negative because firms scale back quantities under joint relations as shown above. We have also shown above that $\pi_z > 0$ so profits rise under joint relations. Under free entry with a CES upper nest, optimal pricing implies $-\left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln z} = \frac{z\mu_u\varepsilon}{1-m} + \frac{d\ln M_c}{d\ln z} + \frac{d\ln M_d}{d\ln z}$ and optimal relations imply $0 = -\frac{z}{1-z} + \frac{2z\mu_u\varepsilon}{1-m} - \frac{\frac{m_q q}{1-m}}{\mu+\mu_u\varepsilon+\frac{m_q q}{1-m}}\frac{d\ln\frac{m_q q}{1-m}}{d\ln z} + \frac{d\ln M_d}{d\ln z} + \frac{d\ln q}{d\ln z}A_q$. From free entry,$-\frac{m_q q}{m}\frac{d\ln M_d}{d\ln z} = \left(1+\frac{m_q q}{m(1-m)}\right)\frac{d\ln M_c}{d\ln z}$ and $\frac{\ln M_d}{d\ln z} = \frac{d\ln M_c}{d\ln z} + z f_c^J/\left(f_c + z f_c^J\right)$. Entry changes by $\frac{d\ln M_c}{d\ln z} = -\frac{m_q q/m}{1+\frac{2-m}{m}\frac{m_q q}{1-m}}\frac{z f_c^J}{f_c + z f_c^J}$ and $\frac{d\ln M_d}{d\ln z} = \frac{1+\frac{m_q q}{m(1-m)}}{1+\frac{2-m}{m}\frac{m_q q}{1-m}}\frac{z f_c^J}{f_c + z f_c^J}$. So the change in quantities is $-\left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln z} = \frac{z\mu_u\varepsilon}{1-m} + \frac{1+\frac{m_q q}{1-m}}{1+\frac{2-m}{m}\frac{m_q q}{1-m}}\frac{z f_c^J}{f_c + z f_c^J}$. Substituting in the welfare derivative,

$$
\begin{aligned}
-\frac{d\ln U}{d\ln z}\Big/\frac{z\mu_u\varepsilon}{1-m} =& \frac{\varepsilon_u\varepsilon}{1+\frac{m_q q}{1-m}} + \frac{\varepsilon_u\varepsilon + \frac{m_q q}{m} - \varepsilon_u - \frac{\varepsilon_u}{1-m}\frac{m_q q}{m}}{1+\frac{2-m}{m}\frac{m_q q}{1-m}}\frac{(1-z)m\mu_u\varepsilon}{\mu+\mu_u\varepsilon+\frac{m_q q}{1-m}} \\
\ge& \frac{\varepsilon_u\varepsilon}{1+\frac{m_q q}{1-m}}\left(1 - \frac{m + m\frac{m_q q}{1-m}}{\mu+\mu_u\varepsilon+\frac{m_q q}{1-m}}\frac{1-\varepsilon+\frac{1}{m}\frac{m_q q}{1-m}}{1+\frac{2-m}{m}\frac{m_q q}{1-m}}(1-z)\mu_u\right) \\
\ge& \frac{\varepsilon_u\varepsilon}{1+\frac{m_q q}{1-m}}\left(1-(1-z)\mu_u\right) \ge 0
\end{aligned}
$$

A switch to joint profit maximization lowers consumer welfare.

Under free entry, the change in welfare for bilateral relations is $d\ln U/d\ln s = 1+d\ln M_c/d\ln s+\varepsilon_u d\ln M_d/d\ln s+\varepsilon_u\varepsilon_v d\ln q^B/d\ln s$. From optimal pricing, $-\left(1+\frac{m_q q}{1-m}\right)\frac{d\ln q}{d\ln s} = 1+\frac{d\ln M_c}{d\ln s}+\frac{d\ln M_d}{d\ln s}$ and free entry implies $\frac{d\ln M_d}{d\ln s} = \frac{d\ln M_c}{d\ln s} = -1-\left(1+\frac{m_q q}{m(1-m)}\right)\frac{d\ln q}{d\ln s}$. Putting these conditions together, quantities and entry fall because $d\ln q/d\ln s = -1/\left(1+\frac{m_q q}{1-m}(2/m-1)\right)$ and $d\ln M_c/d\ln s = d\ln M_d/d\ln s = -1+\frac{1+\frac{m_q q}{m(1-m)}}{1+\frac{m_q q}{1-m}\frac{2-m}{m}}$. Substituting in the welfare derivative, $\left(1+\frac{m_q q}{1-m}\frac{2-m}{m}\right)\frac{d\ln U}{d\ln s} = 1-\varepsilon_u\varepsilon+\frac{m_q q}{m(1-m)}(1-\varepsilon_u(1-m)) > 0$.

Variety-Level Model

This section explains the variety-level predictions in a model with relationship-specific cost $f_{cd} > 0$, ad valorem trade costs $\tau > 1$ and fixed potential entry. The optimal price is $p_{cd}(1-m_{cd}) = cd$ for $m = \mu + z$ and the optimal importer cost cutoff is $(m_{cd_m} - z/\varepsilon_m)\, cd_m q_{cd_m}/(1-m_{cd_m}) = f_{cd}/L$. From optimal pricing, $-\left(\mu_{cd}+\frac{m_q(q_{cd})q_{cd}}{1-m_{cd}}\right)\frac{d\ln q_{cd}}{d\ln z} = \frac{z}{1-m_{cd}}+\mu_u(q_c)\frac{d\ln q_c}{d\ln z}$ and from the optimal cutoff, $\frac{1-z/\varepsilon_{cd_m}}{m_{cd_m}-z/\varepsilon_{cd_m}}\left(\mu_{cd_m}+\frac{m_q(q_{cd_m})q_{cd_m}}{1-m_{cd_m}}\right)\frac{d\ln q_{cd_m}}{d\ln z}+\frac{d\ln d_m}{d\ln z}+\frac{z-z/\varepsilon_{cd_m}}{m_{cd_m}-z/\varepsilon_{cd_m}}+\frac{z}{1-m_{cd_m}} = 0$. Substituting for the change in quantities and re-writing, the change in the importer cost cutoff is

$$-\frac{d\ln d_m}{d\ln z} = \frac{z/\varepsilon_{cd_m}}{1-m_{cd_m}}+\frac{1-z/\varepsilon_{cd_m}}{1-m_{cd_m}}\mu_{u_c}\frac{d\ln q_c}{d\ln z}$$

As $q_c = \int_0^{d_m} v(q)dG$, total quantity changes by $\left(\frac{q_c}{\mu_{u_c}}+\frac{v_{cd_m}d_m(1-z/\varepsilon_{cd_m})}{m_{cd_m}-z/\varepsilon_{cd_m}}+\int\frac{v'(q_{cd})q_{cd}dG_d}{\mu_{cd}+\frac{m_q(q_{cd})q_{cd}}{1-m_{cd}}}\right)\mu_u\frac{d\ln q_c}{d\ln z} = -\left(v_{cd_m}d_m\frac{z/\varepsilon_{cd_m}}{1-m_{cd_m}}+\int\frac{v'(q_{cd})q_{cd}dG_d}{\mu_{cd}+\frac{m_q(q_{cd})q_{cd}}{1-m_{cd}}}\frac{z}{1-m_{cd}}\right)$. So $d\ln q_c/d\ln z < 0$ and total quantities always fall after joint profit maximization. Substituting for the change in total quantity, the change in the importer cost cutoff is $(1-m_{cd_m})\frac{d\ln d_m}{d\ln z} = -\varepsilon_{cd_m}^{-1}\frac{\int v'(q_{cd})q_{cd}\left[1+\frac{z}{\mu_{cd}+\frac{m_q(q_{cd})q_{cd}}{1-m_{cd}}}\frac{1-\mu_{cd}-\varepsilon_{cd_m}}{1-\mu_{cd}-z}\right]dG_d}{q_c/\mu_{u_c}+v_{cd_m}d_m\frac{1-z/\varepsilon_{cd_m}}{1-m_{cd_m}}+\int\frac{v'(q_{cd})q_{cd}dG_d}{\mu_{cd}+\frac{m_q(q_{cd})q_{cd}}{1-m_{cd}}}}$. We will show that $(1-\mu_{cd}-\mu_{u_c}\bar{\varepsilon}_{v_c})\mu_{cd}+(1-\mu_{cd}-\varepsilon_{cd_m})\mu_{u_c}\bar{\varepsilon}_{v_c}+m_q(q_{cd})q_{cd} > 0$ so that the importer cost cutoff falls under joint relations.

First note that the LHS of the inequality is decreasing in $\mu_{u_c}\bar{\varepsilon}_{v_c}$ under $(1-\varepsilon)' > 0$. And we will need to show that $\mu_{u_c}\bar{\varepsilon}_{v_c} < \frac{(1-\mu_{cd})\mu_{cd}}{2\mu_{cd}+\varepsilon_{cd_m}-1}$. The RHS of this inequality is decreasing in μ_{cd} because $\frac{\partial\ln RHS}{\partial\mu} = -\frac{\varepsilon_m+1}{(1-\mu)(2\mu+\varepsilon_m-1)}+\frac{1}{\mu} < -\frac{\varepsilon_m+1}{2\mu+\varepsilon_m-1}+\frac{1}{\mu} = \frac{-(1-\varepsilon_m)(1-\mu)}{\mu(2\mu+\varepsilon_m-1)} < 0$. So the most binding inequality is at the highest μ_{cd} and ε_{cd_m}. At these values, the RHS is $\frac{b(1-b)}{2-3b}$. By assumption, $\mu_{u_c}\bar{\varepsilon}_v < \min\mu_v \min(1-\mu_v) \le b^2$ which is less than the RHS because $3b^2-3b+1 > 0$ for $b\in(0,1)$. So $d\ln d_m/d\ln z < 0$ and the importer cutoff is lower for joint relations. Finally, the price change is $d\ln p_{cd}/d\ln z = -d\ln(1-m_{cd})/d\ln z$ which gives $(1-m_{cd})\,d\ln p_{cd}/d\ln z = m_q q\frac{d\ln q}{d\ln z}+z = -\frac{m_q q}{\mu+\frac{m_q q}{1-m}}\left(\mu_u\frac{d\ln q_c}{d\ln z}\right)+\frac{\mu z}{\mu+\frac{m_q q}{1-m}} > 0$.

Having discussed the changes in observable outcomes across vertical relations, we will provide conditions for an increase in the cost cutoff for joint profit maximization after a reduction in import

tariffs. We look at a reduction in ad valorem tariffs. If τT is the amount paid to exporters, then they receive just T. The exporter's problem can be written as $\Pi_c = \tau^{-1}\beta \int_0^{d_m} \left[\left(p_{cd} - cd\right) q_{cd} L_d - f_{cd}\right] dG_d +$ $\tau^{-1}\beta\lambda_c L_d \left[zq_c - \int_0^{d_m} \nu(q_{cd}) dG_d\right] - z^2 f_c^J$ for a continuous choice of vertical relations denoted by z. Then the final markup is $m \equiv \mu_{v_{cd}} + \mu_{u_c}\bar{\varepsilon}_{v_c}/z \equiv \mu_v + y/z$. Firms will choose joint profit maximization if $\beta^{-1}\frac{d^2\Pi_c}{d\tau^{-1}dz} = \frac{d\int_0^{d_m}[(p_{cd}-cd)q_{cd}L_d - f_{cd}]}{dz} - (1-\eta)\frac{d\ln Q}{d\ln\tau^{-1}}\frac{d\int_0^{d_m} pq}{dz} > 0$. We know that the first terms is positive for joint relations that are viable. This also implies that given aggregate conditions Q, profits are supermodular in τ^{-1} and z or that joint relations are more likely for lower cost firms. When revenues fall under joint relations, we need to show that aggregate quantities rise with trade liberalization. Whenever aggregate trade volumes rise with trade liberalization, profits will be supermodular in vertical relations and the exporter cost cutoff will rise. We therefore provide conditions on primitives that ensure aggregate trade volumes rise after trade liberalization.

By definition, $\frac{d\ln y}{d\ln\tau} = \frac{\mu_u' q_c}{\mu_u}\frac{d\ln q_c}{d\ln\tau} + \int \frac{v'q(1-\mu-\bar{\varepsilon})}{\int v'qdG_d}\frac{d\ln q}{d\ln\tau}dG_d + \frac{(\varepsilon_m-\bar{\varepsilon})v_m d_m}{\int v'qdG_d}\frac{d\ln d_m}{d\ln\tau}$. From optimal pricing, $-\left(\mu + \frac{\mu' q}{1-m}\right)\frac{d\ln q}{d\ln\tau} = (1-\eta)\frac{d\ln Q}{d\ln\tau} - \frac{y/z}{1-m}\frac{d\ln z}{d\ln\tau} + \frac{y/z}{1-m}\frac{d\ln y}{d\ln\tau} + \mu_u\frac{d\ln q_c}{d\ln\tau}$. From optimal vertical relations, $\ln y + (\eta-1)\ln Q + \ln u' + \ln q_c - 2\ln z = \ln\tau + \ln 2f_c^J/\beta L$ so that $2\frac{d\ln z}{d\ln\tau} = \frac{d\ln y}{d\ln\tau} - (1-\eta)\frac{d\ln Q}{d\ln\tau} + (1-\mu_u)\frac{d\ln q_c}{d\ln\tau} - 1$. From the optimal cutoff and substituting for optimal prices, $\frac{d\ln d_m}{d\ln\tau} = -\frac{1}{1-m_m}(1-\eta)\frac{d\ln Q}{d\ln\tau} - \frac{y/z\varepsilon_m}{1-m_m}\frac{d\ln y}{d\ln\tau} + \frac{y/z\varepsilon_m - 1}{1-m_m}\mu_u\frac{d\ln q_c}{d\ln\tau}$. From $\ln q_c = \ln\int_0^{d_m} v(q)dG_d$, the change in total quantities is $\frac{d\ln q_c}{d\ln\tau} = \frac{v_m d_m}{\int vdG_d}\frac{d\ln d_m}{d\ln\tau} + \int\frac{v'q}{\int vdG_d}\frac{d\ln q}{d\ln\tau}$. Substituting for the changes in optimal vertical relations, cutoffs and markups, we obtain the change in q_c in terms of changes in the aggregate quantity Q which can then be solved using the definition of $Q \equiv \int u(q_c)dG_c$. The change in the production cost cutoff is $\frac{d\ln c_m}{d\ln\tau}\int_0^{d_m} cdq_{cd}dG_d = -\int_0^{d_m}\left[\left(p_{cd}-cd\right)q_{cd} - f_{cd}/L\right]dG_d - (1-\eta)\frac{d\ln Q}{d\ln\tau}\int_0^{d_m} p_{cd}q_{cd}dG_d$. The change in exporter-level quantity is

$$\left[1 + \mu_u\frac{v_m d_m}{\int vdG_d}\frac{1-y/z\varepsilon_m}{1-m_m} + \mu_u\int\frac{v'q}{\int vdG_d}\frac{dG_d}{\mu+\frac{\mu' q}{1-m}}\left(1 + \frac{1}{2}\left(1/\mu_u - 1\right)\frac{y/z}{1-m}\right) + A_c\right]\frac{d\ln q_c}{d\ln\tau} = -A/2 - A_Q\left(1-\eta\right)\frac{d\ln Q}{d\ln\tau}$$

where

$$A_y \equiv \left(\frac{v_m d_m}{\int vdG_d}\frac{y/z\varepsilon_m}{1-m_m} + \frac{1}{2}\int\frac{v'q}{\int vdG_d}\frac{1}{\mu+\frac{\mu' q}{1-m}}\frac{y/z}{1-m}dG_d\right) / \left(1 + \int\frac{v'q(1-\mu-\bar{\varepsilon})}{\left(\mu+\frac{\mu' q}{1-m}\right)\int v'qdG_d}\frac{y/z}{1-m}dG_d + \frac{(\varepsilon_m-\bar{\varepsilon})v_m d_m}{\int v'qdG_d}\frac{y/z\varepsilon_m}{1-m_m}\right),$$

$$A \equiv \int\frac{v'q}{\int vdG_d}\frac{1}{\mu+\frac{\mu' q}{1-m}}\frac{y/z}{1-m}dG_d + A_y\int\frac{v'q(1-\mu-\bar{\varepsilon})}{\left(\mu+\frac{\mu' q}{1-m}\right)\int v'q}\frac{y/z}{1-m}dG_d,$$

$$A_c \equiv A_y\left(\frac{\mu_u' q_c}{\mu_u} - \int\frac{v'q(1-\mu-\bar{\varepsilon})}{\left(\mu+\frac{\mu' q}{1-m}\right)\int v'qdG_d}\left(\mu_u - \frac{1}{2}\frac{y/z}{1-m}(1-\mu_u)\right)dG_d - \frac{(\varepsilon_m-\bar{\varepsilon})v_m d_m}{\int v'q}\frac{1-y/z\varepsilon_m}{1-m_m}\mu_u\right) \text{ and}$$

$$A_Q \equiv \frac{v_m d_m}{\int vdG_d}\frac{1}{1-m_m} + \int\frac{v'q}{\int vdG_d}\frac{1}{\mu+\frac{\mu' q}{1-m}}\left(1 + \frac{1}{2}\frac{y/z}{1-m}\right)dG_d + A_y\left(\frac{v'q(1-\mu-\bar{\varepsilon})}{\left(\mu+\frac{\mu' q}{1-m}\right)\int v'qdG_d}\left(1 + \frac{1}{2}\frac{y/z}{1-m}\right)dG_d + \frac{(\varepsilon_m-\bar{\varepsilon})v_m d_m}{(1-m_m)\int v'qdG_d}\right).$$

Then aggregate quantity rises after a reduction in tariffs as long as $A > 0$ and $A_c > -1$ for $z \in [0,1]$.

5.1 Quality-adjusted Triple Prediction

This sub-section reports the triple prediction using quality-adjusted prices, instead of unit values to determine whether prices rise after the FTA. As expected, the middle US exporters are again more likely to have triple predictions, as shown in Column (2) of Table 7. This is not driven by

extreme values, which are trimmed for the top and bottom 0.5 percentile of the κ_{cdsht} distribution in Column (3). This is also confirmed when we add another step to the estimation to recover the markup component that varies systematically with quantities sold to other importers. Specifically, we estimate $\kappa_{cdsht} = g(\ln q_{-cdsht}) + e_{cdsht}$ where $q_{-cdhst} \equiv \sum_{d' \neq d} q_{cd'hst}$ is the quantity sold by exporter c to importers of product h other than importer d. The predicted $\hat{g}_{csht} \equiv \sum_d \hat{g}_{cdsht}$ summarizes our theoretical counterpart of the upper tier markup (from $\mu_u \varepsilon_v$). Column (4) using $\hat{g}$ also shows the middle US exporters continue to have higher prevalence of the triple prediction with this refined measure of markups. The bottom exporters have a larger coefficient on the treatment variable, but the confidence intervals continue to be wide, suggesting lower importance of quantities sold to other importers in their pricing.

Table 7: Quality-adjusted Triple Prediction with Markups

Dependent Variable: ΔQuality-adjusted Triple$_{csht}$

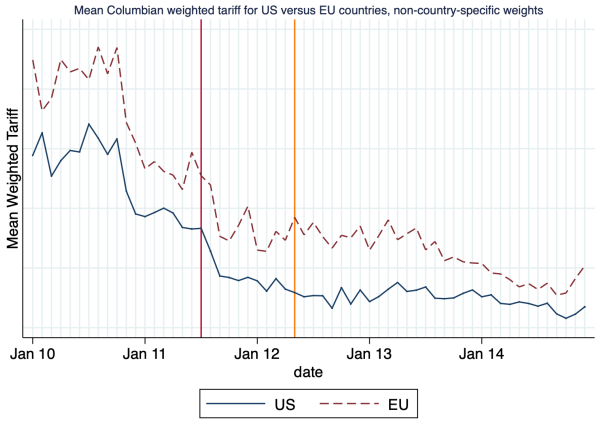
	(1)	(2)	(3)	(4)
	Baseline		Trim κ_{cdsht} at 0.5%	
	Average	90/10 percentile	90/10 percentile	90/10 percentile
$Treat_h \cdot Post_t \cdot USA_s$	0.0062			
	(0.0063)			
$Treat_h \cdot Post_t \cdot USA_s \cdot Bottom_{csh}$		0.0117	0.0116	0.0343
		(0.0230)	(0.0230)	(0.0487)
$Treat_h \cdot Post_t \cdot USA_s \cdot Middle_{csh}$		0.0204**	0.0201**	0.0375**
		(0.0092)	(0.0092)	(0.0151)
$Treat_h \cdot Post_t \cdot USA_s \cdot Top_{csh}$		-0.0372	-0.0383	-0.0288
		(0.0247)	(0.0247)	(0.0327)
Product-time FE	Yes	Yes	Yes	Yes
Country-time FE	Yes	Yes	Yes	Yes
Product-country FE	Yes	Yes	Yes	Yes
Observations	270,907	270,907	270,658	267,466
R^2	0.084	0.090	0.090	0.086

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

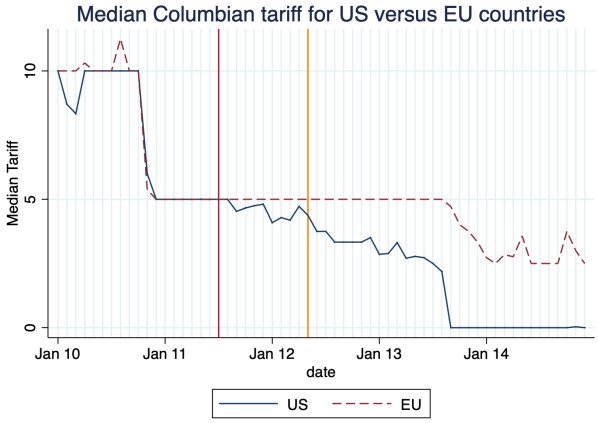
Note: Note: ΔQuality-adjusted Triple$_{csht} = 1$ if $\triangle \hat{\kappa}_{csht} > 0$ & $\triangle Quantity_{csht} < 0$ & $\triangle \# Importers_{csht} < 0$ from period $t-1$ to t and 0 otherwise in Columns 1 to 3 and replaced with $\Delta \hat{g}_{csht} > 0$ & $\triangle Quantity_{csht} < 0$ & $\triangle \# Importers_{csht} < 0$ in Column 4. Standard errors are clustered at the level of product-usa-post-sizebin.

Figure 1: Colombian Tariffs on US and EU Products in Pre and Post Periods

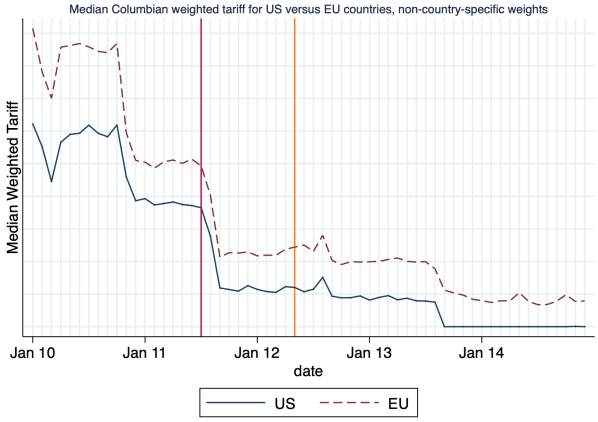
(a) Product share weighted mean



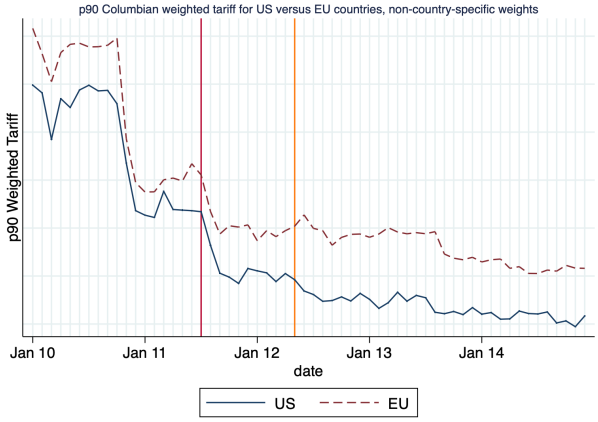
(b) Unweighted median



(c) Product share weighted median

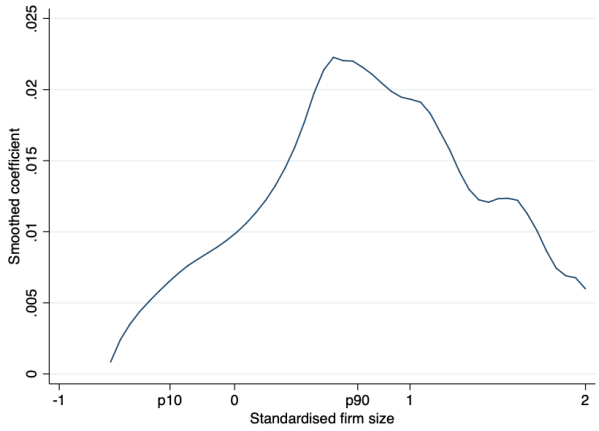


(d) Product share weighted 90th percentile



Note: Pre period refers to $t <$July 2011. Tariff refers to the summary tariff rate levied on US and EU products within a product category. Product share weight is the share of the product in Colombia's total imports from developed countries

Figure 2: Estimated Treatment Effect by Firm Size Distribution



Note: The estimated coefficient on $\text{Post}_t \cdot \text{Treat}_h \cdot \text{USA}_s$ is plotted against the standardized firm size distribution.