The Value of Deep Trade Agreements in the Presence of Pricing-to-Market

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Abstract

Do preferential trade agreements (PTAs) lead to greater market integration, more intense competition and less market power for firms? In this paper, we integrate the detailed data on 257 preferential trade agreements from the World Bank's Deep Trade Agreements (DTA) database with administrative customs datasets of product-level exports by firms from thirteen developing and emerging countries to estimate the responsiveness of firm-level exports, export prices, and destination-specific markups to trade and domestic policy commitments enshrined in deep trade agreements. Our findings suggest that both the direct and indirect effects of deep trade agreement provisions on export sales are quantitatively significant. Perhaps more interestingly, we find suggestive evidence of a pro-competitive effect of PTAs.

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1 Introduction

The vast majority of exporters produce multiple products and sell their wares globally in multiple countries. International pricing strategies are influenced by the degree of competition facing firms in each foreign country. This, in turn, depends on the nature of the product being sold, the number and size of direct competitors, and local institutions and domestic regulatory policies, including those which are affected by a country's participation in bilateral, regional or multilateral trade agreements.

How do the complex features of international trade agreements impact the choices of globally engaged firms? Do preferential trade agreements (PTAs) lead to greater market integration, more intense competition and less destination-specific market power for firms? In this paper, we integrate the detailed data on 257 preferential trade agreements from the World Bank's Deep Trade Agreements (WB DTA) database with administrative customs datasets of product-level exports by firms from thirteen developing and emerging countries to estimate the responsiveness of firm-level exports, export prices, and destination-specific markups to trade and domestic policy commitments enshrined in deep trade agreements.

Recent empirical research using the universe of international trade transactions for the UK over 2010-2017 (Corsetti, Crowley and Han (2020)) and for China over 2000-2014 (Corsetti, Crowley, Han and Song (2019)) has found that exporting firms that serve multiple foreign markets use different pricing strategies according to observable characteristics of the good being traded, the firm's corporate structure, and the currency in which the transaction is invoiced. This research introduced a new, unbiased trade-pattern-sequential-fixed-effects (TPSFE) estimator to analyse the adjustments of markups and sales volumes by multi-destination exporters in response to destination-specific changes in market conditions. This estimator successfully identifies the destination-specific markup elasticity by controlling for unobserved marginal costs in large unbalanced panels where the set of markets served by firms varies endogenously with local market conditions. These studies have advanced our quantitative understanding of the extent to which firms utilize a global versus a local strategy for setting prices. Of particular importance is the finding that pricing-to-market (or, equivalently, the adjustment of markups in local destinations in response to local destination variables such the origin-destination exchange rate) is more significant in consumption goods relative to intermediates, goods which are highly differentiated (i.e., automobiles and consumer electronics), goods which originate from foreign-invested firms, and goods whose sale is invoiced in the local currency of the

destination. This raises the question of which features of the local destination market contribute to an environment in which foreign exporters can exploit their market power and utilize pricing-to-market strategies.

In this paper, we develop a new approach to evaluating how provisions in deep trade agreements that confer a benefit to a trading partner impact firm-level export sales and markups. Of particular interest in our study is quantifying how any deep trade agreement provisions between a destination and its trading partners impact trade from origin countries that do not participate in the deep trade agreement, after controlling for multilateral resistance in the origin and destination. In other words, we examine if preferential trade agreements lead to more intense competition and less destination-specific market power for firms that are outside the agreement.

Our approach builds on the basic insight from the structural gravity literature that changes in prices which reflect PTA-induced changes in the competitive environment in origin and destination countries can be absorbed in time-varying multilateral resistance terms (origin-product-time and destination-product-time fixed effects, as in Anderson and van Wincoop (2003); Feenstra (2004); Redding and Venables (2004); Baier and Bergstrand (2007); Head and Mayer (2014); Baier, Bergstrand and Feng (2014); Mattoo, Mulabdic and Ruta (2017)). Our analysis focuses on bilateral barriers to market access for a firm in origin o exporting to destination d. We consider both direct barriers to market access associated with destination d's policy toward country o as well as any indirect limits to market access that firms from origin o experience as competition from third-country exporters which face a different set of trade policies in destination d.

The direct measures of market access we study include the existence of a PTA, product-level preferential tariffs on imports, and deep trade agreement provisions that further facilitate market access; specifically, rules regarding the documentation necessary to show a good satisfies a PTA's rules of origin, commitments to prohibit or regulate anticompetitive behaviours, and rules regarding mutual recognition of standards or conformity assessment. We introduce the use of trade-weighted measures of policies facing third-country exporters to destination d as proxies that capture the indirect effect of the intensity of competition in the destination on the sales and pricing decisions of firms exporting from origin o. These indirect proxies for the intensity of competition include a trade-weighted measure of PTAs between the destination and third countries, the trade-weighted average tariff facing exporters from third countries, and trade-weighted measures that reflect how widely a particular deep trade agreement provision is available to exporters from third countries.

Our research builds on a methodologically diverse body of work examining how prices and markups change in response to trade policy changes (De Loecker, Goldberg, Khandelwal and Pavcnik (2016), Amiti and Konings (2007), Konings and Vandenbussche (2005), Bown and Crowley (2006), Pierce (2011)). A novel feature of our approach is its examination of how third-country competition impacts prices and markups, building on previous models of trade policy "spillovers" into bilateral trade relations (Chang and Winters (2002), Bown and Crowley (2007), Lee, Mulabdic and Ruta (2019)) and empirical work on exporting firms' cross-market supply responses to changes in destination market markups (Corsetti, Crowley, Han and Song (2019)).

Our findings suggest that both the direct and indirect effects of deep trade agreement provisions on export sales are quantitatively significant. Perhaps more interestingly, we find suggestive evidence of a pro-competitive effect of PTAs. After controlling for time-varying multilateral resistance in a destination, a firm's product-level markup in a destination tends to decline when its origin country participates in a PTA with a destination. While PTAs appear to be associated with lower markups overall, specific provisions related to rules of origin are associated with higher markups while specific commitments to competition-enhancing policies and some provisions related to mutual recognition are associated with lower markups. Additionally, when we restrict our analysis to highly differentiated goods, we estimate a sizeable elasticity of a firm's product-level markup to its tariff in that destination as well as to a weighted average of tariffs faced by its third-country competitors in the destination. For these highly differentiated goods over which firms presumably have greater market power, our preliminary findings suggest higher tariffs facilitate higher markups.

2 Empirical Strategy

Our starting point is the canonical expression of the gravity equation from Baier and Bergstrand (2007), as presented by Limão (2016), adapted to data of firms' product level exports from multiple origin countries o to all destination countries d. It models trade flows as a function of preferential trade agreements (PTAs) and a set of fixed effects.

$$ln(v_{fodit}) = \beta_1 * pta_{odt} + \delta_{foit} + \delta_{dit} + \delta_{od} + \epsilon_{fodit} \tag{1}$$

The dependent variable $ln(v_{fodit})$ is the natural logarithm of the value of firm

f's exports of products i from origin o to destination d at time t. pta_{odt} is an indicator for whether the origin and the destination have an active trade agreement in year t. The three sets of fixed effects capture variation at the firm-origin-product-time (δ_{foit}), destination-product-time (δ_{dit}) and origin-destination levels (δ_{od}). The origin-product-time element of the firm-product-origin-time fixed effects (δ_{foit}) and the destination-product-time fixed effects (δ_{dit}) capture multilateral resistance terms, as is standard in the gravity literature (Anderson and van Wincoop, 2003; Feenstra, 2004; Redding and Venables, 2004; Head and Mayer, 2014; Baier, Bergstrand and Feng, 2014). The inclusion of the more detailed firm-product-origin-time fixed effects allows us to control for time-varying conditions of supply at the level of the product within a firm in an origin.

Of course, the existence of PTAs is intertwined with the level of bilateral trade flows. The larger the trade flows between two countries, the greater the benefits from and therefore the incentive to sign a PTA. This means that there is potential for reverse causality in that it might be large trade flows which cause the PTA, rather than the PTA which causes large trade flows. To the extent that this is a problem, it is likely to be an issue at the aggregate level, and since we are making comparisons across destinations within firm-product-year triplets, the main reverse causality problem is likely to be cross-sectional. Accounting for unobserved heterogeneity at the country-pair level should therefore all but resolve these concerns and, as is common in the literature, we thus include origin-destination fixed effects (δ_{od}), as recommended by Baier and Bergstrand (2007).[1]

Equation 1 allows us to investigate the effect of PTAs between an origin and a destination on their bilateral trade flows. Since we are interested in how market access is affected by both PTAs between the origin and the destination and PTAs between the origin's competitors and the destination, we extend equation 1 to equation 2.

$$\begin{aligned} ln(v_{fodit}) = \beta_1 * pta_{odt} + \beta_2 * competitor\_pta_{(-o)dit} + \\ + \delta_{foit} + \delta_{dit} + \delta_{od} + \epsilon_{fodit} \end{aligned} \tag{2}$$

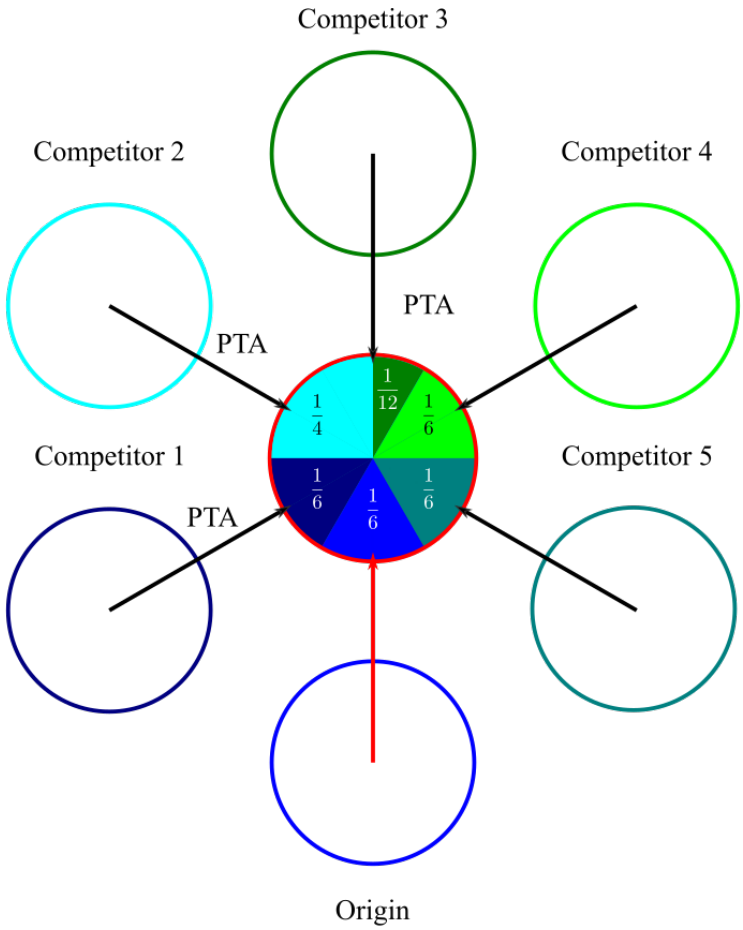
[1]We estimate our specifications using OLS, rather than PPML, as creating a full panel of zero trade flows at the firm and product-level for 13 countries would result in a dataset of several billion observations, making estimation of PPML with conventional multi-core servers infeasible in a reasonable time period. This means that we only use positive trade flow observations. See Helpman, Melitz and Rubinstein (2008) for a discussion of biases associated with omission of zero trade flows. The inclusion of origin-destination fixed effects, however, absorbs most of the variation in trade costs that prevents firms from entering a market and thus accounts for the selection process that gives rise to the positive trade flows (Baier, Bergstrand and Feng, 2014).

Table 1: Variable Definitions

Variable	Definition
$competitor\_pta_{(-o)dit}$	$\frac{\sum_{c \in C \neq o} pta_{cdt} \times trade\_share_{cdit-1}}{\sum_{c \in C \neq o} trade\_share_{cdit-1}}$
	past trade share weighted proportion of competitors c in product i with access to a trade agreement with destination d at time t
$competitor\_provision_{(-o)dit}$	$\frac{\sum_{c \in C \neq o} provision_{cdt} \times trade\_share_{cdit-1}}{\sum_{c \in C \neq o} trade\_share_{cdit-1}}$
	past trade share weighted proportion of competitors c in product i with access to a given provision in a trade agreement with destination d at time t
$competitor\_\tau_{(-o)dit}$	$\frac{\sum_{c \in C \neq o} bilateral\_\tau_{cdit} \times trade\_share_{cdit-1}}{\sum_{c \in C \neq o} trade\_share_{cdit-1}}$
	past trade share weighted average tariff faced by competitors c in destination d and product i at time t

This equation features an additional variable, $competitor\_pta_{(-o)dit}$, that proxies for the third-country competition an exporting firm from origin o faces in destination d. This variable represents the weighted proportion of an origin country's competitors which have access to an active trade agreement with the destination, using the previous period's trade shares as weights. The coefficient β_2 is a semi-elasticity and the statistic $100 * (e^{x * \beta_2} - 1)$ represents the percentage change in a firm's product-level export values in response to another x percent of the origin's competitors gaining access to a PTA with the destination.

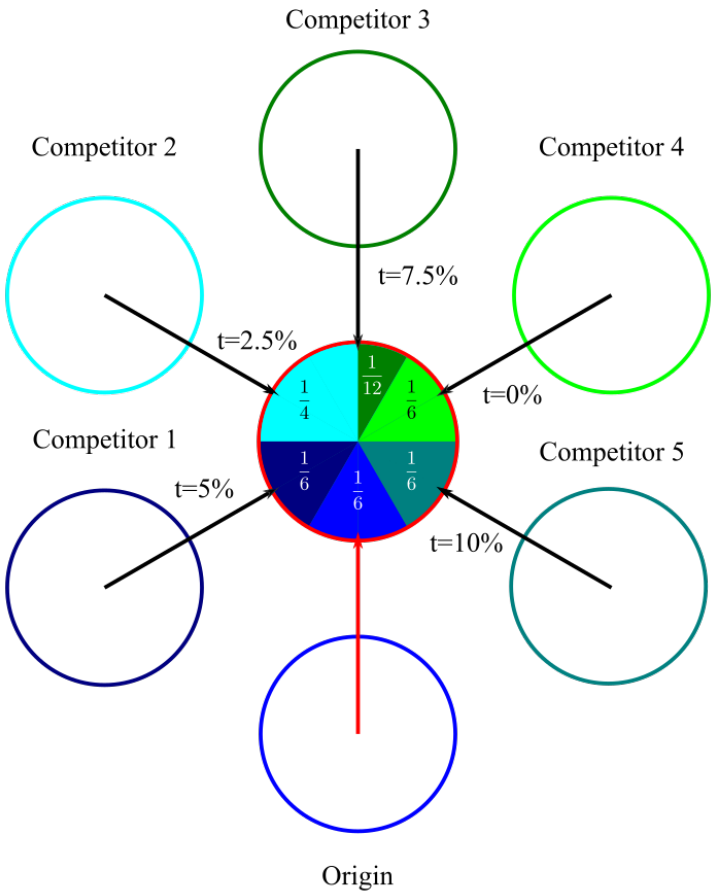
To create this variable, which is illustrated in figure 1 and defined in table 1, we first multiply the trade share of each of the origin's competitors in the destination in the previous period with an indicator for whether this competitor and the destination currently have an active trade agreement. We then sum across these countries to find the trade weighted share of countries, excluding the origin, with access to a PTA with the destination. To turn this into the proportion of the origin's competitors who benefit from preferential treatment, we normalise by dividing by the total trade share of



$$competitor\_pta_{(-o)dit} = \frac{\frac{1}{6} * 1 + \frac{1}{4} * 1 + \frac{1}{12} * 1 + \frac{1}{6} * 0 + \frac{1}{6} * 0}{\frac{1}{6} + \frac{1}{4} + \frac{1}{12} + \frac{1}{6} + \frac{1}{6}} = 0.6$$

Figure 1: Calculating the Proportion of Competitors with Access to a PTA

Note: This figure illustrates how we calculate the variable $competitor\_pta_{(-o)dit}$, which captures the effect of competitors' trade agreements on trade flows. Consider a scenario in which our origin country of interest, the deep blue circle at the bottom, competes with five other countries, the five other blue and green circles on the sides, to sell a given product in a destination, the red circle in the centre. Suppose that the previous year's $(t-1)$ trade shares of the six exporting countries are given by the numbers in the figure. We start by multiplying each of the five competitors' trade shares in the previous year with an indicator for whether this competitor currently has access to a PTA with the destination and then adding these terms together. This is shown in the numerator of the equation at the bottom of the figure. To avoid creating a mechanical relationship between our variable and the origin's trade share, we further normalize by dividing by the total trade share of all five competitors in the previous year. This is the rationale behind the denominator. In this example, our calculations reveal that 60% of the origin country's competitors in the product we are considering have access to a PTA with the destination.



$$competitor\_\tau_{(-o)dit} = \frac{\frac{1}{6} * 5 + \frac{1}{4} * 2.5 + \frac{1}{12} * 7.5 + \frac{1}{6} * 0 + \frac{1}{6} * 10}{\frac{1}{6} + \frac{1}{4} + \frac{1}{12} + \frac{1}{6} + \frac{1}{6}} = 4.5\%$$

Figure 2: Calculating the Average Tariff Faced by Competitors

Note: This figure illustrates how we calculate the variable $competitor\_\tau_{(-o)dit}$, which captures the effect of the average tariff faced by a country's competitors on trade flows. The calculation in this graph is almost identical to that presented in figure 1, with the exception that we use bilateral tariff rates rather than PTA status indicators to construct this variable. As before, the blue circle at the bottom represent an origin country which is competing with five other countries, the remaining blue and green circles, to sell a given product in a destination, the red circle in the centre. The numbers in the centre red circle again indicate the trade shares of these countries in the previous year $(t-1)$. We start by multiplying each of the five competitors' trade shares in the previous year with the bilateral tariff they currently face in the destination and then adding these terms together. This is shown in the numerator of the equation at the bottom of the figure. To avoid creating a mechanical relationship between our variable and the origin's trade share, we further normalize by dividing by the total trade share of all five competitors in the previous year. This is the rationale behind the denominator. In this example, our calculations reveal that the origin country's competitors face an average tariff of 4.5% in the product we are considering.

the origin's competitors in the destination in the previous period. As we use product level trade shares in these calculations, $competitor\_pta_{(-o)dit}$ varies across products as well as across country pairs and time. This means that $competitor\_pta_{(-o)dit}$ can take different values for different products within a given origin-destination country pair and year, provided there is variation in the product-level trade shares of the origin's competitors in the destination in the previous year.[2] Notice that unlike the PTA variable, there should be no endogeneity concerns surrounding the competitor PTA variable so long as policymakers only consider direct bilateral trade flows with their PTA partners when deciding whether or not to sign a PTA.

To allow us to investigate the competitive effects of a broader set of trade policies, our main specification, presented in equation 3, adds tariffs and specific trade agreement provisions to equation 2. This helps us to identify which elements of a preferential trade agreement have the strongest effects on the competitive behaviour of firms.

$$\begin{aligned} ln(v_{fodit}) = {} & \beta_1 * pta_{odt} + \beta_2 * competitor\_pta_{(-o)dit} \\ & + \beta_3 * ln(1 + bilateral\_\tau_{odit}) + \beta_4 * ln(1 + competitor\_\tau_{(-o)dit}) \\ & + \beta_5 * provision_{odt} + \beta_6 * competitor\_provision_{(-o)dit} \\ & + \delta_{foit} + \delta_{dit} + \delta_{od} + \epsilon_{fodit} \end{aligned} \tag{3}$$

There are four new variables in this specification, two relating to the destination's trade policy towards the origin and two relating to the destination's trade policy towards the origin's competitors. The first two capture the direct effect of the PTA on trade between the origin and destination; $ln(1+bilateral\_\tau_{odit})$ denotes the natural logarithm of one plus the tariff the destination charges on imports of product i from the origin while $provision_{odt}$ is an indicator for whether the origin and the destination currently have a specific deep trade agreement provision in any of their active trade agreements.[3] The second two variables are trade-weighted measures of policies facing the origin's competitors, defined analogously to $competitor\_pta_{(-o)dit}$. The variable $ln(1+competitor\_\tau_{(-o)dit})$, illustrated in figure 2, represents the natural logarithm of one plus the weighted tariff faced by the origin's competitors in a given product in the destination while the variable $competitor\_provision_{(-o)dit}$ is the weighted average

[2] As a robustness check, we also constructed competitor variables using the product-level import shares of competitor countries averaged over years $t-1$ to $t-3$ and obtain similar estimation results.

[3] This empirical specification is similar to that used by Bown and Crowley (2007) to capture the third-country "trade deflection and trade depression" effects of antidumping policy.

of an origin country's competitors which have access to a given deep trade agreement provision in any currently active trade agreement with the destination.[4]

In considering the competitive effects of deep trade agreement provisions, we draw a distinction between provisions which exclusively alter the trade costs between the origin and the destination ("bilateral provisions") and provisions which lead the destination to change its behaviour in a way that affects all of its trade partners ("multilateral provisions").[5] Within each set of provisions, we attempt to select examples which seem likely to help and examples which seem likely to hinder trade from other countries. Given that some provisions are often found together, it is of course possible that our variables may capture the effect of provisions that are excluded from our regressions.

2.1 Third-country competition effects on prices and markups

We use a similar empirical strategy to examine both the direct and indirect, third-country, impacts of preferential trade agreements on prices and markups. We begin with a pricing equation similar to (3) which includes both the direct and third-country competitors' effects of PTAs, tariffs, and trade agreement provisions.[6]

$$\begin{aligned} ln(p_{fodit}) = {} & \beta_1 * pta_{odt} + \beta_2 * competitor\_pta_{(-o)dit} \\ & + \beta_3 * ln(1 + bilateral\_\tau_{odit}) + \beta_4 * ln(1 + competitor\_\tau_{(-o)dit}) \\ & + \beta_5 * provision_{odt} + \beta_6 * competitor\_provision_{(-o)dit} \\ & + \delta_{dit} + (\delta_f + \delta_{oit} + \delta_{od}) \text{ OR } (\delta_{foit} + \delta_{od}) + \epsilon_{fodit} \end{aligned} \tag{4}$$

The dependent variable is the natural log of the unit value of a product i sold by firm f located in origin o to destination d in year t. In the last row of equation (4), we indicate that our analysis of prices or markups will proceed by including one of two possible sets of fixed effects: for the firm (δ_f), origin-product-time (δ_{oit}), and origin-destination pair (δ_{od}) when we wish to analyse prices, or for the product sold

[4]Studies on the take-up rate of preferential tariffs have shown that PTA partners do not always take advantage of preferential tariffs. We set this complication aside and implicitly assume that the availability of lower, preferential tariffs increases competitive pressures in destination country d.

[5]An example of a bilateral provision would be a commitment to allow firms from a partner country to submit customs documentation electronically, while an example of a multilateral provision would be a commitment to create a digital customs infrastructure. In the former case only the partner country benefits, whereas in the latter all countries which export to the destination stand to gain.

[6]The inclusion of third country trade policies in an empirical model of prices follows Bown and Crowley (2006).

by a firm located within an origin in a given year (δ_{foit}) and origin-destination pair (δ_{od}) when we want to study markups. When the pricing specification includes firm fixed effects (δ_f), variation related to a firm's time-invariant productivity, size, or, possibly, market power, is absorbed by the fixed effect so that we can interpret the magnitude of both the direct and third country effects arising from PTAs, tariffs, or trade agreement provisions as the responsiveness for an average firm in our thirteen country exporter's dataset. Additionally, the inclusion of an origin-destination fixed effect (δ_{od}) absorbs pricing variation associated with time-invariant features such as distance or quality (Bastos and Silva (2010)) or via, for instance, the Alchian-Allen effect (Hummels and Skiba (2004)). For example, if prices within a bilateral pair are generally higher or lower relative to the average for a product in the destination, this control will allow us to identify the average effect of policy on prices across all bilateral pairs. The origin-product-time fixed effect serves as a control for cost-push inflationary pressures on prices, such as increases in industry wages.

Lastly, when the log unit value (price) is the dependent variable, the inclusion of firm-origin-product-time fixed effects controls for time-varying marginal costs at the level of the product within a firm as well as time-variation in the global or common markup that the firm charges in all foreign destinations (Corsetti, Crowley, Han and Song (2019)). This specification allows us to identify how the component of the markup that is specific to a destination (i.e., the pricing-to-market component) changes when a country joins a PTA, has competitors join a PTA in a destination, faces tariff changes in the destination, etc. As in the pricing specification, the inclusion of origin-destination fixed effects controls for average differences in price levels across country-pairs.

Because destination-product-time fixed effects are included in all price and markup specifications, our analysis always controls for changes in multilateral resistance in a destination-product-time triplet. Thus, if a destination's participation in a PTA is pro-competitive, inducing a fall in average prices or markups, this effect is captured by the δ_{dit} fixed effect. Our use of direct PTA, tariff, and trade agreement provision variables as well as trade-weighted competitors' variables enables us to decompose the remaining variation in prices and markups by exporters into (partial) pro-competitive effects of direct policy changes as well as those due to increased competition from policy changes against competitors.[7]

[7]In future work, we plan to expand our study of markups by implementing the trade patterns sequential fixed effect estimator of Corsetti, Crowley, Han and Song (2019) which will better enable us to control for composition changes in the mix of products sold within a HS06 product code associated with firm-product entry into and exit from different destinations.

2.2 Changes in firms' market shares

Our last empirical specification explores a new area for firm-level studies of trade; a firm's product-level share of each destination's import market. Our baseline specification uses firm-level trade data from 13 countries to calculate each firm's share of a destination's import market at the HS06 product-level among these 13 countries. We regress these import market shares on measures of PTAs, tariffs, competitors' PTAs and competitors' tariffs along with firm-origin-product-time, destination-product-time and origin-destination fixed effects.[8]

$$\begin{aligned} ms_{f\in dit} = {} & \beta_1 * pta_{odt} + \beta_2 * competitor\_pta_{(-o)dit} \\ & + \beta_3 * ln(1 + bilateral\_\tau_{odit}) + \beta_4 * ln(1 + competitor\_\tau_{(-o)dit}) \\ & + \delta_{foit} + \delta_{dit} + \delta_{od} + \epsilon_{fodit} \end{aligned} \tag{5}$$

Our motivation to examine firm-product import market shares arises from our interest in how changes in these shares impact a firm's pricing power and destination-specific markup. For example, in the Melitz (2003) model of heterogeneous firms and CES demand, firms with the highest productivity have the largest market shares and the highest markups over marginal cost. Joining a DTA can change the distribution of foreign market shares for firms, with the most productive firms increasing their market share while the least productive experience a contraction in sales. Because the CES demand structure implies constant markups, we would expect no correlation between change in market share and a firm's markup.[9] In contrast, Atkeson and Burstein (2008) embed oligopolistic competition among firms in a CES demand structure in which there is substituability within sectors (ρ) and across sectors (η) in each destination. This structure generates variable markups that directly increase with the firm's market share in the destination because the elasticity of demand facing each firm is a function of the firm's market share.

Our final specification repeats specification (5) but uses as the dependent variable a firm's share of a destination's import market among firms from its own origin

[8] While we define the firm's share of the destination's import market relative to the destination's imports from the 13 countries in our sample, rather than relative to the destination's total imports, the inclusion of destination-product-time fixed effects implies that both definitions would give the same result.

[9] Of course, a trade agreement could have a non-linear impact on import market shares; firms with the largest foreign market shares pre-liberalization could increase their market shares while the lowest productivity exporting firms could see their foreign market shares fall. We are reserving an examination of non-linear responses for future research.

($ms_{f \in oidt}$) rather than among firms from all origins for which we have data. The formation of a new PTA or a reduction in destination import tariffs should be expected to increase the number of exporters from an origin, resulting in a reduction in the average market share of firm's from that origin.

3 Data

To investigate how deep trade agreement provisions affect the sales and pricing decisions of firms, we bring together information on i) firms' product-level export values and quantities from thirteen countries, ii) product-level imports from 250 countries, iii) 257 preferential trade agreements, and iv) bilateral tariffs from 165 countries. Our final dataset spans the years 1993-2016 and contains 27,549,039 firm-product-origin-destination-year quintuplets, of which 84% are from 2000-2006, 91% from 2000-2009 and 98% from 2000-2012.

3.1 Firm-Level Trade

We use administrative data on the universe of firm-level exports for 13 developing and emerging economies, obtained from three different sources. Data for Albania, Bulgaria, Burkina Faso, Guatemala, Jordan, Malawi, Mexico, Peru, Senegal, Uruguay and Yemen are taken from the World Bank Exporter Dynamics Database, data for Egypt from the Economic Research Forum Exports Dataset and data for China from the Chinese Customs Database.[10]

Apart from the Chinese Customs Database, which contains monthly data on HS08 products, these datasets provide information on non-zero annual firm-product level export values and volumes to individual foreign destinations based on HS06 products. To ensure the data are comparable and easily matched to our tariff and commodity classification data, we aggregate the Chinese data to the annual and HS06 product levels. As summarised in table 2, data for different countries is available for different years. Export values are free on board figures reported in US dollars for all countries other than Senegal, for which export values represent cost, insurance and freight figures. With the exception of China and Egypt, which use a variety of measures, as well as Mexico, for which there is no information on units for the years 2000-2009, export volumes are reported as net weight in kilograms. Data on this

[10]For more information about the World Bank Exporter Dynamics Database, see Cebeci, Fernandes, Freund and Pierola (2012) and Bortoluzzi, Fernandes and Pierola (2015).

variable are not available for Guatemala and Jordan. Similar to other studies using administrative data, we use trade unit values as a proxy for prices.

3.2 Product-Level Imports

To calculate the trade shares which feature in our main independent variables of interest – competitors' PTA, competitors' average tariff, and competitors' access to a specific DTA provision– we use import data at the HS06 level, reported inclusive of cost, insurance and freight, for the years 1990-2016 from UN Comtrade.

3.3 Trade Agreements

Our data on trade agreements comes from the new World Bank Deep Trade Agreements (WB DTA) Database, which contains detailed information on various disaggregated provisions in 257 agreements which entered into force between 1958 and 2015. We focus on four provisions in particular. The first two provisions are related to rules of origin (ROO) and respectively encode whether i) certificates can be issued by the exporter/importer without the need for authentication by a competent (government) authority and ii) certificates have to be issued by competent (government) authorities of the exporting party.[11] The second two provisions are about technical barriers to trade and specify whether the agreement contains i) mutual recognition of standards and ii) mutual recognition of conformity assessment.[12]

[11] Trade agreement provisions related to rules of origin are found in Chapter 8 of the WB DTA Database. We refer to the first ROO provision as self-certification by the exporting firm. This is a binary variable coded as 1 when the answer to the following question about the PTA is yes. "Can the [origin] certificate be issued on the basis of self-certification by the exporter / producer / importer without need for authentication by the competent authority?" The second ROO provision we study is one indicating that origin certifications must by issued by a government or other designated authority. It is coded as 1 when the answer to the following question is yes. "Does the certificate have to be issued by competent authorities of the exporting party, including customs administrations, other government authorities, and designated private ones?"

[12] Trade agreement provisions related to trade facilitation through mutual recognition are found in Chapter 11 of the WB DTA Database. The first mutual recognition provision is a binary variable coded as 1 when the answer to the following question about the PTA is yes. "Standards: - Is mutual recognition in force?" The second mutual recognition provision is a binary variable equal to 1 when the answer to the following question is yes. "Conformity Assessment - Is mutual recognition in force? "

Table 2: Firm-Level Trade Data: Countries and Years

Country	Years	Value	Volume	Firms	Observations	... with PTA	... with Competitor PTA
Albania	2004-2012	✓	✓	6, 314	69, 788	6, 090	53, 511
Burkina Faso	2005-2007	✓	✓	718	6, 692	3, 413	4, 808
	2008-2012	✓	✓	1, 173	10, 606	6,016	7, 936
Bulgaria	2001-2006	✓	✓	50, 788	835, 042	524, 232	684, 753
China	2000-2006	✓	✓	230, 339	20, 043, 171	1, 168, 391	15, 635, 899
Egypt	2005-2016	✓	✓	24, 150	815, 819	658, 215	644, 381
Guatemala	2005-2013	✓		13, 635	505, 809	288, 229	405, 090
Jordan	2003-2012	✓		7, 356	113, 608	85,279	70, 057
Mexico	2000-2007	✓	✓	112, 826	2, 146, 259	1, 230, 160	1, 666, 231
	2007-2009	✓	✓	59, 719	1, 073, 386	599, 038	869, 610
	2010-2011	✓	✓	47, 881	764, 277	415, 385	631, 294
	2012	✓	✓	34, 684	448, 804	308, 744	368, 904
Malawi	2006-2008	✓	✓	1, 360	9, 832	5, 903	8, 802
	2009-2012	✓	✓	3, 036	21, 476	13, 818	19, 236
Peru	1993-2013	✓	✓	37, 145	1, 150, 110	368, 623	941, 634
Senegal	2000-2012	✓	✓	3, 002	95, 025	44, 955	42, 240
Uruguay	2001-2012	✓	✓	7, 306	141, 163	45, 210	115, 603
Yemen	2008-2012	✓	✓	1, 246	19, 858	11, 533	12, 332

Notes: The columns "...with PTA" and "...with Competitor PTA" report the number of observations for which our pta_{odt} and $competitor\_pta(-o)dit$ variables take positive values. For pta_{odt}, this amounts to the number of observations for which there is an active PTA between the origin and the destination. The variable $competitor\_pta(-o)dit$ appears in our dataset with a positive value if two conditions are met: (1) the destination has an active PTA with a competitor country and (2) the destination had non-zero imports of product i from this competitor in $t-1$. Thus, of 69k export observations from Albania, 53k of these exports were to destinations in which at least one competitor had a PTA.

3.4 Tariffs

Our data on bilateral ad-valorem tariffs is constructed from data on preferential and applied most favoured nation (MFN) tariffs available on the WTO website.[13] Where destinations report preferential tariffs, we set our bilateral tariff variable equal to the lowest reported preferential tariff a destination offers to exporters from a given origin. Otherwise, we use data on the MFN tariff applied by the destination.[14]

In many cases, countries do not report their tariff schedules to the WTO every year. Whenever possible, we attempt to impute missing values, following the steps set out in Feenstra and Romalis (2014). For applied MFN tariffs, we replace missing values with the closest preceding value, on the basis that updated tariff schedules are more likely to be available after significant changes. In cases where there is no preceding value, we use the closest subsequent value. For preferential tariffs, which are frequently phased-in after an agreement is negotiated, we attempt to replace missing values with information we extract from the data collected by Feenstra and Romalis (2014).

3.5 Classification of Product Differentiation

Our analysis of markups and pricing-to-market responses is predicated on the idea that some firms hold significant market power in at least some products traded internationally. In prior work (Corsetti, Crowley, Han and Song (2019)), we document that market power and pricing-to-market vary systematically across different types of globally traded products. To investigate the competitive effects of trade policy for different types of products, we employ the CCHS commodity classification system to determine the degree of product differentiation. Our empirical analysis begins with the universe of traded goods. We then restrict our analysis to a sample of highly differentiated goods to determine if the sales values, prices or markups of products in which firms presumably hold more market power respond diferently to trade policy changes.[15]

[13] Preferential and applied MFN tariffs are available for 138 and 165 of the 250 importers in our sample, respectively.

[14] We have data on bilateral tariffs for 26,283,633 of the 27,549,039 observations in our final dataset.

[15] Most studies adopt the industry classifications set forth by Rauch (1999), according to which a product is differentiated if it does not trade on organized exchanges and/or its price is not regularly published in industry sales catalogues. While this system is quite powerful in identifying commodities, a drawback is that the vast majority of manufactured goods end up being classified as differentiated. The CCHS classification refines the class of differentiated goods in Rauch into two categories—high and low differentiation. Corsetti, Crowley, Han and Song (2019) calculate that in

The CCHS classification sorts products into two distinct groups, high and low differentiation goods, according to a linguistic feature of the Chinese language that is present in China's quantification of export volumes in customs declarations. The core idea is a simple one: traded goods whose quantity is recorded in customs data in countable units are more differentiated than goods whose quantity is recorded by weight or volume (e.g., motorcycles and consumer electronics are more differentiated than canned tomato paste or industrial chemicals). In Chinese trade data, we find quantity reported in more than 30 indigenous Chinese units of measure, including distinct words representing the unit count of wheeled vehicles, engines, upper-body clothing articles, etc. Because the choice of the *measure word* used to record a product's quantity is predetermined by Chinese grammar and linguistics, it reflects a good's intrinsic physical features, and pre-dates modern customs systems of recording quantity. By exploiting the distinction between what linguists refer to as count versus mass measure words, we are able to construct a general product classification for the Harmonized System.[16]

3.6 Broad Economic Categories

To partition the product space even further we use the fourth revision of the UN's Broad Economic Categories (BEC) classification, which categorises all internationally traded goods according to their end-use, to distinguish between intermediate and consumption goods. This is particularly useful because it enables us to examine the differential impacts of PTAs on trade values, markups and, indirectly, competition across these two types of goods, allowing us to investigate the effect which PTAs have on global value chains.

3.7 HS Product Classification

Our firm- and product-level trade, tariff and commodity classification data are reported based on the HS product classification system. As our data span a large number of years and the HS system is updated periodically, our data feature five different revisions of the HS system (HS1992, HS1996, HS2002, HS2007 and HS2012). To ensure that the product codes in our analysis are consistent over time, we follow

the Chinese Customs Database 2000-2014, 79.8 percent of observations are classified by Rauch as differentiated. Of these, only 48.6 percent are categorized as highly differentiated under the CCHS Chinese-linguistics-based classification system.

[16] See Corsetti, Crowley, Han and Song (2019) for a more extensive discussion of measure words and evidence of how they are used in other East Asian customs recording systems.

Cebeci (2015) and consolidate HS codes, by identifying networks of related product codes in the HS system and assigning a unique consolidated code to each network. This reduces the number of distinct products in the HS system from 6,293 to 4,039.

4 Results

Firms in the thirteen emerging and developing countries in our dataset trade more with countries with which they form PTAs. However, perhaps somewhat surprisingly, the signing of a PTA between an origin and a destination is associated with a modest decline in the average value of a firm's exports. In table 3 column (1), the baseline specification shows that the existence of a PTA between a country pair is associated with higher firm-level exports, a partial PTA effect of 0.42, or 52% higher trade. At first blush, this estimate seems to be broadly in line with panel data estimates from Baier and Bergstrand (2007) of 0.46 or Limão (2016) of 0.37. However, it is worthwhile noting at the outset that these panel data studies covering global trade flows over multiple decades obtain their estimates of the partial PTA effect after controlling for time invariant bilateral features of a country-pair such as distance, language, etc. with origin-destination bilateral fixed effects. Our estimate in column (1) excludes any control for bilateral pairs and, hence, is identified off time variation within a bilateral pair associated with the PTA variable as well as cross-sectional variation between bilateral pairs that do or do not form PTAs. The focus of our analysis is on PTAs between developing country origins and destinations at all levels of development; for developing countries, much of the benefit of a PTA comes from tariff cuts. If we introduce a bilateral origin-destination fixed effect to the specification in column (1), then this yields an imprecise partial PTA effect that is statistically indistinguishable from zero. However, we continue to observe a negative coefficient on the tariff variable, consistent with the idea that PTAs benefit developing countries largely through the tariff cuts they provide.[17] Further, the unit of observation under study, product-level exports by firms, has a highly active extensive margin of trade (see, for example, Han (2018)).[18] Unfortunately, the size of our firm and product-level dataset means that it is technically not feasible to estimate models such as PPML which incorporate the firm and product extensive margin.[19]

[17] We thank Jeff Bergstrand for drawing our attention to this.

[18] The literature has suggested a variety of ways to examine the contribution of the extensive margin of trade. See Hummels and Klenow (2005) and Kehoe and Ruhl (2013).

[19] We are investigating practical methods to address the high computational burden of this type of exercise.

Table 3 column (2) introduces the proxy measures of third country competition coming from competitors's access to a PTA in the destination and the competitors' average tariff for each product in the destination. It shows that a firm's trade to a destination is decreasing when more competitors in the same product have signed a PTA with the destination. Specifically, the estimate of -0.82 implies that if the share of competitors in a destination with access to a PTA rose by 10%, then the average sales by a firm in the origin to this destination would decline by 7.9%. Further, we see that a firm's exports to a destination are decreasing when the firm's competitors from other origin countries face a lower tariff; a 1 percent decline in the competitors' average tariff is associated with a 3.6% decline in an origin firm's exports. Notably, the inclusion of these third country competition proxies reduces the direct partial PTA effect to 0.35, or a 42% increase in trade (from 52% in column (1)). The direct effect of a 1% tariff reduction on trade similarly falls from 4.0% to 3.8%. Interestingly, in column (3), although the inclusion of origin-destination fixed effects results in much smaller direct effects of PTAs on firms' exports, the effects coming from one's own tariff and competitors' market access remain substantial. A 1% decline in destination tariffs against an origin raises the average exports by a firm in the origin by 1.3%. If an additional 10 percent of a firm's competitors sign PTAs with the destination, an origin firm's export value falls by 2.5%; a 1% decline in competitors' average tariff leads to a 3.1% decline in trade by firms from the origin. Column (4) reports the introduction of a PTA is associated with a 3% increase in the physical quantity of a product shipped by a firm. A tariff reduction tends to increase quantity more than value, but the impacts of competitors' PTAs and average tariffs on quantity are similar to those on value.

Turning to prices in column (5), the standout result is that an exporting firm's price in a destination is increasing in the tariff. This specification controls for firm fixed effects, absorbing variation related to a firm's time-invariant productivity, size, or, indirectly, market power, as well as origin-product-time fixed effects to control for industry-level supply shocks in the origin, destination-product-time fixed effects to control for shifts in destination demand, and origin-destination fixed effects to capture pair-specific features such as distance or common legal system or language. The positive sign on on the tariff coefficient is puzzling; it implies an increase in the export price in response to an increase in the tariff. This is the opposite of what one would expect from optimal tariff theory or in a strategic trade policy model (Cournot or Bertrand). We return to this puzzle in our discussion of markups below.[20]

[20]Recent studies of prices and tariffs have yielded results that are puzzling in light of optimal

We note that the direct effect of a PTA on prices is a modest reduction. Turning to the effect of a competitors' PTA, we find that if an additional 10% of a firm's competitors in a destination sign a PTA, then prices charged by firms in the origin decline by a modest 0.7%. Although modest in magnitude, we think this finding is interesting and important because our measure shows the existence of a pro-competitive effect arising from destinations' PTAs with third countries (after we have controlled for changes in multilateral resistance in the destination with destination-product-time fixed effects (Anderson and van Wincoop (2003)).

Finally, we turn to markups. In specification (6), in which the log unit value (price) is the dependent variable, the inclusion of firm-origin-product-time fixed effects controls for time-varying marginal costs at the level of the product within a firm as well as time-variation in the global or common markup that the firm charges in all foreign destinations. This allows us to identify how the component of the markup that is specific to a destination (i.e., the pricing-to-market component) changes when a country joins a PTA. We find that markups are slightly (3%) lower when a firm has a PTA with a destination, and more interestingly, markups decline 0.5% when an additional 10% of a firm's third-country competitors have signed a PTA with the destination. Following on the puzzling result in column (5) that a firm's export price is increasing in the tariff, we also observe that a 10% increase in the tariff on a product is associated with a 4% increase in its markup. In the context of the workhorse model of variable markups in international trade, Atkeson and Burstein (2008), the elasticity of demand facing a firm is a function of the firm's own market share in the destination, as well as the elasticities of substitution within (ρ) and across (η) sectors. Thus, for a firm's markup to rise in response to a tariff increase, it should be the case that the firm's market share is increasing in the tariff. We will return to a discussion of the empirical relationship between market shares and tariffs below.

In table 4, we turn to the question of whether the direct and indirect effects of PTAs on firm-level export sales, prices, and markups change systematically for those goods which are more highly differentiated. In the CCHS product classification system, roughly one-half of goods classified as "differentiated" according to Rauch (1999) are classified as highly differentiated. In product markets in which firms hold greater market power, a reduction in barriers to trade such as the tariff facing a

tariff theory; in these studies, export prices do not respond to tariff changes. In studies of the US-China trade war, Amiti, Redding and Weinstein (2019) and Fajgelbaum, Goldberg, Kennedy and Khandelwal (2019) find complete pass-through of US tariff hikes into domestic prices; similarly Besedes, Kohl and Lake (2020) find complete pass-through of tariff cuts into US prices during the phase-in of NAFTA.

Table 3: PTA and competition effects in Deep Trade Agreements

	Value (1)	Value (2)	Value (3)	Quantity (4)	Prices (5)	Markups (6)
PTA_{odt}	0.42***	0.35***	-0.03*	0.03*	-0.03***	-0.03***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
$Tariff_{odit}$	-4.08***	-3.84***	-1.33***	-1.95***	0.74***	0.39***
	(0.07)	(0.08)	(0.11)	(0.13)	(0.047)	(0.05)
Competitors' Avg $PTA_{(-o)dit}$		-0.82***	-0.25***	-0.13***	-0.07***	-0.05***
		(0.03)	(0.03)	(0.04)	(0.01)	(0.01)
Competitors' Avg $Tariff_{(-o)dit}$		3.58***	3.12***	3.17***	0.27	-0.21
		(0.39)	(0.37)	(0.45)	(0.16)	(0.17)
Observations	16,204,208	15,200,888	15,200,754	14,931,830	23,072,647	14,931,830
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓		✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination			✓	✓	✓	✓
Firm					✓	
Origin-product-year					✓	

Notes: The dependent variable is the log export value, columns (1) - (3), log quantity, column(4), and log unit value, columns (5) and (6) at the firm-product-origin-destination-year level. In column (6) the inclusion of firm-origin-product-year fixed effects implies that results are for the markup. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

third-country competitor would be expected, all else equal, to have a larger pro-competitive effect on prices and markups. Comparing the results from table 3 which are based on all HS06 goods and are reproduced in the odd numbered columns of table 4 to estimates for the sample of CCHS highly differentiated goods (presented in the even numbered columns), we generally find that trade values, quantities, prices, and markups of highly differentiated goods are more responsive to bilateral tariffs than a general category of merchandise that includes all traded goods. Particularly interesting is the fact that both prices and markups are increasing in the tariff a firm faces in a destination; a 1% increase in the tariff in a destination is associated with a 1.3% increase in the price and a 0.8% increase in the markup. Together, these two facts suggest that almost two-thirds of the price increase associated with a higher tariff comes from firms charging higher markups in the destination. The value and quantity of highly differentiated goods are more responsive to the change in the tariff charged on its third country competitors than a general category of all goods. For prices, the formation of a PTA between a destination and third countries is associated with a small increase in the price of highly differentiated goods. This contrasts strongly with the result in column (5) that PTA formation between a destination and third countries generates a small decrease in the average price for an

estimation sample that includes all goods. Most importantly, for highly differentiated goods, the formation of a PTA among a destination and third countries reduces the markup charged by firms from origin o by 0.9%, evidence of a pro-competitive effect that is substantially larger than the pro-competitive effect for the complete dataset of all goods.

To investigate the puzzling empirical relationship between markups and tariffs, and specifically our empirical finding that both prices and markups are increasing in the magnitude of the bilateral tariff, in table 5 we look at the evolution of firms' market shares. The key empirical regularity that emerges in this table is that, using a traditional definition of import market share, that of the firm among exporters from all origins (see columns (1), (2), (5), and (6)), we find a firm's market share is decreasing in the tariff.[21] This tells us, unsurprisingly, that when a country faces a higher bilateral tariff in a destination, the average import market share of its firms is smaller. This would seem to imply that firm's facing higher bilateral tariffs would have less market power and set lower markups, in sharp contrast to our results in tables 3 and 4.

This leads us to consider a second, alternative measure of market share, the firm's import market share in the destination among all firms from its own origin, reported in columns (3), (4), (7) and (8). With this measure, we find that a higher bilateral tariff is associated with substantial increases in the average market share of an exporting firm. From this we infer that the pricing behaviour of firms depends on which other firms they see as strategic competitors. The empirical evidence in our study suggests that firms see other firms from their own origin as the relevant set of competitors when they set prices. Specifically, our evidence suggests that the average market shares of origin o firms relative to their own peers are higher when bilateral tariffs are higher; a tariff reduction stimulates entry from competing firms from the same origin, resulting in a decline in average market share among all firms from the origin AND a reduction in average prices and markups. In other words, the average substitutability of varieties from competing firms from a single origin within a destination must be higher than that among competing firms from different origins within a destination.

These finding have important implications for firm-level models of trade among many countries. For example, models in which variable markups in a destination

[21] Recall that while we define a firm's import market share relative to the destination's imports from the 13 countries in our sample, the inclusion of destination-product-time fixed effects ensures that this is equivalent to calculating the firm's share relative to the destination's total imports.

derive from oligopolistic competition, such as Atkeson and Burstein (2008), should be adapted to account for the fact that a firm's market share in a destination is not always the empirically most relevant measure to correctly capture how variable markups change in response to trade liberalizations. In multicountry models of trade, it might be more accurate to consider demand structures in which output by compatriot firms is more substitutable than that among firms from different origins.

Table 4: PTA and competition effects for all goods versus highly differentiated goods

	Value all goods (1)	Value high diff. (2)	Quantity all goods (3)	Quantity high diff. (4)	Prices all goods (5)	Prices high diff. (6)	Markups all goods (7)	Markups high diff. (8)
PTA_{odt}	-0.03*	-0.06**	0.03*	0.05	-0.03***	0.00	-0.03***	-0.04***
	(0.0152)	(0.03)	(0.02)	(0.04)	(0.01)	(0.01)	(0.01)	(0.02)
$Tariff_{odit}$	-1.33***	-1.99***	-1.95***	-2.78***	0.74***	1.31***	0.39***	0.86***
	(0.109)	(0.18)	(0.13)	(0.22)	(0.05)	(0.07)	(0.05)	(0.08)
Competitors' Avg $PTA_{(-o)dit}$	-0.25***	0.02	-0.13***	0.16**	-0.07***	0.04*	-0.05***	-0.09***
	(0.03)	(0.05)	(0.04)	(0.06)	(0.01)	(0.02)	(0.01)	(0.03)
Competitors' Avg $Tariff_{(-o)dit}$	3.12***	4.50***	3.17***	5.51***	0.27*	-0.13	-0.21	-0.24
	(0.37)	(0.65)	(0.45)	(0.77)	(0.16)	(0.25)	(0.17)	(0.30)
Observations	15,200,754	5,508,516	14,931,830	5,447,012	23,072,647	8,472,732	14,931,830	5,447,012
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓			✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓
Firm					✓	✓		
Origin-product-year					✓	✓		

Notes: The dependent variable is the log export value, columns (1) and (2), log quantity, columns (3) and (4), and log unit value, columns (5) - (8), at the firm-product-origin-destination-year level. In columns (7) and (8) the inclusion of firm-origin-product-year fixed effects implies that results are for the markup. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

Table 5: PTA and competition effects on a firm's market share among competitors for its own origin and all origins

	Mkt share $f \in dit$ all goods (1)	Mkt share $f \in dit$ all goods (2)	Mkt share $f \in oidt$ all goods (3)	Mkt share $f \in oidt$ all goods (4)	Mkt share $f \in dit$ high diff. (5)	Mkt share $f \in dit$ high diff. (6)	Mkt share $f \in oidt$ high diff. (7)	Mkt share $f \in oidt$ high diff. (8)
PTA_{odt}	-0.01	-0.01	0.00	-0.03**	-0.07**	-0.05*	0.19***	0.13***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Tariff_{odit}	-1.56***	-1.11***	1.99***	1.23***	-2.38***	-1.76***	2.96***	2.48***
	(0.10)	(0.11)	(0.10)	(0.11)	(0.17)	(0.18)	(0.17)	(0.18)
Competitors' Avg $\text{PTA}_{(-o)dit}$		-0.12***		-0.37***		0.05		-0.52***
		(0.03)		(0.03)		(0.05)		(0.06)
Competitors' Avg $\text{Tariff}_{(-o)dit}$		4.17***		-6.81***		5.68***		-4.35***
		(0.34)		(0.36)		(0.56)		(0.56)
Observations	16,204,047	16,069,093	16,204,047	16,069,093	5,878,849	5,840,346	5,878,849	5,840,346
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the firm's product-level share of the destination's import market relative to firms from the thirteen origin countries in our dataset, columns (1), (2), (5), and (6), and relative to other firms from its own origin, columns (3), (4), (7), and (8). In columns (5) - (8), only CCHS highly differentiated products are included in the sample. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

Table 6: Competition Effects in Deep Trade Agreements: China's Role

	Value	Value ex. China	Quantity	Quantity ex. China	Prices	Prices ex. China	Markups	Markups ex. China
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PTA_{odt}	-0.03*	0.01	0.03*	0.11***	-0.03***	-0.04***	-0.03***	-0.04***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
$Tariff_{odit}$	-1.33***	-0.50***	-1.95***	-0.69***	0.74***	-0.16**	0.39***	-0.07
	(0.11)	(0.15)	(0.13)	(0.21)	(0.05)	(0.07)	(0.05)	(0.08)
Competitors' Avg $PTA_{(-o)dit}$	-0.25***	-0.60***	-0.13***	-0.86***	-0.07***	-0.06**	-0.05***	0.07**
	(0.03)	(0.04)	(0.04)	(0.08)	(0.01)	(0.03)	(0.01)	(0.03)
Competitors' Avg $Tariff_{(-o)dit}$	3.12***	7.46***	3.17***	6.80***	0.27*	0.37	-0.21	0.48
	(0.37)	(0.61)	(0.45)	(0.95)	(0.16)	(0.37)	(0.17)	(0.40)
Constant	9.16***	8.49***	7.89***	5.83***	1.39***	2.77***	1.29***	2.81***
	(0.03)	(0.05)	(0.04)	(0.08)	(0.01)	(0.03)	(0.02)	(0.03)
Observations	15,200,754	2,336,892	14,931,830	2,096,440	23,072,647	5,150,477	14,931,830	2,096,440
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓			✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓
Firm					✓	✓		
Origin-product-destination					✓	✓		

Notes: The dependent variable is the log export value, columns (1) and (2), log quantity, columns (3) and (4), and log unit value, columns (5) - (8), at the firm-product-origin-destination-year level. In columns (7) and (8) the inclusion of firm-origin-product-year fixed effects implies that results are for the markup. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

While our dataset comprises information from 13 exporting countries, the majority of our observations come from China's exports over 2000-2006. Table 6 documents that the broad outline of results from the 13 exporting country sample are robust when we exclude all data from China as an exporter, the notable exceptions being the responsiveness of prices and markups to tariffs.

4.1 DTAs and Global Value Chains

In this section, we explore the role of PTA participation in global value chains. Our focus is on identifying differences, if any exist, in the effect of PTAs on the growth of trade for intermediate inputs versus final consumption goods as well as differential effects on markups. To do this, we subdivide the firm and product level administrative data into ever more refined subsamples. We then apply the regression models used previously on each subsample of data. The first, most basic split is between final consumption goods and intermediate inputs. We then refine these subsamples into groups of highly differentiated and less differentiated goods.

We begin by examining how PTA participation affects firm-level exports of final consumption goods versus intermediate inputs in table 7 columns (1) and (2), respectively. For the thirteen middle and low-income economies in our sample, joining a PTA is associated with a 7.2% increase in the export of final goods, but a 5.8% *reduction* in exports of intermediates. This hints at a fundamental change in trade structure associated with PTA participation. Under these PTAs, low and middle income countries increase their role as assemblers of final goods for export to their PTA partners and reduce their activity in producing basic parts and components for export. A further refinement of the breakdown of consumption goods between highly differentiated and less differentiated products, columns (3) and (4) respectively, reveals that all of the trade growth in final goods comes from less differentiated products which see their value increase 16.2% under a new PTA. The reduction in sales of intermediates appears to be almost entirely driven by a 4.9% fall in exports of less differentiated varieties (column (6)).[22]

The overall pattern of the impact on final versus intermediate goods is repeated when we examine tariff reductions. A 1% reduction in the tariff increases exports of final goods by 1.56% whereas the impact on intermediates is a more muted increase of only 0.42%. Within the set of final goods, tariff reductions have a larger trade-increasing impact on highly differentiated goods of 1.94% compared to the

[22] Appendix B presents additional tables of results by product end-use for quantity and price of exports.

0.78% increase for less differentiated final goods. Finally, we find that when one's competitors enjoy a PTA with a foreign destination market, the negative impact of a competitors' tariff reduction is substantial for all varieties of goods along all positions on the value chain of production.

In table 8 we shift focus to markups and observe that participation in a PTA has a robust markup-reducing impact on final consumption goods, while the negative impact for intermediates is slightly smaller in magnitude and imprecisely estimated in some subsamples (see columns (2), (5), and (6)). Interestingly, the most differentiated consumption goods enjoy the largest markup reduction associated with joining a PTA, -6% (see column (3)). Although less differentiated consumption goods enjoyed the largest increases in trade value (see table 7), the negative impact of PTA participation on the markups of these goods is small and imprecisely estimated (column (4)).

Table 7: PTAs and Global Value Chains: Changes in Trade Value by End-Use Category

	Value	Value	Value	Value	Value	Value	Value	Value
	all cons. goods	all intermeds.	high diff cons. goods	low diff. cons. goods	high diff intermeds.	low diff. intermeds.	all high diff. goods	all low diff. goods
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PTA_{odt}	0.07***	-0.06**	-0.02	0.15***	0.05	-0.05*	-0.06**	0.03*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.08)	(0.03)	(0.03)	(0.02)
$Tariff_{odit}$	-1.56***	-0.51**	-1.94***	-0.78***	0.11	-0.72***	-1.99***	-0.42***
	(0.15)	(0.21)	(0.21)	(0.25)	(0.70)	(0.22)	(0.18)	(0.15)
Competitors' Avg $PTA_{(-o)dit}$	-0.01	-0.44***	0.24***	-0.17***	-0.09	-0.43***	0.02	-0.31***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.16)	(0.05)	(0.05)	(0.03)
Competitors' Avg $Tariff_{(-o)dit}$	2.57***	3.01***	2.99***	3.87***	14.45***	2.42***	4.50***	3.30***
	(0.49)	(0.63)	(0.69)	(0.73)	(3.22)	(0.63)	(0.65)	(0.47)
Observations	6,604,995	5,504,814	3,865,122	2,586,795	659,685	4,472,141	5,508,516	7,503,566
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log trade value at the firm-product-origin-destination-year level in all columns. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

Table 8: PTAs and Global Value Chains: Changes in Markups by End-Use Category

	Markups	Markups	Markups	Markups	Markups	Markups	Markups	Markups
	all cons. goods (1)	all intermeds. (2)	high diff cons. goods (3)	low diff. cons. goods (4)	high diff intermeds. (5)	low diff. intermeds. (6)	all high diff. goods (7)	all low diff. goods (8)
PTA_{odt}	-0.03***	-0.02*	-0.06***	-0.02	-0.02	-0.03*	-0.04***	-0.03***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.05)	(0.01)	(0.02)	(0.01)
$Tariff_{odit}$	0.62***	0.13	0.98***	0.00	0.38	0.16	0.86***	0.04
	(0.06)	(0.11)	(0.08)	(0.11)	(0.38)	(0.11)	(0.08)	(0.07)
Competitors' Avg $PTA_{(-o)dit}$	-0.05**	-0.02	-0.13***	-0.01	-0.04	0.00	-0.09***	-0.00
	(0.02)	(0.02)	(0.03)	(0.03)	(0.09)	(0.03)	(0.03)	(0.02)
Competitors' Avg $Tariff_{(-o)dit}$	-0.25	0.45	-0.19	-1.07***	1.25	0.58*	-0.24	-0.14
	(0.23)	(0.30)	(0.30)	(0.37)	(1.61)	(0.30)	(0.30)	(0.23)
Observations	6,510,590	5,378,875	3,827,927	2,531,263	648,764	4,359,788	5,447,012	7,328,290
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level in all columns. The inclusion of firm-origin-product-year fixed effects implies that results are for the markup. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

4.2 DTA Provisions on Certifying Rules of Origin

We next turn to the detailed provisions in deep trade agreements regarding the documentation to verify that a firm's exports satisfy the rules of origin (ROO) of a preferential trade agreement. We focus on two distinct and mutually exclusive provisions. Firstly, we examine how a provision that allows a firm to self-certify that its exported goods meet the trade agreement's rules of origin impacts the firm's trade. Similarly, we include a trade-weighted measure of the share of a firm's third country competitors who are able to self-certify that their merchandise satisfies the rules of origin of any PTA they have with the destination. Secondly, we examine how a more burdensome evidentiary requirement for proving rules of origin impacts trade.

Interestingly, a firm's average sales are unchanged when it participates in a trade agreement that allows it to self-certify that it meets a PTA's rules of origin. See the estimate in the first row of column (2) in table 9. Although one might have expected a simplied bureaucratic procedure for documenting rules of origin would have facilitated more trade, we find that, after controlling for origin-destination fixed effects and the existence of a PTA, this provision has no additional benefit. Weirdly, we find that a provision that allows for self-certification of rules of origin actually tends to *reduce* imports of highly differentiated goods by 24%. Presumably this is capturing some other provision whose inclusion in a PTA is correlated with the inclusion of a self-certification provision. For example, it might be that this provision to simplify the bureaucratic procedures around rules of origin is only included in PTAs that set very demanding requirements for rules of origin so that the estimated effect of the provision is actually capturing the more difficult rules of origin.

Perhaps even more interesting is the finding that these rules of origing provisions are associated with classic Vinerian trade diversion – when the privileged ROO status for self-certification is extended to more of a firm's competitors, this tends to reduce the firm's sales in the destination, by -6.3% if an additional 10% of one's competitors enjoy PTAs with this provision (from the estimate of -0.66 in column (2)). Quantitatively larger impacts are observed for highly differentiated goods, where the expansion of this favourable treatment to 10% more competitors reduces average firm-level exports from the origin country by 7.6% (from the column (3) estimate of -0.79).

When an exporter must have a government authority provide the necessary documents to prove that it meets the PTAs rules of origin, the impact on trade is negative (column (5)). More interestingly, we see that when this burdensome requirement that

government authorities must provide proof of origin is applied to a firm's competitors in a destination, the point estimates of the impact on the value of firm-level trade from an exporting firm in origin o are negative, but the magnitudes of the effect are smaller. That is, the nature of the documentary evidence required to prove that rules of origin are satisfied under a PTA have different effects on third-countries – when a PTA between any two parties allows self-certification of rules of origin, this harms third country competitors substantially (columns (2) and (3)). In contrast, when a PTA between any two parties requires that a government authority be involved in proving compliance with rules of origin, the negative impact is far more modest (column (5)), perhaps because, in a relative sense, the more burdensome requirements create a lower incentive for trade diversion.

Table 9: Trade Effects from Rules of Origin Certification in a PTA

	Value all goods (1)	Value all goods (2)	Value high diff. (3)	Value ex. China (4)	Value all goods (5)	Value high diff. (6)	Value ex. China (7)
Firm self-certifies origin$_{odt}$		0.03	-0.27***	0.06			
		(0.03)	(0.05)	(0.04)			
Competitors self-certify origin$_{(-o)dit}$		-0.66***	-0.79***	-0.05			
		(0.05)	(0.10)	(0.09)			
Gov't authority certifies origin$_{odt}$					-0.05*	0.09	-0.03
					(0.03)	(0.06)	(0.05)
Competitors require a gov't authority to certify origin$_{(-o)dit}$					-0.21***	-0.70***	-0.18*
					(0.06)	(0.11)	(0.10)
PTA$_{odt}$	-0.03*	-0.03	0.08**	-0.04	-0.01	-0.14***	0.01
	(0.02)	(0.02)	(0.04)	(0.04)	(0.02)	(0.03)	(0.02)
Competitors' Avg PTA$_{(-o)dit}$	-0.25***	0.07**	0.38***	-0.56***	-0.21***	0.16***	-0.56***
	(0.03)	(0.04)	(0.06)	(0.08)	(0.03)	(0.06)	(0.05)
Tariff$_{odit}$	-1.33***	-1.30***	-2.05***	-0.49***	-1.35***	-2.05***	-0.52***
	(0.11)	(0.11)	(0.18)	(0.15)	(0.11)	(0.18)	(0.15)
Competitors' Avg Tariff$_{(-o)dit}$	3.12***	3.44***	4.30***	7.57***	2.91***	3.88***	7.16***
	(0.37)	(0.37)	(0.65)	(0.63)	(0.38)	(0.66)	(0.63)
Observations	15,200,754	15,200,754	5,508,516	2,336,892	15,200,754	5,508,516	2,336,892
Fixed Effects							
Firm-origin-product-year	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log export value at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

In table 10, we find striking differences on trade volumes associated with self-certification of ROOs versus government authorities' certification of ROOs. Column (1) shows that a self-certification provision is associate with a 17.3% increase in the volume of trade by firms (from the coefficient estimate of 0.16) whereas a provision

requiring certification by a government authority reduces trade by 18.9% (from the coefficient estimate of -0.21 in column 4). Consistent with our finding that the value of highly differentiated goods' trade declines with self-certification, we observe that self-certification is associated with a 17.3% decline in the quantity of highly differentiated exports. As was observed for values, the negative impact on trade volume of having one's competitors in a destination sign a PTA with self-certification is larger than that of having one's competitors sign a PTA which requires the more burdensome government certification of ROOs.

The results in table 11 show that price effects of ROO provisions are sensitive to the sample of goods. In the previous two tables we found that the average value and volume of highly differentiated goods fell in response to a provision allowing a firm to self-certify its ROOs. Here we see the flip side, for those same goods, the self-certification provision is associated with a 7.2% increase in the price. The impacts on price of a PTA which requires government certification are small and imprecisely estimated.

In table 12, we examine the impact of rules of origin provisions on the destination-specific component of a firm's markup on a product i. Recall that the dependent variable is the log unit value, but the inclusion of firm-product-year fixed effects which control for changes over time in production costs imply that we are are capturing changes in a firm's destination-specific markup. We find that a firm's markup is unchanged when it joins a PTA that allows it to self-certify that it satisfies a PTAs rules of origin. In contrast, when a firm's competitors in a destination have signed a PTA under which they can self-certify ROO compliance, there is evidence from column (1) that this tends to reduce a firm's markup. Specifically, from column (1), we see that markups on goods from an origin country are 0.6% lower when 10% of the firm's competitors have signed a PTA that allows for self-certification. This suggests that the competitive pressure on markups from third-countries having better market access exists, but is modest. Lastly, for highly differentiated goods, all estimates of provisions' impacts are imprecisely estimated.

When a PTA requires that a government authority must provide documentation that a firm satisfies rules of origin, there seems to be some evidence that government certification is associated with higher markups. This could reflect that the bureaucratic burden of proving ROOs to the government reduces competition in the market.

Table 10: Trade Volume Effects from Rules of Origin Certification in a PTA

	Quantity all goods (1)	Quantity high diff. (2)	Quantity ex. China (3)	Quantity all goods (4)	Quantity high diff. (5)	Quantity ex. China (6)
Firm self-certifies origin$_{odt}$	0.16***	-0.19***	0.17***			
	(0.04)	(0.07)	(0.05)			
Competitors self-certify origin$_{(-o)dit}$	-0.74***	-1.00***	-0.38**			
	(0.07)	(0.13)	(0.15)			
Gov't authority certifies origin$_{odt}$				-0.21***	-0.08	-0.110*
				(0.04)	(0.07)	(0.06)
Competitors require a gov't				-0.48***	-0.86***	-0.36**
authority to certify origin$_{(-o)dit}$				(0.07)	(0.13)	(0.14)
PTA$_{odt}$	-0.01	0.13***	0.01	0.11***	0.02	0.14***
	(0.02)	(0.04)	(0.04)	(0.03)	(0.05)	(0.03)
Competitors' Avg PTA$_{(-o)dit}$	0.10**	0.49***	-0.72***	-0.02	0.34***	-0.69***
	(0.04)	(0.07)	(0.09)	(0.04)	(0.07)	(0.11)
Tariff$_{odit}$	-1.93***	-2.88***	-0.62***	-1.97***	-2.83***	-0.71***
	(0.13)	(0.22)	(0.21)	(0.13)	(0.22)	(0.21)
Competitors' Avg Tariff$_{(-o)dit}$	3.02***	4.74***	7.27***	2.66***	4.69***	6.27***
	(0.45)	(0.77)	(0.97)	(0.45)	(0.79)	(0.97)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log export quantity at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

4.3 Competition Policy Provisions in a DTA

A fundamental question about the value of so-called "deep" trade agreements is whether the numerous provisions they include have deep, profound impacts on trade or merely pay lip-service to the cause of deeper economic integration. We examine the different competition policy objectives and provisions of deep trade agreements to get at this question. Our analysis focuses on three distinct questions in the DTA database. The first is whether or not the trade agreement "establishes cooperation in the field of competition" as a high-level general objective. Within our DTA sample of 257 agreements, 120 explicitly include this high-level objective. The second and third provisions focus on commitments in PTA chapters covering intellectual property, government procurement, e-Commerce, agriculture or investment that prohibit or regulate anticompetitive behaviours. The second provision asks, "Does the agree-

Table 11: Price Effects from Rules of Origin Certification in a PTA

	Price all goods (1)	Price high diff. (2)	Price ex. China (3)	Price all goods (4)	Price high diff. (5)	Price ex. China (6)
Firm self-certifies origin$_{odt}$	0.02	0.07**	-0.00			
	(0.02)	(0.03)	(0.02)			
Competitors self-certify origin$_{(-o)dit}$	-0.04	0.11**	0.02			
	(0.03)	(0.05)	(0.07)			
Gov't authority certifies origin$_{odt}$				0.03	-0.05	-0.04
				(0.02)	(0.03)	(0.03)
Competitors require a gov't				0.05*	-0.11**	0.06
authority to certify origin$_{(-o)dit}$				(0.03)	(0.05)	(0.07)
PTA$_{odt}$	-0.04***	-0.05**	-0.04**	-0.04***	-0.01	-0.03**
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Competitors' Avg PTA$_{(-o)dit}$	-0.04**	-0.11***	0.05	-0.06***	-0.05*	0.03
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.05)
Tariff$_{odit}$	0.48***	1.05***	-0.10	0.47***	1.03***	-0.09
	(0.06)	(0.09)	(0.08)	(0.06)	(0.08)	(0.08)
Competitors' Avg Tariff$_{(-o)dit}$	-0.06	-0.03	0.71	0.01	-0.24	0.83*
	(0.19)	(0.31)	(0.46)	(0.19)	(0.31)	(0.46)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm	✓	✓	✓	✓	✓	✓
Origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

ment prohibit or regulate cartels or concerted practices?" while the third asks "Does the agreement prohibit or regulate abuse of market dominance?" Notably, in our sample of 257 agreements, there are 61 PTAs that do not include a general objective for cooperation over competition policy but do commit to prohibiting or regulating cartels and 68 without a cooperation objective but with a specific obligation to prohibit or regulate market dominance. To refer to these three distinct provisions, we adopt the short names "cooperation objective," "prohibits cartels," and "prohibits market dominance." Because both the "prohibits cartels" and "prohibits market dominance" provisions are commitments that rely on the existence of domestic bodies with a competition mandate, we see both of these provisions are far more substantive than the possibly aspirational language of a "cooperation objective."

When a PTA explicitly states that one of its general objectives is to establish co-

Table 12: Markup Effects from Rules of Origin Certification in a PTA

	Markup all goods (1)	Markup high diff. (2)	Markup ex. China (3)	Markup all goods (4)	Markup high diff. (5)	Markup ex. China (6)
Firm self-certifies origin$_{odt}$	-0.01	0.01	-0.01			
	(0.02)	(0.03)	(0.02)			
Competitors self-certify origin$_{(-o)dit}$	-0.06**	0.05	-0.04			
	(0.03)	(0.05)	(0.06)			
Gov't authority certifies origin$_{odt}$				0.07***	0.02	-0.01
				(0.02)	(0.03)	(0.02)
Competitors require a gov't				0.06**	-0.03	0.03
authority to certify origin$_{(-o)dit}$				(0.03)	(0.05)	(0.06)
PTA$_{odt}$	-0.02**	-0.05**	-0.04**	-0.06***	-0.05***	-0.04***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Competitors' Avg PTA$_{(-o)dit}$	-0.03	-0.11***	0.09**	-0.06***	-0.08***	0.06
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.05)
Tariff$_{odit}$	0.38***	0.87***	-0.07	0.38***	0.85***	-0.06
	(0.05)	(0.08)	(0.08)	(0.05)	(0.08)	(0.08)
Competitors' Avg Tariff$_{(-o)dit}$	-0.22	-0.20	0.52	-0.13	-0.26	0.53
	(0.17)	(0.30)	(0.39)	(0.18)	(0.30)	(0.40)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level. The inclusion of firm-product-origin-time fixed effects implies that the estimated effects are for markups. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

operation in the field of competition, we find that bilateral trade is 16.5% lower (see table 13 column (1)). This negative effect holds both for one's own bilateral PTA as well as when one's competitors in a destination have this objective in their PTA with the destination. In sharp contrast, the two provisions that explicitly limit specific anticompetitive behaviours are associated with increases in the value of trade of 10.5% and 9.4% (table 13 columns (2) and (3)) . The empirical estimates associated with including either of these provisions are almost identical, and they are markedly different from the impact of including aspirational language about cooperation. Further, when one's competitors in a destination have commited to prohibiting cartels or regulating market dominance in their PTAs with the destination, this also has a trade-expanding effect on the origin. In other words, the general practice of making a substantive commitment to competition agencies is associated with greater

trade from all destinations. One possible interpretation of these results is that inclusion of a cooperation objective in the agreement, without specific commitments to anticompetitive practices, signals that the parties to the agreement anticipated problematic barriers to market access. In contrast, provisions which included substantive commitments to competition generate real improvements in economic integration by expanding the value of trade among partners. This pattern of impact across the three competition provisions is repeated, with larger economic magnitudes, for the volume of trade in columns (4) - (6).

In table 14, we examine the effect of competition policy provisions on prices and markups. Although the three provisions have no discernible effect on prices, we find an imporant impact on markups. Those agreements that state cooperation in competiton as an objective are associated with an increase in markups of 4%. This is a puzzling finding, but might reflect a negative selection effect. It could be that this objective is included in the trade agreement precisely when competition policy (or the lack of competition policy in one member of the PTA) is anticipated to be a future problem for the trade agreement partners. However, the inclusion of substantial commitments to prohibit or regulate anticompetitive practices yields real reductions in markups of 4.0% regardless of whether the commitment is to limit cartels or market dominance.

In summary, our analysis of competition policy provisions points the effectiveness and utility of examining the substance of trade agreement provisions econometrically. While high-level non-specific language over cooperation is shown to be associated with declining trade and rising markups, specific legal commitments to regulate anticompetitive behaviours are shown to enhance trade value and reduce markups.

4.4 Mutual Recognition Provisions in a DTA

The last set of results explore how PTA provisions by which countries commit to mutual recognition of a trading partner's standards, technical regulations or conformity assessment procedures impact trade, prices and markups. These three provisions represent different approaches to cooperation on standards and respectively amount to treating a partner's voluntary standards, mandatory technical regulations and test results the same as their domestic counterparts.[23] In the WB DTA Database,

[23]The World Trade Organisation's Agreement on Technical Barriers to Trade defines a standard as a "document approved by a recognised body, that provides, for common and repeated use, rules, guidelines or characteristics for products or related processes and production methods, with which compliance is not mandatory" and a technical regulation as a "document which lays down product characteristics or their related processes and production methods, including the applicable

Table 13: Trade Value and Volume Effects from Competition Provisions in a PTA

	Value (1)	Value (2)	Value (3)	Quantity (4)	Quantity (5)	Quantity (6)
Cooperation Obj.$_{odt}$	-0.18***			-0.34***		
	(0.03)			(0.04)		
Comps' Coop Obj.$_{(-o)dit}$	-0.46***			-0.51***		
	(0.06)			(0.08)		
Prohib Cartel$_{odt}$		0.10***			0.20***	
		(0.02)			(0.04)	
Comps' Prohib Cartel$_{(-o)dit}$		0.64***			0.91***	
		(0.05)			(0.06)	
Prohib Mkt Dom$_{odt}$			0.09***			0.19***
			(0.02)			(0.04)
Comps' Prohib Mkt Dom$_{(-o)dit}$			0.62***			0.90***
			(0.05)			(0.06)
PTA$_{odt}$	0.05***	-0.06***	-0.06***	0.20***	-0.04**	-0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Comps' Avg PTA$_{(-o)dit}$	0.15**	-0.46***	-0.46***	0.30***	-0.48***	-0.47***
	(0.06)	(0.03)	(0.03)	(0.08)	(0.04)	(0.04)
Tariff$_{odit}$	-1.31***	-1.39***	-1.38***	-1.91***	-2.06***	-2.06***
	(0.11)	(0.11)	(0.11)	(0.13)	(0.13)	(0.13)
Comps' Avg Tariff$_{(-o)dit}$	3.26***	2.29***	2.29***	3.22***	1.77***	1.79***
	(0.37)	(0.37)	(0.37)	(0.45)	(0.45)	(0.45)
Observations	15,200,754	15,200,754	15,200,754	14,931,830	14,931,830	14,931,830
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log export value, columns (1) - (3), and log export quantity, columns (4) - (6) at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

however, they appear to be very closely related; there are only 10 agreements with a provision on mutual recognition of standards, all of which are either treaties or accession agreements relating to either the European Union or the Eurasion Economic Union. Since the same 10 agreements are also the only ones featuring provisions on the mutual recognition of technical regulations, the results for these two provisions are identical and we only report those for mutual recognition of standards. All 10

administrative provisions, with which compliance is mandatory." Both "may also include or deal exclusively with terminology, symbols, packaging, marking or labelling requirements as they apply to a product, process or production method." Conformity assessment, meanwhile, is defined as "any procedure used, directly or indirectly, to determine that relevant requirements in technical regulations or standards are fulfilled" and may include "procedures for sampling, testing and inspection; evaluation, verification and assurance of conformity; registration, accreditation and approval as well as their combinations" (WTO, 1994).

Table 14: Price and Markup Effects from Competition Provisions in a PTA

	Prices (1)	Prices (2)	Prices (3)	Markups (4)	Markups (5)	Markups (6)
Cooperation Obj.$_{odt}$	0.01			0.04***		
	(0.02)			(0.02)		
Comps' Coop Obj.$_{(-o)dit}$	-0.07*			-0.06		
	(0.04)			(0.04)		
Prohib Cartel$_{odt}$		-0.00			-0.04***	
		(0.02)			(0.02)	
Comps' Prohib Cartel$_{(-o)dit}$		0.04			0.04	
		(0.03)			(0.03)	
Prohib Mkt Dom$_{odt}$			-0.00			-0.04***
			(0.02)			(0.01)
Comps' Prohib Mkt Dom$_{(-o)dit}$			0.04			0.04
			(0.03)			(0.03)
PTA$_{odt}$	-0.04***	-0.03***	-0.03***	-0.05***	-0.01	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Competitors' Avg PTA$_{(-o)dit}$	0.01	-0.07***	-0.07***	0.01	-0.06***	-0.06***
	(0.04)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Tariff$_{odit}$	0.47***	0.47***	0.47***	0.38***	0.38***	0.38***
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
Competitors' Avg Tariff$_{(-o)dit}$	-0.04	-0.11	-0.11	-0.19	-0.26	-0.27
	(0.19)	(0.19)	(0.19)	(0.17)	(0.18)	(0.18)
Observations	14,931,830	14,931,830	14,931,830	14,931,830	14,931,830	14,931,830
Fixed Effects						
Firm-origin-product-year				✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓
Firm	✓	✓	✓			
Origin-product-year	✓	✓	✓			

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level in all columns. The inclusion of firm-origin-product-year fixed effects in columns (3) - (6) implies that results are for the markup. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

of these agreements further contain a provision on mutual recognition of conformity assessment, as do 6 other agreements in the dataset.

Mutual recognition of standards/technical regulations and mutual recognition of conformity assessment provisions appear to have trade-promoting effects on third countries.[24] As shown in the top panel of table 15, a 10% increase in the share of competitors with access to a such a provision seems to increases firm-level exports by

[24]For the sample of thirteen developing and emerging countries in our sample, the direct impact of provisions for mutual recognition associated with PTAs cannot be identified separately from the impact of the PTAs. Thus, individual coeffcient estimates on provisions are omitted.

13.6% in the case of standards/technical regulations (column (1) estimate of 1.28) and by the same amount in the case of conformity assessment (column (4) estimate of 1.29). These magnitudes are somewhat larger, 17.6%, when we examine the impact of an additional 10% of competitors enjoying these mutual recognition provisions for trade in highly differentiated goods in columns (2) and (6). The magnitudes are substantially larger when we exclude trade with China from the estimation sample.

This somewhat surprising "competition" effect might capture a de facto simplification of the regulatory environment facing exporters. Overall, it seems to suggest that some types of deep trade agreement provisions faciliate trade not only among signatories, but also with third countries outside the agreement. Results presented in table 16 are quantitatively similar to those for trade values. The pronounced similarity of our results for different types of mutual recognition provisions is almost certainly due to the close relationship of these provisions, and the small number of agreements which feature them, in the WB DTA Database. In fact, our results could be quite different if the data contained information on mutual recognition agreements, stand-alone agreements for mutual recognition of conformity assessment (Prayer, 2020). The UK, for example, had access to 6 stand-alone mutual recognition agreements via its EU membership during our sample period, none of which are included in the WB DTA Database.

Turning to tables 17 and 18, in our baseline sample of all goods, as well as the sample of highly differentiated goods, we find no statistically significant impact on prices or markups when more of one's competitors in a destination have signed a PTA that includes mutual recognition provisions. However, when we restrict the sample to exclude trade with China, we find that both mutual recognition provisions for a firm's competitors are associated with reductions in prices and markups. Though modest in magnitude, this is further evidence that some PTA provisions tend to stimulate a more intense level of competition among firms, even those outside the PTA.

5 Conclusion

This paper introduces a new methodology for examining whether the detailed provisions of preferential trade agreements (PTAs) lead to greater market integration, more intense competition and less market power for firms. In this paper, we show how firm-level exports from multiple countries can be used to assess both the direct and indirect third-country impacts of preferential trade agreements, tariffs, and trade

Table 15: Trade Effects due to Mutual Recognition (MR) Provisions in a PTA

	Value all goods (1)	Value high diff. (2)	Value ex. China (3)	Value all goods (4)	Value high diff. (5)	Value ex. China (6)
Competitors enjoy MR of Standards$_{(-o)idt}$	1.28***	1.62***	6.25***			
	(0.06)	(0.11)	(0.38)			
Competitors enjoy MR of Conformity Assess$_{(-o)idt}$				1.29***	1.64***	6.19***
				(0.06)	(0.11)	(0.38)
PTA$_{odt}$	-0.05***	-0.11***	0.00	-0.05***	-0.11***	0.00
	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
Competitors' Avg PTA$_{(-o)dit}$	-0.50***	-0.44***	-0.64***	-0.50***	-0.45***	-0.65***
	(0.03)	(0.06)	(0.04)	(0.03)	(0.06)	(0.04)
Tariff$_{odit}$	-1.43***	-2.16***	-0.54***	-1.43***	-2.17***	-0.54***
	(0.11)	(0.18)	(0.15)	(0.11)	(0.18)	(0.15)
Competitors' Avg Tariff$_{(-o)dit}$	1.80***	2.26***	6.94***	1.78***	2.22***	6.93***
	(0.37)	(0.66)	(0.61)	(0.37)	(0.66)	(0.61)
Observations	15,200,754	5,508,516	2,336,892	15,200,754	5,508,516	2,336,892
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log export value at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

agreement provisions while controlling for multilateral resistance at the product level in both the origin and destination. Our analysis investigated a small number of trade agreement provisions related to rules of origin certification, competition policy, and mutual recognition. However, our methodology can be applied to the hundreds of provisions in the 257 preferential trade agreements from the World Bank's Deep Trade Agreements (WB DTA) database.

Our study reveals interesting new results about third-country competition. Firstly, if 10% of one's competitors in a destination have a PTA, this reduces one's exports by about 8%. Interestingly, our analysis of specific provisions demonstrates that the third country competition effect varies substantially with the precise provisions in a PTA. For PTAs that allow one's competitors to self-certify rules of origin, the damage to one's own trade is around of 6-7%. In sharp contrast, our study of mutual recognitition provisions finds that when one's competitors have signed a PTA that allows for mutual recognition of standards or conformity assessment, a firm's own

Table 16: Trade Volume Effects due to Mutual Recognition (MR) Provisions in a PTA

	Quantity all goods (1)	Quantity high diff. (2)	Quantity ex. China (3)	Quantity all goods (4)	Quantity high diff. (5)	Quantity ex. China (6)
Competitors enjoy MR of Standards$_{(-o)idt}$	1.35***	1.76***	6.68***			
	(0.07)	(0.12)	(0.40)			
Competitors enjoy MR of Conformity Assess$_{(-o)idt}$				1.36***	1.77***	6.63***
				(0.07)	(0.12)	(0.40)
PTA$_{odt}$	0.01	-0.02	0.11***	0.01	-0.02	0.11***
	(0.02)	(0.04)	(0.03)	(0.02)	(0.04)	(0.03)
Competitors' Avg PTA$_{(-o)dit}$	-0.50***	-0.45***	-1.01***	-0.50***	-0.46***	-1.02***
	(0.04)	(0.08)	(0.08)	(0.04)	(0.08)	(0.08)
Tariff$_{odit}$	-2.12***	-3.05***	-0.79***	-2.12***	-3.05***	-0.79***
	(0.13)	(0.22)	(0.21)	(0.13)	(0.22)	(0.21)
Competitors' Avg Tariff$_{(-o)dit}$	1.05**	2.29***	5.37***	1.02**	2.25***	5.34***
	(0.45)	(0.80)	(0.95)	(0.45)	(0.80)	(0.95)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log export quantity at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

exports to that destination are higher – the mechanism is unclear, but perhaps is related to regulatory simplification in the destination.

Perhaps more interestingly, we find suggestive evidence of a pro-competitive effect of PTAs. After controlling for time-varying multilateral resistance in a destination, a firm's product-level price and markup in a destination tends to decline when its origin country participates in a PTA with a destination. We also find that substantive commitments that prohibit or regulate anticompetitive behaviours are associated with higher trade volumes and lower markups. While PTAs appear to be associated with lower markups overall, the picture gets murkier when we turn to specific provisions related to rules of origin and mutual recognition. However, the third-country effects of ROO regimes with self-certification appear to be pro-competitive. When we examine all goods from all thirteen exporting countries, we find that a rules of origin provision allowing competitors easier market access via self-certification leads to lower markups. Altogether, these findings present a complex picture which highlight

Table 17: Price Effects due to Mutual Recognition (MR) Provisions in a PTA

	Price all goods (1)	Price high diff. (2)	Price ex. China (3)	Price all goods (4)	Price high diff. (5)	Price ex. China (6)
Competitors enjoy MR of Standards$_{(-o)idt}$	-0.04	-0.04	-0.30**			
	(0.03)	(0.05)	(0.13)			
Competitors enjoy MR of Conformity Assess$_{(-o)idt}$				-0.04	-0.03	-0.32**
				(0.03)	(0.05)	(0.13)
PTA$_{odt}$	-0.03***	-0.02	-0.04***	-0.03***	-0.02	-0.04***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Competitors' Avg PTA$_{(-o)dit}$	-0.04**	-0.06*	0.06*	-0.04**	-0.06*	0.06*
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.04)
Tariff$_{odit}$	0.48***	1.03***	-0.09	0.48***	1.03***	-0.09
	(0.06)	(0.09)	(0.08)	(0.06)	(0.09)	(0.08)
Competitors' Avg Tariff$_{(-o)dit}$	0.02	-0.05	0.80*	0.01	-0.06	0.81*
	(0.20)	(0.32)	(0.46)	(0.20)	(0.32)	(0.46)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm	✓	✓	✓	✓	✓	✓
Origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

the important role of PTA provisions in facilitating or retarding competition.

Table 18: Markup Effects due to Mutual Recognition (MR) Provisions in a PTA

	Markup all goods (1)	Markup high diff. (2)	Markup ex. China (3)	Markup all goods (4)	Markup high diff. (5)	Markup ex. China (6)
Competitors enjoy MR of Standards$_{(-o)idt}$	-0.01	-0.00	-0.29**			
	(0.03)	(0.05)	(0.12)			
Competitors enjoy MR of Conformity Assess$_{(-o)idt}$				-0.01	0.00	-0.31***
				(0.03)	(0.05)	(0.12)
PTA$_{odt}$	-0.03***	-0.04***	-0.04***	-0.03***	-0.04***	-0.04***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Competitors' Avg PTA$_{(-o)dit}$	-0.04**	-0.09***	0.08**	-0.04**	-0.09***	0.08**
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.04)
Tariff$_{odit}$	0.39***	0.86***	-0.06	0.39***	0.86***	-0.06
	(0.05)	(0.08)	(0.08)	(0.05)	(0.08)	(0.08)
Competitors' Avg Tariff$_{(-o)dit}$	-0.19	-0.23	0.54	-0.19	-0.24	0.54
	(0.18)	(0.31)	(0.40)	(0.18)	(0.31)	(0.40)
Observations	14,931,830	5,447,012	2,096,440	14,931,830	5,447,012	2,096,440
Fixed Effects						
Firm-origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level. Inclusion of firm-product-origin-time fixed effects implies an analysis of markups. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority. Where noted, all firm-product level exports from China (as an origin) are omitted from the analysis.

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A Appendix: Aggregating Firm-level Data to the Industry Level

Table A19: Industry Level Trade Flows

	Value all goods	Value high diff.	Quantity all goods	Quantity high diff.	Prices all goods	Prices high diff.
PTA_{odt}	0.01	-0.04	0.08***	0.03	-0.02*	-0.02
	(0.02)	(0.04)	(0.03)	(0.05)	(0.01)	(0.02)
$Tariff_{odit}$	-1.96***	-3.40***	-2.63***	-3.93***	-0.15*	0.29**
	(0.17)	(0.25)	(0.20)	(0.29)	(0.08)	(0.14)
Competitors' Avg $PTA_{(-o)dit}$	-0.10**	0.05	0.34***	0.42***	0.06***	0.18***
	(0.04)	(0.07)	(0.05)	(0.08)	(0.02)	(0.04)
Competitors' Avg $Tariff_{(-o)dit}$	8.50***	9.61***	8.77***	10.23***	0.50*	1.30***
	(0.68)	(0.97)	(0.83)	(1.08)	(0.27)	(0.47)
Observations	1,167,776	383,253	1,010,728	331,743	1,010,728	331,743
Fixed Effects						
Origin-product-year	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log trade value, columns (1) and (2), log quantity, columns (3) and (4), and log-unit value, columns (5) and (6), at the product-origin-destination-year level. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

In table A19, we aggregate the firm-product-origin-destination-year level data for the 13 countries in our sample to the product-origin-destination-year level and estimate a conventional gravity specification featuring our new independent variables. The results broadly mirror the findings presented in table 3, with three exceptions. First, industry level trade volumes and unit values are now increasing in competitor's PTAs. Second, the puzzling finding that prices and markups are increasing in tariffs does not hold at the industry level. And third, prices are now increasing in competitors' tariffs.

B Appendix: Global Value Chains and Product End-Use

Table B20: PTAs and Global Value Chains: Changes in Trade Volume by End-Use Category

	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
	all cons. goods	all intermeds.	high diff cons. goods	low diff. cons. goods	high diff intermeds.	low diff. intermeds.	all high diff. goods	all low diff. goods
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PTA_{odt}	0.21***	-0.04	0.17***	0.27***	0.05	-0.02	0.05	0.10***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.10)	(0.03)	(0.04)	(0.02)
$Tariff_{odit}$	-2.30***	-0.92***	-2.83***	-1.23***	0.13	-1.27***	-2.78***	-0.93***
	(0.19)	(0.24)	(0.25)	(0.32)	(0.87)	(0.26)	(0.22)	(0.19)
Competitors' Avg $PTA_{(-o)dit}$	0.24***	-0.40***	0.44***	0.09	-0.10	-0.42***	0.16**	-0.22***
	(0.05)	(0.06)	(0.07)	(0.07)	(0.22)	(0.06)	(0.06)	(0.05)
Competitors' Avg $Tariff_{(-o)dit}$	3.40***	1.87***	3.84***	4.77***	12.64***	1.14	5.51***	2.60***
	(0.60)	(0.70)	(0.81)	(0.96)	(3.96)	(0.70)	(0.77)	(0.57)
Observations	6,510,590	5,378,875	3,827,927	2,531,263	648,764	4,359,788	5,447,012	7,328,290
Fixed Effects								
Firm-origin-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log quantity at the firm-product-origin-destination-year level in all columns. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.

Table B21: PTAs and Global Value Chains: Changes in Price by End-Use Category

	Prices	Prices	Prices	Prices	Prices	Prices	Prices	Prices
	all cons. goods	all intermeds.	high diff cons. goods	low diff. cons. goods	high diff intermeds.	low diff. intermeds.	all high diff. goods	all low diff. goods
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PTA_{odt}	-0.02**	-0.04***	-0.05***	-0.02	-0.01	-0.04***	-0.03	-0.04***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.05)	(0.02)	(0.02)	(0.01)
$Tariff_{odit}$	0.65***	0.23**	0.95***	0.05	0.69*	0.30**	1.03***	0.08
	(0.07)	(0.11)	(0.08)	(0.11)	(0.41)	(0.12)	(0.08)	(0.08)
Competitors' Avg $PTA_{(-o)dit}$	-0.05**	-0.02	-0.14***	0.00	-0.12	0.02	-0.07***	0.00
	(0.02)	(0.03)	(0.03)	(0.03)	(0.10)	(0.03)	(0.03)	(0.02)
Competitors' Avg $Tariff_{(-o)dit}$	0.21	0.54*	0.01	-0.56	-1.50	0.94***	-0.13	0.11
	(0.23)	(0.33)	(0.29)	(0.37)	(1.88)	(0.33)	(0.31)	(0.24)
Observations	6,510,590	5,378,875	3,827,927	2,531,263	648,764	4,359,788	5,447,012	7,328,290
Fixed Effects								
Firm	✓	✓	✓	✓	✓	✓	✓	✓
Origin-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Destination-product-year	✓	✓	✓	✓	✓	✓	✓	✓
Origin-destination	✓	✓	✓	✓	✓	✓	✓	✓

Notes: The dependent variable is the log unit value at the firm-product-origin-destination-year level in all columns. Significance: *** p<0.01, ** p<0.05, and * p<0.1 are based on robust standard errors, which are reported in parentheses. Data sources: Thirteen datasets of firms' exports from the World Bank Exporter Dynamics Database, China's Customs Authority, and Egypt's Customs Authority.