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# *Analysis of Colombian Trade Agreements from 2007 to 2013*[*]

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**ABSTRACT**

I analyze the firm-level effects on Colombia entering into Preferential Trade Agreements (PTAs) between 2007 and 2013. The combination of detailed firm-level data and PTAs make this article unique. In particular, I look at two separate potential trade-promotion effects of the agreements. The first result deals with how exporting firms in Colombia respond to the tariff cuts in the agreements. The tariff cuts from the agreements increase the size of exports by Colombian firms (the intensive margin); however, tariff cuts do not increase the number of exporting Colombian firms (the extensive margin). The second result deals with how the signed PTAs affect how Colombia sets tariffs on the set of the world. I find that the agreements do not affect Colombia's other tariffs, a result that further complicates the open question of whether trade agreements lead to lower overall tariffs (building-block effect) or higher overall tariffs (stumbling-block effect).

**KEY WORDS** Trade Margins; Trade Liberalization; Trade Agreements

I investigate the effects of trade liberalization by Colombia from 2007 to 2013. During this time, Colombia entered into six preferential trade agreements (PTAs). These agreements were all signed during the struggling, and now broken-down, Doha Round of the World Trade Organization (WTO). Specifically, I look at the margins of trade in relation to tariffs and preference margins. Along with investigating trade margins, I look at the relationship between preferential tariff cuts and multilateral tariff cuts.

I also investigate the building-block or stumbling-block effects of PTAs that entered into force for Colombia. A stumbling-block effect would imply that Colombia's entry into PTAs decreases the country's future trade liberalization. Unlike previous papers that have analyzed trade at the HS6 level, or even more aggregate product levels, I employ a firm-level data set of imports into Colombia and exports from Colombia.

The first benefit of the firm-level data is that both the intensive and extensive margins can be analyzed. Previous work has been limited to view the changes in total

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trade volume. I comment on the changes in trade volume, the number of firms in the market, and the distribution of firms. Specifically, regarding exporting firms, their presence in every market is tracked: entry, number of shipments, and trade volume for imports into and exports out of Colombia.

The second benefit of firm-level data is that the detailed nature of the data allows for analysis at the tariff line. Previous work has relied on more aggregated HS6 codes. Tariff lines are often set at the HS8 or HS10 level, however; therefore, earlier work has had to rely on averages of the tariffs at the HS6 level, rather than on the true tariff. When analyzing the building-block or stumbling-block effect of PTAs, I am thus able to look at detailed tariff lines. The effect for non-Colombia signees will be analyzed at the HS6 level, but specificity is available for Colombia.

A third benefit is the specificity of the trade agreements. Some tariff reductions are phased in. I am able to analyze the subsequent years along with the initial tariff cut. It is known that the benefits of trade agreements are not instantly seen; I will speak to the prolonged benefit of trade agreements. Similarly, the dates that trade agreements were signed, but not enforced, are known. The dates of signing can allow for changes in behavior in anticipation of the agreement being enacted. Likewise, multiple trade agreements went into force during the years for which data is available.

## LITERATURE REVIEW

As I investigate various aspects of preferential agreements, trade margins, and stumbling-block or building-block effects, there are two tangentially related literatures, which I discuss below.

### *Trade Margins*

Chaney (2008) lays the theoretical framework for breaking down trade into firm-level extensive and intensive margins within a gravity model. Early test evidence on the margins focused on distance. Hillberry and Hummels (2008) analyze trade within the United States. They find that the extensive margin is the primary driver of trade margins. The number of shipments is highly sensitive to the distance; however, the average value of a shipment is roughly constant for local destinations before gradually decreasing. Crozet and Koenig (2010) similarly investigate the role of distance on trade and follows a similar methodology to Hillberry and Hummels (2008). With a similar methodology, the same basic result is found of distance affecting the extensive margin more. Ottaviano and Mayer (2007) also look at the role of distance on trade margins, but they look at the margins from an aggregated country level.

My work is most similar to that of Buono and Lalanne (2012) and Debaere and Mostashari (2010). Buono and Lalanne (2012) investigate the intensive and extensive margin using French data. The product data uses three-digit summary economic classification product classifications, whereas I am able to use HS codes, which at the six-digit level correspond perfectly to applied tariff data provided by the WTO. Similarly, the three-digit NES code allows for country-sector analysis, not analysis at the product

level. Buono and Lalanne (2012) find that the intensive margin is much more affected by tariff cuts, while the extensive margin is smaller in magnitude and significance. The tariff cuts investigated were all part of the Uruguay Round of trade negotiations. By the built-in most-favored-nation (MFN) structure of the WTO, there is no ability to analyze preferential rates granted to French exporters. Lastly, the Uruguay Round is generally considered a success. The same cannot be said of the recent and currently suspended Doha Round.

Debaere and Mostashari (2010) analyze exports to the United States from 1989–2006 and are able to make use of disaggregated HS6 product codes. Thus, unlike for Buono and Lalanne (2012), their analysis is at the product level, not the sector level. Debaere and Mostashari analyzes only the extensive margin, which is found to be much less important for low-income countries; however, although the export data is disaggregated at the product level, there is no data for the number of firms. In a love-of-variety framework, there are gains of trade to be made by having a second firm export the same product. Debaere and Mostashari do find that the extensive margin is of little importance, although using U.S. tariff data does not include a variable for the preference margin.

Foster, Poeschl, and Stehrer (2011) include a dummy if a PTA was signed between two countries. That paper finds weak evidence that extensive margin is more important for PTAs, but it does not use actual tariff levels, only the presence of a PTA entering into force. Likewise, Baier, Bergstrand, and Feng (2014) look at the product extensive margin, but they break agreements down based on how "deep" the agreements are. Baier et al. find that the deeper the agreement (or the more integrated the two countries become), the larger the effect on both trade margins. Another novel approach in the paper was to analyze the lagged time effects of tariff changes on the margins. Both Foster et al. and Baier et al. follow the decomposition formulated in Hummels and Klenow (2005).

### *Stumbling Block or Building Block*

The basic premise of trade diversion is that when countries sign a PTA or enter a customs union, the "new" trade between the member nations is not newly created trade but rather, trade has moved from nonmember countries to member countries. The trade diversion between nonmembers and members needs to be less than the new trade between member countries for a regional trade agreement (RTA) to be trade-creating. Because of this trade diversion, trade agreements can actually serve as stumbling blocks to further trade liberalization. Theoretical work by Limao (2007) has found that if preferential agreements serve in part to extract non-trade concessions and environmental, labor, and intellectual property standards, agreements can serve as stumbling blocks. Horn, Mavroidis, and Sapir (2010) suggest that these "WTO extra" agreements, agreements with the above-mentioned standards, and their implications offer an area of study.

A popularly analyzed trade agreement was the creation of Mercosur, a Latin American trade bloc and customs union. Bohara, Gawande, and Sanguinetti (2004) analyze Argentinian data to test the Richardson hypothesis that trade diversion can lead

to declines in external tariffs. Bohara et al. pinpoint industries that experienced trade diversion, finding that these industries experienced a decline in tariffs. Thus, although relative prices change, the decline in tariffs could help offset the changes in terms-of-trade; however, issues include that the data begin after Mercosur went into effect and do not adjust for Mercosur becoming a customs union. Estevadeordal, Freund, and Ornelas (2008) also look at Mercosur, along with other Latin American countries. They find that RTAs are often building blocks to further agreements.

Expanding with Estevadeordal et al. (2008), Tovar (2012) conducts a similar study finding evidence of RTAs serving as a stumbling block; however, Tovar looks at small Central American countries that entered into Dominican Republic–Centra America Free Trade Agreement, and finds a small stumbling-block effect. Tovar deals with a shorter time frame—2005–2009, compared to 1990–2001. Limao (2006) finds that PTAs serve as stumbling blocks for the United States. Similarly, Limao (2007) finds that trade agreements can serve as stumbling blocks for multilateralism. Trade agreements are not found to be stumbling blocks to EU ascension, however. Karacaovali and Limao (2008) look at the European Union and United States, thus offering a look at large developed countries instead of the small developing countries found in Tovar (2012). It is worth noting that Karacaovali and Limao find that often, the United States and European Union offer unilateral concessions for gains in nontariff areas.

Some papers have attempted to analyze the effects of trade agreements on trade creation and trade diversion. Magee (2008) finds evidence of trade diversion but that the benefits of trade creation outweigh the costs of diversion. Magee also provides evidence of the anticipatory effects of trade creation. In a short study, Dai, Yotov, and Zylkin (2014) use a gravity model to find that trade agreements have trade-diversion effects. Endoh (1999) runs a gravity model, but the estimation is not the PPML used in current gravity estimation, so it is not certain the results are unbiased.

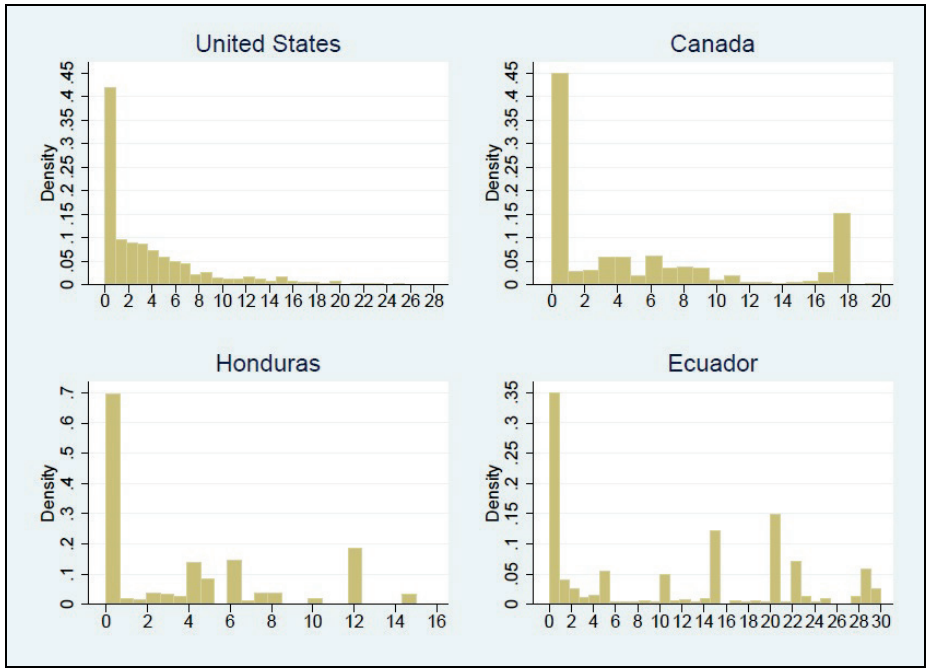
## DATA AND DESCRIPTIVE STATISTICS

Data on trade flows, imports, and exports were collected from Colombia governmental agencies. The data contain the Colombian firm, the value of trade in both FOB (Free On Board; the value of exports and imports of goods as they leave the exporting country, which does not include shipping, insurance, and other charges) and CIF (Cost, Insurance, and Freight; the value of exports and imports, including the cost of shipping and insurance) at the HS10 level, and information on the partner firm. Additional information on firms is from DANE and SIREM, two Colombian data sources. The data cover 2007 to 2013.

During the years of data availability, Colombia entered into six PTAs, with Canada, Chile, the Northern Triangle (El Salvador, Guatemala, and Honduras), the EFTA (Lichtenstein, Iceland, Norway, and Switzerland), the European Union, and the United States. Because of data availability from the WTO on specific preferential tariffs, only the agreements with Canada, Chile, the Northern Triangle, and the European Union are analyzed for Colombian imports. For exports, data are also available for the United States.

Figure 1 illustrates the size of the preference margin given to Colombia by various PTA partners in 2013. As seen, many tariff lines do not have preference margins. The lack of preference margin is often a result of the MFN tariff being set at zero. Also seen in Figure 1 is a glimpse of nations setting MFN tariffs. For both Honduras and Ecuador, the density of preference margins spikes at "round" numbers: 5, 10, 15, and 20 for Ecuador, for example (and likewise other members of the Andean Community, or CAN).

**Figure 1. Colombian Preference Margins in 2013**




As seen in Table 1, the PTA tariff is often much lower. On average, the preference margin is greater than 3.5. There is also anecdotal evidence of the building-blocks theory of trade agreements.

As seen in Table 2, most of the tariff cuts are in the first year, as the average PTA drops, at most, a little over one percentage point. Similarly, it seems that most cuts to zero occur in the first year of the agreement; however, there is large variation in percent of lines that are not cut. The smaller countries see little movement in more tariffs being cut. Meanwhile, for the larger countries (the European Union and Canada), the decrease in the average PTA tariff for later years is also being driven by cuts in tariffs that were originally unchanged.

**Table 1. Summary Stats: Tariff Cuts on Colombian Imports, First Year of Agreement**

| Country | Date Signed | Date Enforced | Avg MFN Tariff | Avg PTA Tariff | % to Zero | % Not Cut | Total Tariff Lines |
|---|---|---|---|---|---|---|---|
| Chile | 27 Nov 2006 | 8 May 2009 | 12.16 | 0.35 | 97.48 | 0 | 7264 |
| Guatemala | 9 Aug 2007 | 12 Nov 2009 | 11.84 | 5.59 | 63.96 | 20.70 | 7055 |
| El Salvador | 9 Aug 2007 | 1 Feb 2009 | 11.85 | 5.62 | 64.20 | 21.56 | 7073 |
| Honduras | 9 Aug 2007 | 21 Mar 2010 | 11.80 | 3.23 | 77.76 | 7.96 | 7075 |
| Canada | 21 Nov 2008 | 15 Aug 2011 | 8.50 | 3.75 | 65.97 | 30.92 | 7267 |
| European Union | 26 Jun 2012 | 1 Mar 2013 | 7.84 | 3.88 | 59.89 | 34.38 | 6853 |

*Note*: Avg=average; MFN=most favored nation; PTA=preferential trade agreements.

**Table 2. Summary Statistics: Tariff Cuts on Colombian Imports in Years Following Agreement**

| | Second Year | | | Third Year | | |
|---|---|---|---|---|---|---|
| | Avg PTA Tariff | % to Zero | % Not Cut | Avg PTA Tariff | % to Zero | % Not Cut |
| Chile | 0.23 | 97.48 | 0 | 0.12 | 97.48 | 0 |
| Guatemala | 5.28 | 63.96 | 20.70 | 4.96 | 63.96 | 20.70 |
| El Salvador | 5.27 | 64.20 | 21.56 | 4.93 | 64.28 | 21.56 |
| Honduras | 2.89 | 77.76 | 7.96 | 2.55 | 77.84 | 7.96 |
| Canada | 3.54 | 65.97 | 22.52 | 3.06 | 65.97 | 10.62 |
| European Union | 3.68 | 59.89 | 31.05 | 3.31 | 59.89 | 19.99 |

*Note*: Avg=average; MFN=most favored nation; PTA=preferential trade agreements.

## RESULTS

This section details the econometric specifications and their results. The first subsection investigates the effect of PTAs on the margins of trade. The second subsection investigates whether the recent string of PTAs has aided or harmed multilateral trade reduction, building-block or stumbling-block effect.

### *Trade Margins*

I break the log of trade volume, $x_{jkt}$, down by $x_{jkt} = n_{jkt} + v_{jkt}$, where $n_{jkt}$ is the log number of firms exporting and $v_{jkt}$ is the average volume of exports by firm. The subscripts denote partner ($j$), product ($k$), and year ($t$). This breakdown of trade margins results in the extensive margin being defined as the number of firms exporting a product to a destination. This definition of the extensive margin differs from that of Buono and Lalanne (2012), in which the extensive margin is the number of firms in a sector exporting to a destination. When the extensive margin is defined at the product level, the gains from trade due to more varieties can be analyzed. Now as more firms export a product, the number of varieties available to consumers increases.

Defining the margin of interest as $M_{jkt}$ and exploiting the fact that tariffs vary across destination, product, and year, the regression of interest is specified as

$$M_{jkt} = \alpha_0 + \alpha_1 Tariff_{jkt} + \alpha_2 Pref_{jkt} + \delta_{jt}^{1} + \delta_{st}^{2} + \varepsilon_{jkt} \quad (1)$$

*Tarff* is defined as $\ln(1 + t_{jkt})$, where $t_{jkt}$ is the ad velorem tariff rate; *Pref* captures the importance of the preference margin, the difference between the MFN tariff at the preferential tariff; $\delta_{jt}^{1}$ and $\delta_{st}^{2}$ represent destination-year and HS2-sector-year dummies; and $\varepsilon_{jkt}$ is the error term.

As seen in Table 3, the traditional gravity controls are of expected sign and magnitude. Distance is negative and of similar size to the results in Buono and Lalanne (2012). With Colombia, colonial ties are strictly with Spain, so the colonial-ties variable is not included. The inclusion of country-year dummies greatly lowers the coefficients on both the tariff and preference margin, as seen in Table 4.

Without including the preference margin, the coefficients on the tariff take similar values and significance to those in Buono and Lalanne (2012). Once the preference margin is included, however, the importance of the tariff is cut in half and there are large drops in significance. As with the tariff, the preference margin plays a larger role than the intensive margin. The main takeaway from Table 4 is that trade agreements increase trade volume by granting lower preferential tariffs. This importance is demonstrated by the fact that *Pref* is large and statistically significant in the last three columns of Table 4 while *Tariff* is often insignificant, as well as magnitudes smaller. Additionally, trade agreements do not increase the number of firms that export (extensive margin); rather, the increase in trade is due to more volume (intensive margin). The results on the extensive margin are similar to those shown in Buono and Lalanne (2012); however, I analyze preferential tariff cuts rather than WTO tariff cuts.

**Table 3. OLS Trade Margins, Gravity Controls**

| | Without variable *Pref* | | | With variable *Pref* | | |
|---|---|---|---|---|---|---|
| **Variables** | **Total** | **Intensive** | **Extensive** | **Total** | **Intensive** | **Extensive** |
| Tariff | –4.013*** | –3.394*** | –0.619*** | –1.656** | –1.049*** | –0.606*** |
| | (0.556) | (0.447) | (0.145) | (0.465) | (0.358) | (0.145) |
| Pref | | | | 4.551*** | 4.357*** | 0.195 |
| | | | | (0.383) | (0.313) | (0.142) |
| GDP | 0.375*** | 0.245*** | 0.130*** | 0.358*** | 0.225*** | 0.133*** |
| | (0.0179) | (0.0152) | (0.0050) | (0.0176) | (0.0144) | (0.0050) |
| Distance | –1.122*** | –0.697*** | –0.425*** | –1.015*** | –0.579*** | –0.436*** |
| | (0.0528) | (0.0452) | (0.0158) | (0.0498) | (0.0403) | (0.0161) |
| Landlocked | –0.0418 | –0.0142 | –0.0276 | –0.316*** | –0.284*** | –0.0321 |
| | (0.0923) | (0.0803) | (0.0264) | (0.103) | (0.0918) | (0.0284) |
| Common Language | 0.447*** | 0.178*** | 0.269*** | 0.407*** | 0.147** | 0.259*** |
| | (0.0745) | (0.0641) | (0.0202) | (0.0729) | (0.0619) | (0.0204) |
| Obs | 165,162 | 165,162 | 165,162 | 159,624 | 159,624 | 159,624 |
| R-squared | 0.308 | 0.317 | 0.356 | 0.319 | 0.330 | 0.359 |

*Notes:* GDP=gross domestic product; Obs=number of observations; OLS=ordinary least squares; Pref=preference margin.

Standard errors are two-tailed and clustered at the HS6 product level.

Year fixed effects are used in each.

* $p < .1$ ** $p < .05$ *** $p < .001$

**Table 4. OLS Margins, Equation 1**

| | Without variable *Pref* | | | With variable *Pref* | | |
|---|---|---|---|---|---|---|
| **Variables** | **Total** | **Intensive** | **Extensive** | **Total** | **Intensive** | **Extensive** |
| Tariff | –1.698*** | –1.568*** | –0.130 | –0.810* | –0.769** | –0.0410 |
| | (0.438) | (0.352) | (0.120) | (0.430) | (0.345) | (0.119) |
| Pref | | | | 2.875*** | 2.548*** | 0.327* |
| | | | | (0.460) | (0.360) | (0.172) |
| Observations | 166,116 | 166,116 | 166,116 | 160,609 | 160,609 | 160,609 |
| R-squared | 0.341 | 0.348 | 0.391 | 0.348 | 0.356 | 0.394 |

*Notes*: OLS=ordinary least squares; Pref=preference margin.

Standard errors are two-tailed and clustered at the HS2 sector level.

Country-year and sector-year fixed effects are used in each.

* $p < .1$ ** $p < .05$ *** $p < .001$

*Stumbling Block or Building Block*

The first investigation is of the building-block or stumbling-block effect of preferential trade agreements. To test, I ran a regression similar to that of Estevadeordal et al. (2008) and Tovar (2012):

$$\Delta MFN_t = \beta_0 + \beta_1 L.\Delta MinPref_t + \beta_2 L.MRG_t + \beta_3 L.s_t + \beta_4 L.(MRG*s)_t + \delta_{st}^2 + \varepsilon_t \quad (2)$$

The *L.* in front of all variable names indicates that the value from the previous year, or lagged value, is used. $L.\Delta MinPref_t$ is the change in the minimum preference margin. (As a reminder, the preference margin is defined as the MFN tariff minus the preferential tariff.) *L.MRG* is a dummy variable that takes the value of 1 if the preference margin is greater than 2.5. The variable *L.s* represents the share of imports from all partners with preferential agreements. *L.(MRG*s)* is an interaction term. HS2-sector-year dummies ($\delta_{st}^2$) are included. Unlike the previous section, which looked at how changes in the tariffs faced by Colombian exporters affected their export decisions, this section of the paper relies on import tariffs set by Colombia.

Although Tables 1 and 2 indicate that there might be some building-block effect as MFN rates are also falling, it is important to note that in 2013, more than 65 percent of imports were from PTA members. Combine the percent of imports from PTA members with the fact that 17 percent of all imports originated in China; a large portion of trade is under preferential agreements or with China.

The results in Table 5 show neither a stumbling-block nor a building-block effect. The lack of subsequent multilateral tariff reductions could be a result of the Doha Round failing to materialize in large tariff cuts. With the failure of the Doha Round, there have been worries that the WTO is becoming outdated and that multilateral trade reductions could be difficult going forward, although there is little evidence from Colombia that the new PTAs have hurt tariff concessions to nonmembers. The coefficient on the preference-margin dummy is weakly significant, however. The negative sign on *L.MRG* could indicate that Colombia also reduced MFN tariffs on products for which the country offered larger tariff concessions on in PTAs.

As Estevadeordal et al. (2008) found, any stumbling block effect is driven by the formation of customs unions (CUs). Colombia did not enter into any CUs during the years analyzed, but it is a part of the Andean Community (CAN), which contains Colombia, Bolivia, Peru, and Ecuador. Columns two and four categorize trade from agreement members based on whether the member is in a PTA (*sPTA*) or CU (*sCU*) with Colombia. This extra classification does not affect the results. Also in line with Estevadeordal et al. and Tovar, I used the preferential tariff cuts of Colombia's cosigner to instrument Colombia's preferential cuts. The IV approach does not alter the results. As can be seen in Table 5, the IV regressions cannot be performed at the HS10 level, as after the HS6 level, product classifications need not be the same across countries; therefore, there are fewer product lines. Even with the IV specification and the separation of CU members and PTA members, there still does not appear to be evidence that Colombia's

trade liberalization between 2007 and 2013 was either a stumbling block or a building block to future tariff reductions.

**Table 5. Building Block or Stumbling Block, Equation 2**

| | (1) OLS | (2) OLS | (3) OLS-IV | (4) OLS-IV |
|---|---|---|---|---|
| L.ΔMinPref | 0.00102 | –0.00136 | –0.0114 | –0.0119 |
| | (0.0270) | (0.0238) | (0.00764) | (0.00764) |
| L.MRG | –2.203** | –1.065** | –1.658** | –1.411* |
| | (0.913) | (0.519) | (0.658) | (0.755) |
| L.s | 6.020 | | 1.064 | |
| | (4.978) | | (1.196) | |
| L.(MRG*s) | –0.188 | | 0.0494 | |
| | (0.122) | | (0.107) | |
| L.sCU | | 2.704 | | 0.990 |
| | | (2.910) | | (1.964) |
| L.(MRG*sCU) | | –2.883 | | –0.918 |
| | | (2.944) | | (1.978) |
| L.sPTA | | 6.020 | | 1.064 |
| | | (4.978) | | (1.196) |
| L.(MRG*sPTA) | | –6.180 | | –1.021 |
| | | (5.003) | | (1.227) |
| Observations | 13,564 | 13,564 | 6,196 | 6,196 |
| R-squared | 0.571 | 0.576 | 0.719 | 0.719 |

*Notes*: OLS=ordinary least squares; OLS-IV=ordinary least squares-instrumenal variable.

Columns 1 and 3 treat all trade agreements as the same; columns 2 and 4 break up *s* based on the type of trade agreement.

Standard erross are two-tailed and clustered at the HS2 sector level.

Sector-year fixed effects are used in each.

* $p < .1$ ** $p < .05$ *** $p < .001$

## CONCLUSION

Using a unique firm-level data set for Colombian trade flows, I was able to analyze two separate implications of Colombia entering into PTAs between 2007 and 2013.

The first main results are that PTAs increase the amount that Colombian firms export, an increase in the intensive margin of trade; however, the PTAs do not increase the number of Colombian firms that export, the extensive margin of trade. Thus, I find that essentially all of the increase in trade after an agreement is due to existing exporters

increasing the sizes of their shipments. Previous papers were not able to provide this level of firm and product detail.

The second main result is that more-recent Latin American PTAs do not seem to act as either stumbling blocks or building blocks to future trade liberalization. Whereas previous papers looked at older trade agreements, to find stumbling blocks or building blocks, I analyzed recent trade agreements that took place during the failed Doha Round of WTO negotiations. My finding that the agreements functioned as neither a stumbling block nor a building block further complicates the open question regarding the role of trade agreements promoting future trade liberalization.

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