International Trade at the Margin: Estimating the Economic Implications of Preferential Trade Agreements

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Abstract

Preferential Trade Agreements (PTAs) have become the most prevalent form of international trade liberalization in recent decades, even though it remains far from clear what their effects on economies and their key units, firms, are. We develop theoretical arguments to this end, focusing on how PTAs should effect the intensive and extensive margins of exporting firms. We then test these arguments for the Dominican Republic – Central America – United States Free Trade Agreement (CAFTA-DR) and exporting firms based in Costa Rica in the time-period 2000-2014. The analysis covers both the firm and the product level. The results of our study suggest that the effects of CAFTA-DR differ depending on whether we analyze the firm or the product level, whether we look at the extensive or the intensive margin, and whether we differentiate by firm size. Contrary to our expectations, we find that CAFTA-DR's entry into force does in general neither effect the intensive margin (export volumes per firm and per product) nor the extensive margin (number of exporting firms and products per firm). However, several industries have gained in the context of CAFTA-DR since especially the mineral products industry saw both an increase in the number of firms as well as an increase

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in the export volume. Yet, other industries, e.g. the metals or the transportation industry, saw a decline in export volume. In addition, while it is mainly the large firms that gain on the extensive margin, it is the small firms that seem to benefit on average at the intensive margin.

Introduction

What are the consequences of trade agreements for trade flow patterns? Starting with the seminal contribution by Rose (2004), an important literature developed around the question of whether such agreements indeed increase trade between member states. This debate started in the context of the World Trade Organization (WTO) but soon spilled over to regional respectively preferential trade agreements (PTAs) as the latter have been rapidly proliferating over the last decades.

Most research on trade agreements evaluates their effects on the country level (Baier & Bergstrand 2007; Baldwin 2008; Freund & Ornelas 2010; Egger et al. 2011). However, analyzing the effects of trade agreements on the country level might hide important sector respectively firm level heterogeneity. This implies that within the same country some sectors or firms might greatly benefit from trade liberalization while others might not (Subramanian & Wei 2007). The empirical observation that not all firms within an industry gain equally from a change in trade barriers (Bernard et al. 2003; Bernard & Jensen 1999; Eaton & Kortum 2002; Eaton et al. 2004), e.g. a trade agreement, is reflected in models of new, new trade theory (Melitz 2003). These models show that while trade liberalization typically benefits those firms that are very productive – mostly large firms (Osgood et al. 2017) –, less productive firms, even within the same industry, can often not compete in foreign markets and thus cannot reap the benefits attached to trade liberalization. The reason for this unequal effect of trade liberalization is that only the most productive firms can compensate for the increased competition in their home market as well as the fixed costs attached to exporting by the gains achieved through selling their products in new markets. For the least productive firms, trade liberalization can even imply market exit. Consequently, the implementation of trade agreements should come along with interesting distributional effects not only within countries but also within sectors and between firms.

We can currently witness such distributional conflicts among others in the context of the Trans-Pacific Partnership (TPP) and the US shoe industry more specifically. Whereas Nike strongly welcomes the TPP agreement as it heavily relies on production facilities in several of the involved TPP partner countries, New Balance on the other hand produces its shoes in the US and thus fears increased competition using cheaper foreign production facilities (Politico 2016).

In addition to highlighting the distributional consequences of trade liberalization *within* industries, the literature has begun to separate

two distinct aspects in which trade liberalization could result in higher trade flows: the intensive vs. the extensive margin of trade (Chaney 2008). Correspondingly, trade liberalization could lead to increased trade flows because either firms trade more volume in products they have already traded before (intensive margin) or because they start to trade products they have not traded previously (extensive margin), or both. In the context of the WTO, for example, Dutt et al. (2011) can show that the WTO and its predecessor the GATT almost exclusively impacts the extensive margin of trade. This implies that once countries become a member of the WTO they begin to trade products that have previously not traded. However, at the same time, the WTO/GATT seems to have a negative effect on the intensive product margin, which would imply that upon membership countries trade less volume of products that they have already traded before.

Understanding the effects of PTAs on the firm level therefore requires a detailed analysis of how firm and product level trade flows react to the implementation of such an agreement with regard to both the intensive and the extensive margin of trade. In this paper, we focus on the effect of one specific PTA, the Dominican Republic – Central America – United States Free Trade Agreement (CAFTA-DR),[1] on firm- and product-level trade flows. In particular, we analyze whether the set of exporters and products – extensive margin – and the actual trade volume exported by firm respectively product – intensive margin – has changed due to the implementation of CAFTA-DR.

We theoretically expect that CAFTA-DR should positively affect both the intensive and the extensive margin since a reduction in trade barriers should allow already exporting firms to export more and at the same time enable firms that were almost ready to export before the agreement was in place to start exporting. However, these effects should be conditional on both the size of the firm and the type of product. We expect a more pronounced effect of CAFTA-DR for larger, and thus more profitable, firms, as well as a differentiated impact of CAFTA-DR on differentiated vs. homogenous products.

To empirically test whether and how firm and product level extensive and intensive margins react to the implementation of CAFTA-DR, we use a novel dataset that provides information disaggregated at the firm-product level for the years 2000 to 2014. Since all other

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[1]The Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR) was signed by the United States, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and the Dominican Republic on August 5, 2004. In 2006, CAFTA-DR entered into force for the United States, El Salvador, Guatemala, Honduras, and Nicaragua. The Dominican Republic joined in March 2007 and Costa Rica in January 2009 (US Trade Representative 2014).

CAFTA-DR member countries were already in a PTA with Costa Rica long before 2009, the year in which CAFTA-DR entered into force for Costa Rica, we focus our analysis on how Costa Rican exports to the US market change with entering into force of CAFTA-DR in relation to those markets for which we observe no trade liberalization, i.e. the non-PTA markets. This empirical identification strategy is necessary to be able to draw causal inference given our empirical setting. Simply analyzing how trade flows of all CAFTA-DR members evolved compared to other markets would conflate markets that have been previously liberalized with those that only saw trade liberalization because of CAFTA-DR. Following this strategy, we are therefore able to empirically study firm as well as product level heterogeneity as we distinguish between the effect of a change in trade barriers on the extensive vs. the intensive margin of trade flows to the US market.

We thereby advance the existing literature in several ways. First, while most of the literature evaluates PTAs at the country level, our disaggregated firm-product level data enables us to study the effects of CAFTA-DR on the extensive and the intensive margin both at the firm and at the product level. Second, over the last decades more and more developing and emerging market economies have started to negotiate PTAs, often including large advanced economies. So far, the literature has, however, mainly focused on advanced economies when evaluating the impact of such trade agreements. Hence we know little about the impact of PTAs on emerging market economies. Costa Rica is a prime example of such an economy and it is crucial to understand whether these countries benefit from PTAs in a similar manner as industrialized countries and how benefits within these countries are distributed.

With our study, we can thereby answer the question as to whether CAFTA-DR had a positive effect by creating new export possibilities for firms not already serving these markets or whether CAFTA-DR mainly benefited those firms that were already able to serve foreign markets. Answering this question is important since it allows us to understand whether trade agreements are profitable for countries in that they expand both the set of exporting firms as well as the set of products. Or if the benefits of a trade agreement come mainly from expanding the volume of those goods that are already exported without creating new export opportunities.

What do we know about the effects of trade agreements on trade flows?

Do trade agreements actually lead to an increase in trade flows between their member countries? And if so, is this because trade agreements allow new firms to start exporting or because firms already exporting are able to export even more?

The question whether trade agreements indeed fulfill the aim that they were created for, namely, to increase trade flows between their member countries, started in the context of the WTO. While a first assessment of this question seemed to suggest that neither the WTO nor its predecessor the GATT had an effect on actual trade flows (Rose 2004), later studies point towards a more nuanced picture (Tomz et al. 2007; Subramanian & Wei 2007). For example, Subramanian & Wei (2007) show that the WTO promotes trade but unevenly: industrial countries that participated more actively in trade negotiations experienced a stronger increase in trade upon membership. Furthermore, only sectors that were indeed liberalized witnessed a significant increase in trade flows with bilateral trade flows increasing most when both countries in the dyad decided to liberalize.

More recently, research started to analyze whether the WTO/GATT enabled trade in new products that were not traded previously (extensive margin) or whether it increased trade in products already traded (intensive margin). Dutt et al. (2011) can show that the WTO/GATT almost exclusively impacts the extensive margin of trade leading to an increase in trade in products that have previously not been traded. However, at the same time the WTO/GATT seems to have a negative effect on the intensive product margin, i.e. it decreases the volume of products that countries have already traded before. These findings suggests that while the number of products countries tend to trade when entering into the WTO/GATT increases, the volume of products traded tend to decrease, which would be in line with the earlier finding of Rose (2004) that the WTO/GATT has no discernible effect on trade volumes.

Turning from the WTO to PTAs, the literature generally shows that PTAs tend to increase trade between their members, with small trade-diverting effects for non-members (Baier & Bergstrand 2004, 2007; Baldwin 2008; Egger et al. 2008, 2011; Freund & Ornelas 2010; Magee 2008). Some studies go beyond the pure trade effects of PTAs and analyze how PTAs affect other macro economic indicators such as employment and country level welfare (Egger & Larch 2011; Romalis 2007; Trefler 2004). However, while most of this research shows that PTAs tend to increase trade between member countries, these studies

tend to evaluate the effect of PTAs on the country level. While it is clearly important to understand whether trade agreements benefit their member countries as a whole, new research on international trade flows suggest that any analysis on the country level might hide important variation since most action in international trade does not occur on the country or even industry but rather on the firm level. Moreover, the distinction between trade effects on the intensive versus the extensive margin as introduced in the context of the WTO (Dutt et al. 2011) provides an additional layer of complexity that should allow for a more precise understanding of the actual impact of preferential trade agreements.

Empirical patterns for firms and trade

While standard models of trade – Heckscher-Ohlin vs. Ricardo-Viner – come to different conclusions as to who benefits from trade liberalization, they have in common that they treat firms within industries as identical and products within industries as homogeneous. Yet, recent empirical studies have found some regularities in trade patterns that are hard to bring in line with these models. In particular, these empirical regularities suggest that firms who export differ from firms producing for their home market, independent of the sector in which they are operating. Exporters tend to be larger in size and are much more productive (Aw et al. 1998; Bernard et al. 2003; Bernard & Jensen 1999; Eaton & Kortum 2002; Eaton et al. 2004). Furthermore, a minority of firms export and those who export typically only serve one or few markets (Eaton et al. 2004).

Melitz (2003) introduced a theoretical model to account for the observed heterogeneity of firms within industries. In this model trade liberalization typically benefits those firms that already export and that are most productive whereas it tends to harm non-exporting firms and those that are least productive. The reason for this unequal effect of trade liberalization is that only the most productive firms can offset the increased competition in their home market by higher levels of exports. For the least productive firms, trade liberalization can even imply market exit.

Furthermore, Chaney (2008) distinguishes the effect of a change in trade barriers on the extensive vs. the intensive margin, where the extensive margin is the set of exporters, i.e. how many firms export, and the intensive margin is the size of exports by firms. If trade barriers change both extensive and intensive margin could change, i.e. less firms could export and they could change the quantity of goods exported. Chaney (2008) shows that the effect of a change in trade

barriers depends on the elasticity of substitution: if elasticity is high the intensive margin reacts more strongly than the extensive margin to a change in trade barriers.

While there exist an emerging literature in political science evaluating the implications of firm level heterogeneity on trade preferences and trade policy lobbying (Plouffe 2012; Jensen et al. 2015; Kim 2016; Osgood 2016; Osgood et al. 2016), few empirical studies evaluate the effect of PTAs on the firm or even product level.[2] For example, Baggs & Brander (2006), relying on firm level data to estimate the effect of the Canada-US free trade agreement on Canadian firms' profits, find, using a sample of all Canadian companies paying taxes, that decreases in domestic tariffs are associated with lower profits for import-competing firms. In contrast, decreases in foreign tariffs are associated with higher profits for exporting firms. Following a different approach, Moser & Rose (2014) evaluate the effect of PTAs on firms using stock market data. However, while relying on firm level data, they aggregate their analysis on the country level to be able to estimate the effect of PTAs on countries' overall welfare.

In summary, the literature on trade patterns focusing on the firm level is developing rapidly and produces important insights on how firms that export differ from those that do not. However, few studies, with the exception of Baggs & Brander (2006), analyze how PTAs affect trade flows at the firm level. Furthermore, the differentiation between the effect of trade liberalization for the intensive vs. the extensive margin of trade has been studied in the context of the WTO Dutt et al. (2011), but not in the context of PTAs. Our study of how CAFTA-DR affects the extensive and the intensive margin of trade at the firm and product level intends to fill these gaps.

The effect of CAFTA-DR on trade flows – Theoretical expectations

Building on the idea of firm level heterogeneity, we study the effect of one specific preferential trade agreement, namely CAFTA-DR, on the extensive vs. the intensive margin of trade (Chaney 2008), both at the firm and at the product level. On the firm level, the extensive margin indicates the set of firms exporting per year, i.e. how many firms export, while the intensive margin refers to the size of exports by firm and year. On the product level, the extensive margin indicates the number of different products exported by firm and year and

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[2]See Wagner (2012) for an excellent overview of the empirical literature on firm performance and trade.

the intensive margin the volume of each product by firm and year. If trade barriers change, for example with the entering into force of CAFTA-DR, both extensive and intensive margin could change. For instance, fewer firms could continue to export, i.e. the extensive margin would decrease, but quantities of goods exported could increase, or vice versa.

In the following paragraphs, we first outline how we expect CAFTA-DR to affect the number of firms and products as well as the volume of traded products. In a second step, we condition this effect on firm size to incorporate insights of new, new trade theory. Finally, we introduce product differentiation to theoretically derive a different effect of CAFTA-DR on the extensive vs. the intensive margin.

In general, following the extent literature, we expect a positive effect of CAFTA-DR for both margins. After all, a preferential trade agreement implies a reduction in trade barriers thus lowering the costs of exporting. If the costs for exporting decrease this should affect those firms that already export since they should be able to export more. Hence we should observe a positive effect of CAFTA-DR on the intensive margin of trade since trade volume should increase at the firm and product level.

At the same time, for those firms not exporting before CAFTA-DR was in force but who were efficient enough to almost export, a lowering in trade barriers could tip the balance. Hence by lowering trade barriers CAFTA-DR should allow some firms that were almost profitable enough to export before the agreement was in place, to start exporting once the agreement has entered into force. Consequently, we should also observe an increase in the extensive margin due to CAFTA-DR.

However, building on the insights of new, new trade theory, the effect of CAFTA-DR should not materialize equally for all exporting firms. More precisely, we expect the effect of CAFTA-DR to vary with the size of the firm. Following Melitz (2003), trade liberalization typically benefits those firms that already export and that are most productive whereas it tends to harm non-exporting firms and those that are least productive. The reason for this unequal effect of trade liberalization is that only the most productive firms can offset the increased competition in their home market by higher levels of exports.

In the context of CAFTA-DR, this would imply that the benefits of the agreement would go mainly to the most productive exporters in Costa Rica, i.e. those firms that are larger in size. However, this conditional effect should mainly happen on the intensive margin of trade. The reason is that those firms who should profit most from a reduction in trade barriers should be the most profitable firms. At the

same time, the most profitable firms are most likely those that have already exported prior to entering into force of a trade agreement. Hence CAFTA-DR should increase exports more for those firms most profitable, i.e. the larger exporting firms.

However, firm size should not be the only factor important for a differentiated impact of CAFTA-DR. Chaney (2008) shows that the effect of a change in trade barriers depends on the elasticity of substitution between varieties. In line with our theoretical prediction above, Chaney (2008) expects a change in trade barriers to increase both the number of firms and products as well as the volume of products traded. Hence lower trade barriers imply that more volume is exported and that somewhat less profitable firms start to export (see paragraph above). If products are easily substitutable, i.e. elasticity of substitution is high (homogenous goods), these new firms can only capture a small share of the export business. However, if elasticity of substitution is low, i.e. products are not easily substitutable (differentiated goods), firms are better sheltered from competition and can reap a larger share of the market. Hence for differentiated goods a change in trade barriers should imply a stronger increase in trade volume than if goods are homogenous. This implies that the intensive margin should react more strongly than extensive margin to a change in trade barriers if elasticity is high.

Empirical Analysis

Our empirical focus is on Costa Rica, an upper middle-income country, which is the oldest democracy in Latin America, and after the debt-crisis of the 1980s had embarked on an ambitious trade liberalization process. In 2007 the country held a nation-wide referendum on the ratification of the trade agreement with El Salvador, Guatemala, Honduras, Nicaragua, the United Sates and and the Dominican Republic (CAFTA-DR), a first for a developing country. CAFTA-DR entered into force in 2009, thus allowing for detailed assessment of its effects on firm and product level trade flows.

Our selection of Costa Rica is motivated by several reasons. First and most importantly, our data on product-firm-level yearly exports is unique in many ways. It is, to the best of our knowledge, the only dataset covering all exported products at the HS10 level for a substantial time period (2000-2014). We obtained the data from Procomer (Promotora del Comercio Exterior de Costa Rica), the Export Promotion Agency of Costa Rica, a public quasi-independent agency founded in 1996, which is part of the Ministry of Trade. This data allows us to test our theoretical expectations regarding the effect of CAFTA-DR

on firms' intensive vs. extensive margin. The Procomer data lists for each exporting firm and year the different products it exported, how much of each product and to which country. The structure of the data is therefore unique in that it is suitable for analyzing the intensive and the extensive margin, both on the firm and the product level. Furthermore, Lederman et al. (2011) can show that the aggregated Procomer data closely corresponds to trade flow data by the Worldbank underlying the validity of the data. We will discuss the dataset in more detail in the following section.

Second, since Costa Rica is a rapidly growing, globalizing developing country it provides an highly interesting case to examine the effects of a PTA. Most of the literature studying trade at the firm level, focuses on industrialized countries (Eaton et al. 2004; Baggs & Brander 2006). Hence we know very little about the effects of trade agreements in the context of developing countries.

Third, while historically Costa Rica exported mainly agricultural commodities, this has changed dramatically over the last decades. As will be discussed in the following section, Costa Rican' exports cover a wide range of industries and firms allowing for a detailed assessment of CAFTA-DR for both the intensive and the extensive margin of trade.

Export data

Before turning to a detailed analysis of the effect of CAFTA-DR on the extensive and intensive margin of exporters in Costa Rica we present an overview of the Procomer data. Over the entire timespan from 2000-2014, the Procomer dataset list 15,625 individual firms that exported at least one specific product in at least one of the years under investigation. However, not all firms continuously export. Figure 1 shows the number of firms that export per year. We can observe that this number has increased from 2416 in the year 2000 to more than 4000 firms in the year 2014.

Figure 1 further reveals that while the number of firms exporting to CAFTA-DR markets tends to be always larger than the number of firms exporting to other markets, the two lines move somewhat closer together from 2009 onwards. This slight convergence in the number of firms exporting to CAFTA-DR and non-CAFTA-DR markets is contrary to the expectation that CAFTA-DR positively affects the extensive margin at the firm level. In this case, one should have observed a stronger increase in the number of firms exporting to CAFTA-DR markets and not in the number of firms exporting to non-CAFTA-DR markets.

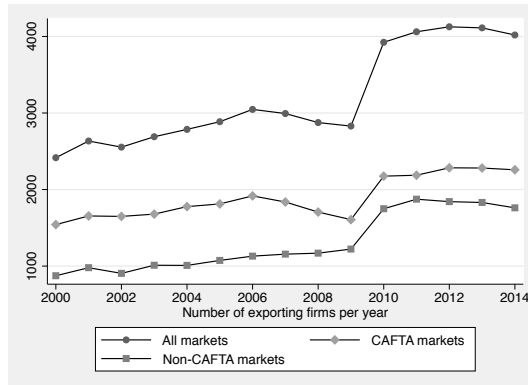If we consider the number of export markets per year, we also

Figure 1: Number of firms per year
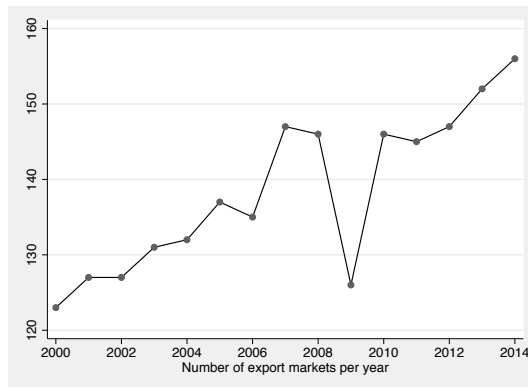
Figure 2: Number of export markets per year

observe an increase in the total number. Figure 2 shows that the number of export markets has risen from 123 in 2000 to 156 in 2014. In 2009, however, we can observe a large drop in the number of export markets, which coincides with the height of the worldwide economic crisis. In 2010 already, the number of export markets are back to pre-crisis levels, however.

While the top one export market in terms of export volume, stays the same during all these years, namely the United States, there is some movement within the top ten list of export markets. Tables 1 and 2 therefore list for each year the top ten export markets. With the exception of the Netherlands, Belgium, the UK and Germany, the most important trading partners can be found in close vicinity of Costa Rica. Nicaragua, Guatemala, Panama, El Salvador, Honduras, Mexico as well as the Dominican Republic are among the most im-

portant trading partners. Interestingly, from 2005 onwards and thus clearly preceding the China-Costa Rica PTA entering into force in 2011[3], one can observe the rise of Hong Kong and China as important export markets for the Costa Rican economy. Already in 2005, Hong Kong has become the second biggest export market in terms of export volume.

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[3]See Table 4 for a list of all Costa Rican PTAs.

Table 1: Top 10 markets per year (value of exports)

	2000	2001	2002	2003	2004	2005	2006
1st	US	US	US	US	US	US	US
2nd	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands	Hong Kong	China
3rd	UK	Guatemala	Guatemala	Guatemala	Guatemala	Netherlands	Hong Kong
4th	Guatemala	Nicaragua	Nicaragua	Malaysia	Germany	Guatemala	Netherlands
5th	Nicaragua	Malaysia	Honduras	Nicaragua	Nicaragua	Nicaragua	Guatemala
6th	Germany	El Salvador	Panama	Germany	El Salvador	China	Nicaragua
7th	El Salvador	Panama	Germany	El Salvador	Honduras	Honduras	Honduras
8th	Panama	UK	El Salvador	Panama	Panama	Panama	Panama
9th	Honduras	Honduras	Malaysia	UK	China	El Salvador	El Salvador
10th	Belgium	Germany	Mexico	Honduras	Malaysia	Germany	Germany

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Table 2: Top 10 markets per year – continued

	2007	2008	2009	2010	2011	2012	2013	2014
1st	US	US	US	US	US	US	US	US
2nd	China	China	China	Netherlands	Netherlands	Netherlands	Netherlands	Netherlands
3rd	Hong Kong	Netherlands	Netherlands	Hong Kong	Panama	Panama	Hong Kong	Panama
4th	Netherlands	Hong Kong	Panama	Panama	Hong Kong	Hong Kong	Panama	Nicaragua
5th	Guatemala	Panama	Hong Kong	Nicaragua	Nicaragua	Nicaragua	Nicaragua	Guatemala
6th	Nicaragua	Nicaragua	Nicaragua	Guatemala	Guatemala	Guatemala	Guatemala	Hong Kong
7th	Panama	Guatemala	Guatemala	Belgium	Honduras	Honduras	China	Malaysia
8th	Honduras	Honduras	Belgium	Honduras	Mexico	China	Honduras	Belgium
9th	El Salvador	Belgium	Dominican Republic	China	Belgium	Mexico	Belgium	China
10th	Mexico	El Salvador	Honduras	El Salvador	El Salvador	El Salvador	El Salvador	Honduras

Turning to the product level, we can observe that Costa Rica is not only very diversified with regards to export markets but also exports a large number of different products. For the time period from 2000-2014, Costa Rican firms exported 9,720 different products at the HS10 level. Again, as in the case of the number of firms, the number of products exported by year varies. As figure 3 shows the number of products to all markets increased from 3,623 in 2000 to 4,793 in 2014. The figure also shows that more products are exported to CAFTA-DR markets, however, that the number of products exported to non-CAFTA-DR markets has increased more strongly especially from 2008 onwards. This is again contrary to the expectation that CAFTA-DR has a positive effect on the extensive margin at the product level.[4]
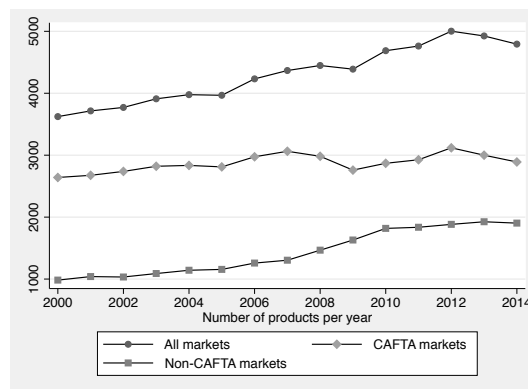

Figure 3: Number of different products at HS10 level per year

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[4]Figure **??** in the Appendix shows the same picture but with products aggregated to HS6 levels, which accounts for 5,073 different products.

If we look at the intensive margin instead of the extensive margin, we also observe this convergence in exports to CAFTA-DR and to non-CAFTA-DR markets. Figure 4 shows the trade volume in US Dollars in millions per year to all markets, to CAFTA-DR and to non-CAFTA-DR markets. Again the worldwide economic crisis is strongly reflected as we observe a huge dip in the export volume in 2009.
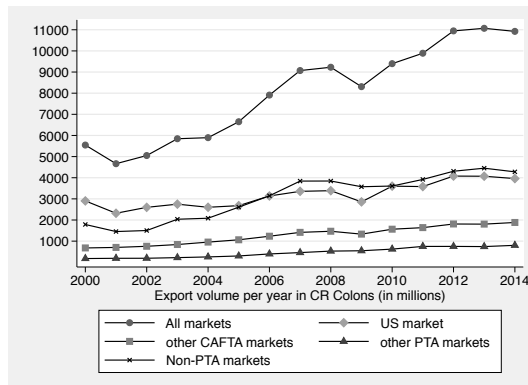
Figure 4: Export volume per year

Finally, Table 3 lists the top five products in terms of export volume per year aggregated on the HS2 level. While Costa Rica is often portrayed as an agricultural economy, the data in Table 3 clearly shows that agricultural exports are not dominating the Costa Rican export portfolio. In contrast, products such as electrical machinery, computers as well as some articles of apparel are among the products exported most.

Table 3: Top 5 exports by HS 2

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1st	84	84	84	84	84	85	85	85	85	84	08	85	85	85	85
2nd	08	08	08	08	08	08	08	08	08	08	85	08	08	08	08
3rd	85	85	85	90	85	84	84	84	84	85	90	90	90	90	90
4th	09	62	90	85	90	90	90	90	90	90	84	09	09	21	21
5th	62	90	62	62	62	62	62	30	09	30	21	21	21	39	39

HS 08: Edible Fruits & Nuts, Peel of Citrus/Melons
HS 09: Coffee, Tea, Mate & Spices
HS 21: Miscellaneous Edible Preparations
HS 30: Pharmaceutical Products
HS 62: Articles of Apparel & Clothing Accessories-Not Knitted or Crocheted
HS 84: Nuclear Reactors, Boilers, Machinery, Mechanical Appliances, Computers
HS 85: Electrical Machinery & Equip. & Parts, Telecommunications Equip.,
Sound Recorders, Television Recorders
HS 90: Optical, Photographic, Cinematographic, Measuring, Checking, Precision
Medical Or Surgical Instruments & Accessories

Identification strategy

To be able to draw causal inference in a panel data set-up it is important to carefully determine the correct control cases (Kosuke & Kim 2016). Our dataset includes data on all exporters thus including both exports to countries with which Costa Rica has a PTA for the complete time span, e.g. El Salvador, those with which Costa Rica has no PTA for the period under investigation, e.g. India, and countries for which Costa Rica enters into a PTA during the period under investigation, e.g. the US or China. This implies that when evaluating the effect of CAFTA-DR we need to thoroughly decide which exports to which markets to compare with which control units. For example, simply comparing firms' exports to CAFTA-DR markets before and after the agreement entered into force with all other markets would conflate for the control units both markets with and without Costa Rican PTAs. Hence for all analyses below we carefully distinguish which exports we compare to which control units.

Table 4: List of PTAs including Costa Rica

Year	Name of agreement	Country
1967	FTA Central America	El Salvador
1967	FTA Central America	Guatemala
1967	FTA Central America	Honduras
1967	FTA Central America	Nicaragua
2002	FTA Canada–Costa Rica	Canada
2002	FTA Chile–Central America	Chile
2002	Dominican Republic–Central America	Dominican Republic
2005	FTA CARICOM	Trinidad and Tobago
2006	FTA CARICOM	Barbados
2006	FTA CARICOM	Guyana
2011	FTA CARICOM	Belize
2008	Panama–Central America	Panama
2009	CAFTA-DR	US
2011	China–Costa Rica	China
2013	Mexico–Central America	Mexico
2013	Costa Rica–Peru	Peru
2013	Costa Rica–Singapore	Singapore
2013	EU–Central America	All EU countries[5]
2014	EFTA–Central America	Iceland
2014	EFTA–Central America	Liechtenstein
2014	EFTA–Central America	Norway
2014	EFTA–Central America	Switzerland

Furthermore, as Table 4 shows Costa Rica has already had a PTA with all other members of CAFTA-DR except the US. Hence trade was already liberalized between Costa Rica and El Salvador, Guatemala, Honduras, Nicaragua, and Dominican Republic. The major change that came along with CAFTA-DR was therefore the preferential market access for the Central American countries with the US and vice versa. However, this implies for our analysis that we need to focus our analysis of the effect of CAFTA-DR on the US market only since there should not be any differences for exporters to the other CAFTA-DR markets given their already existing trade liberalization with Costa Rica.

Our empirical analysis is structured such that the first part of the analysis focuses on the extensive margin and the second part on the intensive margin. The unit of analysis for the first part of the analysis is therefore the number of firms per export market per year and the number of firms per industry and export market per year. In our analysis of the intensive margin we first focus on the firm-export market pair per year and then further disaggregate to the product-firm-export market combination per year. Since the unit of analysis as well as the control cases differ for each of these analyses we define the respective dependent variable at the beginning of each section below.

Our main independent variables stay the same for all analyses below. They are two indicator variables: The first one indicates all exports going to the US market and the second one indicates the time period after CAFTA-DR is in force (2009 to 2014) as well as the interaction effect of the two. Using these three indicator variables, we can estimate the difference in the extensive and intensive margin before and after CAFTA-DR is in force for both markets that belong to CAFTA-DR and markets that do not. Table 5 list the independent variables.

Overall our dataset includes 15,625 firms, however, not all of them export on a regular basis. As Figure 5 displays the largest part of the firms in our sample, about 55%, export for one year only. About 13% of the firms export for two years and only about 3% of the firms in our sample, i.e. 481 firms in total, export over the whole time span of 15 years.[6]

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[6]To obtain this figure we have aggregated the data on the firm level such that each firm exporting any type of product to any kind of market in a specific year forms the unit of analysis.

Table 5: Independent variables

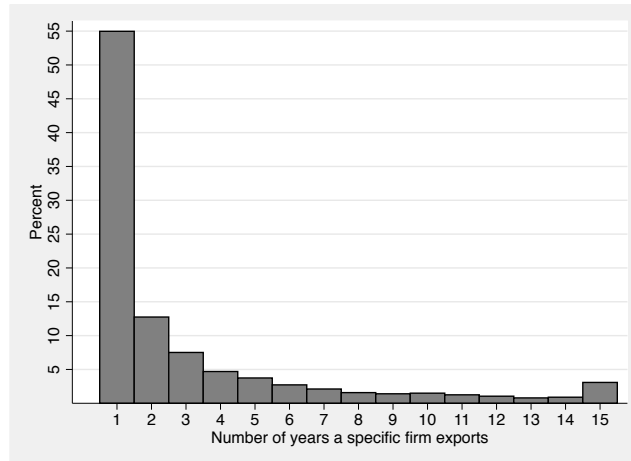|	
CAFTA-DR in force	0 for the years 2000-2008 1 for the years 2009-2014
US market	0 for other markets 1 for US market
Interaction effect	1 for US market with CAFTA-DR DR in force 0 for all other observations

Figure 5: Number of years that each firm in the dataset exports between 2000-2014 to any kind of export market

Extensive margin

The analysis of the extensive margin at the firm level implies to evaluate whether firms not exporting to the US market before CAFTA-DR entered into force were able to export to the US afterwards. Again, as discussed in the section above, it is not possible to make this evaluation for the other CAFTA-DR market countries since all of them had a free trade agreement with Costa Rica already before CAFTA-DR entered into force. The dependent variable is the number of firms to each export market. Furthermore, as discussed further above we focus our comparison on those markets that have not seen a trade liberalization, i.e. markets without a PTA in force, and the US market. Since CAFTA-DR entered into force in 2009 our first comparison – Model (1) in Table 6 – are the two consequent years right before and after the agreement entered into force, i.e. 2008 and 2009. Since the year 2009 coincides with the worldwide financial crisis and to capture the more long term effects of CAFTA-DR Model (2) compares the years 2008 and 2014. Finally, Model (3) evaluates the average effects in that it compares the average number of firms per export markets from 2000-2008 with the average number between 2009 and 20014. Due to our dependent variable being a count variable we use Poisson regression models.

Table 6: Poisson Regression – extensive margin

	(1) 08/09	(2) 08/14	(3) averages
US	3.75***	3.75***	3.91***
	(0.155)	(0.155)	(0.162)
CAFTA-DR in place	0.17	0.16	0.30
	(0.218)	(0.215)	(0.222)
US*CAFTA-DR in place	-0.19	0.16	-0.04
	(0.218)	(0.215)	(0.222)
Constant	3.37***	3.37***	3.20***
	(0.155)	(0.155)	(0.162)
Observations	250	280	280

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results displayed in Table 6 shows that in contrast to our

theoretical expectation CAFTA-DR has no discernible impact on the extensive margin. While the US market in general attracts more firms than other markets there is no increase in this number of firms associated with the entering into force of the agreement. This finding is independent of the time period under investigation as Models (1) to (3) all show insignificant coefficients for the interaction effects.

If we, however, disaggregate the analysis and use the country industry level to evaluate the effects of CAFTA-DR on the extensive margin we observe some variation. Table 7 provides a summary of the results. For example, if we consider the comparison between the year 2008 and 2009 the number of firms exporting in the mineral products industry has significantly increased for the US after CAFTA-DR entered into force relative to other non-PTA markets. This is also true for the longer run, as the regression model using the 2008/2014 comparison shows. However, this positive effect is counteracted by a negative effect for the transportation industry. If we look at the models using the longer term comparison more industries are characterized by a positive development on the extensive margin, such as animal products, footwear and headgear, metals etc. If we consider the models using averages only the wood products industry is characterized by an increase in the extensive margin.

Table 7: Within industry variation – extensive margin

	2008/2009	2008/2014	averages
1 Animal & Animal Products		positive	
2 Vegetable Products			
3 Foodstuffs			
4 Mineral Products	positive	positive	
5 Chemicals & Allied Industries			
6 Plastics / Rubbers			
7 Raw Hides, Skins, Leather, & Furs		positive	
8 Wood & Wood Products			positive
9 Textiles			
10 Footwear / Headgear		positive	
11 Stone / Glass		positive	
12 Metals		positive	
13 Machinery / Electrical			
14 Transportation	negative		
15 Miscellaneous		positive	

To test whether larger or smaller firms benefitted differently from CAFTA-DR Table 8 shows the results differentiated by the size of the firm. We distinguish small and large firms in the following way: Those firms employing more than 800 individuals (which corresponds to the 90 percentile of the employment distribution in our dataset) are coded as large, all others as small. Unfortunately, not all firms in our dataset stated their number of employment, which implies that we lose a number of observations.

The results in Table 8 show that in the short term there is no significant increase for any type of firms in our dataset. In the long run, however, it is the big firms that seem to profit as we see a significant increase in the number of large firms by the year 2014, see Models (3).

Table 8: Conditional on employment – extensive margin

	(1) 08/09 big	(2) 08/09 small	(3) 08/14 big	(4) 08/14 small	(5) averages big	(6) averages small
US market	3.44***	3.69***	3.44***	-2.73	3.92***	3.53***
	(0.134)	(0.158)	(0.134)	(32,485.333)	(0.158)	(0.145)
CAFTA-DR in force	0.08	0.12	0.29	0.77	-0.25	0.45**
	(0.194)	(0.217)	(0.194)	(10.919)	(0.215)	(0.210)
US*CAFTA-DR in force	-0.01	-0.14	0.67***	-37.24	0.26	0.07
	(0.194)	(0.217)	(0.194)	(2.138e+20)	(0.215)	(0.210)
Constant	2.26***	3.16***	2.26***	-0.82	2.61***	2.76***
	(0.134)	(0.158)	(0.134)	(9.579)	(0.158)	(0.145)
Observations	179	266	198	242	257	275

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Intensive margin

An analysis of the intensive margin at the firm level implies an evaluation of CAFTA-DR for those firms that have been in business before the agreement entered into force in 2009. Hence we exclude the 7,381 firms that did not export before CAFTA-DR has entered into force. More precisely, we analyze for those firms exporting in 2008 how their export volume has changed with CAFTA-DR entering into force. We therefore further exclude the firms exporting in the early years of our

dataset but which stopped exporting before 2008, which is true for 4,734 firms. We exclude these firms since their decision to stop exporting should be unrelated to the CAFTA-DR agreement and would therefore bias our results. Hence our analysis of the intensive margin at the firm level is based on the 2,875 firms exporting in the year 2008.

In particular, we rely on a within-firm design and evaluate for each firm serving the US market in the year 2008 how much its export volume to the US changed with CAFTA-DR in force compared to the same firms' export to non-PTA countries. Hence the unit of analysis is the firm exporting to a specific market in year t. Our quantity of interest is thus $ln(V_{f,m,t})$, i.e. the logged volume of exports V for firm f to market m in year t. For all firms exporting also to other PTA countries these exports are not included in the analysis. Again as for the analysis on the extensive margin we focus on three types of temporal comparisons: 2008/09, 2008/14 and the averages before and after. Furthermore, in Model (4) in Table 9 we exclude those firms exporting less than USD 5000 on average.

Table 9: Poisson Regression – intensive margin

	(1) 2008/2009	(2) 2008/2014	(3) averages	(4) averages big
US market	2.85***	2.81***	2.77***	2.77***
	(0.248)	(0.241)	(0.204)	(0.204)
CAFTA-DR in force	-0.20	-0.62**	-0.03	-0.03
	(0.347)	(0.303)	(0.280)	(0.280)
US*CAFTA-DR in force	-0.01	0.54	0.15	0.15
	(0.382)	(0.348)	(0.307)	(0.307)
Constant	9.10***	7.76***	4.97***	11.30***
	(0.677)	(0.730)	(0.466)	(0.466)
Firm fixed effects	yes	yes	yes	yes
Observations	14,349	16,802	16,974	16,932

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A further complication arises for those firms exporting in 2008 but not exporting in 2009. Since in 2009 their export volume is zero the question arises how to treat these zero observations because of the log-scale of the dependent variable. We follow Santos Silva & Ten-

reyro (2006) and use a Poisson pseudo-maximum-likelihood method.[7] Using a Poisson model has two advantages over other approaches as it corrects for both the heteroscedasticity of the error term in standard gravity models and for the zero observations.

Table 9 displays the results using this specific approach. All models exclude firms exporting solely to the US. In all regressions, independent of their specification, the US market in general attracts more exports than other markets and the year 2009 is characterized by a decline in exports. Furthermore, the regression results display a negative though not statistically significant coefficient for the interaction term. This suggests that CAFTA-DR had no discernible impact on the intensive margin on the firm level.

If we disaggregate according to industry, we observe mainly negative effects on the long run, see Table 10. With the exception of the wood and wood products industry, which saw a positive increase for the intensive margin on the firm level, several industries saw a decline in their export volumes, e.g. textiles, footwear and headgear and transportation. If we look at the models using averages it is also the mineral products industry that seems to have gained from CAFTA-DR.

If we condition our analysis on employment, we observe a somewhat different pattern as above with regards to the extensive margin. While for both the short and the long run no type of firm seems to significantly benefit from CAFTA-DR, it is the large firms for which the models always display a positive interaction effect. Yet, if we consider the averages it is surprisingly the small firms that seem to benefit most from CAFTA-DR at the intensive margin.

The detailed nature of our data allows us to further disaggregated. In the next step of the analysis, we thus focus on the products at the HS2 level as the unit of analysis. Overall these are 97 categories. The unit of analysis is the volume per HS2 product to a specific market in year t. Our quantity of interest is thus $ln(V_{p,m,t})$ the logged volume of exports V for product p to market m in year t. More precisely, we analyze in a difference-in-difference set-up how the volume per product category has changed from 2008 to 2009 given that this product was exported to the US in the year 2008 (all product-market combinations for which a PTA was already in place before 2009 were not included in the analysis). In those years, in which no volume of the given product was exported to a respective export market given there were previously positive volumes were set to zero.

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[7]Although trade data are no count data, using a Poisson model is appropriate since theoretically deriving the gravity equation leads to a form corresponding to the Poisson model (Santos Silva & Tenreyro 2006).

Table 10: Within industry variation – intensive margin

	2008/2014	averages before and after
1 Animal & Animal Products		
2 Vegetable Products		
3 Foodstuffs		
4 Mineral Products		positive
5 Chemicals & Allied Industries		
6 Plastics / Rubbers		
7 Raw Hides, Skins, Leather, & Furs		
8 Wood & Wood Products	positive	
9 Textiles	negative	
10 Footwear / Headgear	negative	negative
11 Stone / Glass		
12 Metals	negative	
13 Machinery / Electrical		
14 Transportation	negative	
15 Miscellaneous		

Table 11: Poisson Regression – intensive margin conditional on employment

	(1)	(2)	(3)	(4)	(5)	(6)
	08/09	08/09	08/14	08/14	averages	averages
	small	big	small	big	small	big
US market	2.88***	2.77***	2.90***	2.73***	2.67***	2.95***
	(0.136)	(0.400)	(0.139)	(0.378)	(0.090)	(0.377)
CAFTA-DR in place	-0.14	-0.23	-0.42***	-0.70	-0.23**	-0.42
	(0.105)	(0.529)	(0.110)	(0.482)	(0.126)	(0.470)
US*CAFTA-DR in place	-0.19	0.13	0.08	0.82	0.27**	0.56
	(0.149)	(0.590)	(0.175)	(0.564)	(0.126)	(0.536)
Constant	5.38***	4.42***	13.15***	1.82*	9.78***	4.85***
	(0.923)	(1.017)	(0.656)	(1.044)	(0.762)	(1.027)
Firm fixed effects	yes	yes	yes	yes	yes	yes
Observations	12,174	2,293	14,070	2,732	14,070	2,732

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results as displayed in Table 12 show the same pattern as above. While the US in general attracts significantly more trade volume by product than other markets, this is reduced in 2009 and especially, though not significantly so, for the US.

Table 12: Poisson Regression – intensive margin HS2 level

	(1)	(2)
US market	4.29***	3.48***
	(0.219)	(0.410)
CAFTA-DR in place	-0.13	-0.28
	(0.287)	(0.358)
US*CAFTA-DR in place	-0.01	-0.19
	(0.348)	(0.454)
Constant	1.57**	-5.28***
	(0.704)	(1.795)
Product fixed effects	yes	yes
Firm fixed effects		yes
Observations	7,748	7,748

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Conclusion

Most political conflicts associated with negotiating free trade agreements and also when implementing them concern distributional implications. Scholars have come up with various theoretical arguments to predict winners and losers from trade, but empirical testing of these arguments has thus far produced ambiguous results. Notably, it remains unclear whether trade agreements mainly benefit those firms that were already able to serve foreign markets by expanding the intensive margin of trade, or whether trade agreements also expand the set of exporting firms and products, thus increasing the extensive margin of trade? The results of our study suggest that the effect of CAFTA-DR differ depending on whether we analyze the firm or the product level, whether we look at the extensive or the intensive margin, and whether we differentiate by firm size.

Concerning the extensive margin at the firm level, we observe that the years since CAFTA-DR are in general not associated with an

increase in the number of firms in general. Yet, some sectors have nevertheless profited from CAFTA-DR, such as the mineral products industry and footwear and headgear, which both experienced an increase in Costa Rican firms exporting to the US market. Furthermore, in the long run, we observe an increase in the number of large firms.

Turning to the intensive margin on the firm level, we again find that in general there is no differential impact of CAFTA-DR neither on the firm nor on the product level. If we look at the different industries, the impact of CAFTA-DR is, however, even negative: With the exception of the wood and wood products industry, which saw a positive increase for the intensive margin on the firm level, several industries saw a decline in their export volumes, such as textiles, footwear and headgear and transportation. Finally, if we differentiate between large and small firms it is this time not the large firms but rather the small firms that seemed to have gained most, at least if we compare the longer term averages.

Overall, the results so far are rather tentative since we need to go further into detail with regard to the more disaggregated product level and then also look at whether the product is homogenous or not.

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