Essays In International Economics

Inaugural-Dissertation
zur Erlangung des Grades
Doctor oeconomiae publicae (Dr. oec. publ.)
an der Ludwig-Maximilians-Universität München

2020

vorgelegt von

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Promotionsabschlussberatung: 22. Juli 2020

Datum der mündlichen Prüfung: 10. Juli 2020

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Für meine Familie.

Acknowledgements

First and foremost, I would like to thank my supervisor Gabriel Felbermayr for his continuous and outstanding support over the past years. Be it as my co-author, lecturer or center-boss he has taught me incredibly much about international trade policy, economics, and life in general. Thanks for all the inspiring and fruitful discussions—no idea was too crazy, no project too ambitious, no dataset too complex. Gabriel has always pushed me to give my very best, encouraged me when I wanted to do unconventional things, and gave me perspective whenever I lost hope. Furthermore, he helped me to uncover talents that I was not aware of. I am indebted to him for much of what I take away from these years of study.

Monika Schnitzer played a very important role in my upbringing as an economist: more than ten years ago, her lecture on monopolists convinced me to study economics in the first place. Who would have thought that she will be on my dissertation committee? I thank her for being a role model, many helpful comments and suggestions on my work, and for being in my corner in times of need.

I am also grateful to Andy Bernard who helped me to grow as a researcher, challenged me with tough questions, taught me to tackle research questions in a much more structured way, and showed me that—except for the recurring feeling of being a slow thinker—talking to a superstar is not hard, but instead extremely rewarding. He also made my visit to the Tuck School of Business at Dartmouth College possible, where I was inspired to think deeper about economics, work harder, and learn more.

My colleagues at ifo Alexander Sandkamp, Marina Steininger, Martin Braml, and Thomas Steinwachs were always helpful, did not become tired of discussing issues about tariffs with me, and made sure that the years of completing my PhD were not all work but also lots of fun. Special thanks go to Andrea Ariu whose guidance and honest feedback were extremely valuable. Lea Immel, Elisabeth Grewenig, and Markus Nagler deserve special mention for incredible support in the final stage of my dissertation.

Without my good friends, I would not have been able to achieve this. I am very grateful for having you. Most of all, I thank my family. Without their endless love and support, none of this would have been possible.

Feodora Teti
July 2020

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Preface

Trade has skyrocketed over the past two centuries. While in 1820 world trade accounted for only 20% of world GDP this share almost tripled by 2016 and increased to 56%.[1] With trade having a more important role in the world economy, trade policy became more relevant, too. Countries have been using tariffs to regulate trade for a very long time. According to Adam Smith (1776), *"[In France Jean-Baptiste Colbert,] That minister, by the tariff of 1667, imposed very high duties upon a great number of foreign manufactures"* (p. 358). In the 17th century these French tariffs caused—at least in part—the Franco-Dutch war and resulted in similar British duties shortly after. The British Corn Laws (Irwin 1989) and the tariffs applicable in the colonial system (Hill 1892) are other examples that illustrate the historical importance of tariffs in trade policy.

Tariffs are taxes imposed by a country that make imported goods more expensive relative to domestic ones, and, as any tax, tariffs lead to welfare losses. Thus, the question arises: why do countries set tariffs in the first place? There are at least three distinct reasons put forward in the literature. First, they serve as a source of revenue, as tariffs are relatively easy to collect. This argument is especially relevant for countries with weak institutions where governments might have troubles generating revenue through other sources, e.g., Europe during the 17th to the 19th century or developing countries nowadays (cf. Keen 2008; Baunsgaard and Keen 2010). Second, terms-of-trade objectives might also play a role, as large countries can improve their terms-of-trade by imposing tariffs (Bagwell and Staiger 1999). Lastly, political economy motives can determine tariffs; politicians might be influenced by special interest groups and/or their constituencies (Grossman and Helpman 1994), which can go in either direction. The repeal of the Corn Laws in the 19th century is one example when consumer welfare was prioritized. Protection to British agriculture was torn down lowering grain prices substantially (Irwin 1989). In contrast, recent U.S. trade policy increases tariffs to protect industries that lost from trade. One of Donald Trump's central campaign pledges was to impose punitive tariffs on Chinese goods, a promise he kept when adding an up to 25% tariff on most of U.S. imports from China in 2018/19.

[1] These numbers stem from the chart "Globalization over 5 Centuries" at https://ourworldindata.org/grapher/globalization-over-5-centuries.

This thesis consists of three self-contained chapters on trade policy through the lens of tariffs. Chapter 1 reviews how recent trade policy affects the global tariff landscape. To analyze how countries set tariffs, I compile a new tariff database. Chapter 2 analyzes the necessity of rules of origin (RoOs), a regulatory detail that entails high costs and that is embodied in all free trade agreements. To do so, I determine the profitability of trade deflection using the new tariff data presented in the previous chapter.[2] In Chapter 3, I analyze the effect of nonreciprocal trade preferences on firm-level exports.

Up until the outbreak of World War I, global trade policy was characterized by a network of bilateral trade treaties which arose without multilateral cooperation. This system was shattered during the World Wars and the inter-war period, when countries turned to protectionism and international trade broke down. As a return to the "nonsystem" of the late 19th century was considered highly unlikely, the international community, led by the United States and the United Kingdom, agreed on the need for a postwar international agreement on trade policy to reduce trade barriers (Irwin 1995) resulting in the formation of the General Agreement on Tariffs and Trade (GATT) in 1947. The most-favored-nation clause is the defining principle of the GATT and it requires a country to treat all trading partners the same, which internalizes terms-of-trade motives and is therefore welfare enhancing (Bagwell and Staiger 1999). Since then, eight rounds of multilateral trade negotiations have concluded, reducing the average ad valorem tariff on industrial products to below 5% and expanding the multilateral system's membership from 23 to 164 countries (cf. Bagwell et al. 2016). Furthermore, in 1995 the World Trade Organization (WTO) was created.

In Chapter 1, I give a comprehensive overview of the global tariff landscape for the period 1988 to 2017. Although tariffs might be on average low, this is neither true across all countries nor across all sectors. In fact, even within sectors there is large heterogeneity across products. Additionally, regional trade agreements (RTAs) make it possible to discriminate between trading partners. Tariffs are hence characterized by heterogeneity across various dimensions. I answer the following questions: What are the persistent patterns in tariff protectionism across countries and sectors? How and by how much did tariffs change over the past 30 years? What role did the WTO play? How much and when do preferential tariffs liberalize trade?

Tariff data are not easily available. As Anderson and Van Wincoop (2004) state *"the grossly incomplete and inaccurate information on policy barriers available to researchers is a scandal and a puzzle"* (p. 693). The main problem with the data is missing information and misreporting in the official data, in particular for developing countries. Further, preferential RTAs allow for discrimination in terms of the imposed tariff across trading partners making the data problems

[2] Chapter 2 is based on joint work with Gabriel Felbermayr and Erdal Yalcin and has been published in the Journal of International Economics 2019 (2019) 121, 103248.

more severe for this type of tariff. With the current data situation, it is impossible to give informed answers on the landscape of tariffs. Chapter 1 presents a new global tariff database covering tariffs at the six-digit product level for 197 importing countries and their trading partners for 30 years, namely 1988 to 2017. I simultaneously deal with the two major issues, missing data and misreporting, almost doubling the number of available tariffs from 2.9 to 5.7 billion. The improvement is particularly relevant for least developed countries and developing countries: for least developed countries the share of missing data equals 56%, for developing countries it is 42%.

With this new data at hand, I document important new facts about tariffs around the world. First, I show that most of the recent decrease in tariffs is actually due to developing countries unilaterally lowering tariff-levels, independently of multilateral agreements under the WTO. Second, I find two customary practices that apply to all countries when they set tariffs: tariffs are often multiples of five or equal zero and countries tend to set the same tariff for entire tariff headings (HS4-digit) instead on setting tariffs on a product-by-product basis. The reasons for this observation might be attempts to facilitate the customs process and to diminish the risk of fraud. Third, RTAs liberalize trade substantially. Within most RTAs, more than 90% of all trade is duty-free. For RTAs between high income countries this number is extremely asymmetric: while industrial products can essentially be traded for free, only 70% of all agricultural products are exempt from tariffs. In most cases, tariff cuts are implemented immediately when the RTA becomes effective. On average, only 25% of all tariff lines are phased-in over a 10-year period, in developing countries it takes on average a bit longer.

The main contribution of this chapter is twofold: First, it presents a new database that deals simultaneously with the two major issues of existing tariff data, missing data and misreporting. To the best of my knowledge no other comparable database exists. Second, I am the first to document important new facts about tariffs around the world that substantially improve our understanding of how countries set tariffs.

After the initial successes of the GATT/WTO, multilateral negotiations have come to a standstill. Since the conclusion of the Uruguay Round in 1995, no significant new multilateral agreement could be reached due to the high number of members and their diverse interests. Consequently, countries turned to regionalism to further liberalize trade. According to the WTO, in 1988 only 21 RTAs were in force. As of March 2020, this number increased to 304. RTAs are reciprocal preferential trade agreements between two or more partners. They take the form of free trade agreements (FTAs) and customs unions (CUs). In contrast, nonreciprocal trade arrangements are unilateral. Typically, high income countries grant to developing countries duty-free market access for specific products chosen by the the importing country.

Traditionally, trade economists are skeptical of RTAs because of their preferential nature. FTAs grant advantages to some trade partners but withhold them from others. In that way, they lead to harmful trade diversion. Amongst regional trade agreements, customs unions (CUs) are usually preferred over FTAs, because the former create as much trade as the latter but typically divert trade less (Krueger 1997). Rules of origin (RoOs), that are required only in FTAs, are one of the channels through which FTAs can generate additional welfare costs, as they can increase trade diversion vis-à-vis third countries (Conconi et al. 2018; Krishna and Krueger 1995; Krishna 2006).

While CUs have a common external tariff, this is not the case with FTAs. For this reason, in contrast to CUs, FTAs require RoOs that define under which conditions a good is said to originate from a member country of the FTA so that it can benefit from a preferential tariff. Compliance with these rules is costly. First, they cause red tape that reduces the gains from an FTA for the signatory parties. The compliance costs associated with meeting RoOs requirements range from 3-15% of final product prices depending on the method used to measure the restrictiveness of RoOs (Carrère and Melo 2006; Anson et al. 2005; Estevadeordal 2000; Cadot et al. 2006). Second, exporters might need to adjust their global supply chains to meet RoOs requirements that yields distorted trade patterns and investment flows with third countries (Krishna and Krueger 1995; Krishna 2006). Conconi et al. (2018) show that in the absence of RoOs, Mexican imports of intermediates from third countries relative to NAFTA partners would have been 45% higher. Why are RoOs still an inherent part of any FTA given these high costs? According to advocates of RoOs, without them each imported commodity would enter the FTA through the country with the lowest tariff. RoOs prohibit this arbitrage activity, often referred to as trade deflection.

To determine the necessity of RoOs, Chapter 2 investigates if trade deflection is realistic empirically. We show the analytical conditions under which trade deflection is profitable. The profitability of trade deflection correlates positively with the difference in external tariffs between the FTA member countries and negatively with additionally arising transportation costs due to transshipment. This insight guides the empirical analysis. To evaluate the profitability of trade deflection, we use the tariff database presented in Chapter 1 and compile a new dataset on product level transportation costs. We can show that for most country pairs in FTAs, trade deflection is unprofitable. The reason for this is that tariffs are generally low, countries in a common FTA tend to have similar external tariff levels, and when tariff levels differ, deflection is profitable at most for one country in the pair.

To the best of our knowledge, this fact has been overlooked so far although it is essential for the debate on RoOs: it makes clear that the existence of hundreds of pages of text on RoOs in modern FTAs is indicative of rent seeking rather than necessary due to the inherent logic of a trade agreement. The result suggests a fundamental re-thinking of the use of RoOs in trade agreements. One could substantially relax the requirements to prove the origin of goods in many trade agreements without risking any trade deflection.

Besides FTAs and CUs, there is one more exception that allows countries to deviate from the defining principle of the GATT/WTO, i.e. no discrimination across trading partners—the so-called most-favored-nation (MFN) principle. The GATT/WTO agreements contain special and differential treatment for developing countries. Nonreciprocal trade arrangements are one cornerstone of the special and differential treatment of developing countries. Under these arrangements high income countries grant developing countries preferential market access conditional on them implementing reforms like complying with international labor standards or enforcement of intellectual property rights. The main idea of these trade arrangements is to use trade for aid: lower trade costs shall increase trade helping to alleviate poverty in developing countries and to create jobs.

So far, it is still unclear if the nonreciprocal trade preferences have in fact a trade promoting effect and if so, along which margins they operate. The literature finds conflicting evidence depending on the specific trade arrangement, the level of aggregation, and the period of observation. Furthermore, it is difficult to find causal effects because the products that become eligible for preferences might be chosen endogenously. Lastly, so far, no evidence exists on how receiving nonreciprocal preferences affect firms' export-performance.

To fill this gap, in Chapter 3 I analyze how the expansion of the Andean Trade Preference Act in 2002—a program that improves access to the American market for firms from Bolivia, Colombia, Ecuador and Peru— affected Peruvian firm-level exports to the United States. From 2002 onwards, 600 additional products became eligible for nonreciprocal preferences. I compare these with the products that have already received preferences before. To deal with endogeneity, I use nonreciprocal preferences the United States granted to sub-Saharan countries under the African Growth and Opportunity Act (AGOA), as an instrument for the set of eligible products in the Peruvian context. Then, I make use of the disaggregated nature of the export data to compare the export growth of the same firm to the same destination across products, i.e. a triple difference-in-differences approach. I compare exports of products eligible for preferences with those that are not within the same firm-destination combination. One objective of nonreciprocal arrangements is to generate positive spillover effects: by facilitating trade to the donor country firms can learn important skills that they can then use to also serve other markets. I explicitly account for third country effects to identify such spillover effects.

I find that firms increase exports of eligible products to the United States relative to ineligible products on average by 25%. However, this increase goes in line with a strong trade diversion effect, i.e., a shift of exports away from third countries towards the United States, resulting in a net increase of 5%. Most interestingly, the results on the intensive margin are almost entirely driven by exporters that rearrange export destinations after facing fiercer competition in the European Union due to the eastern enlargement. The extensive margin is not driven by this event. While an increase in the probability of exporting eligible products relative to ineligible products can be observed for the United States, nonreciprocal preferences do not affect the probability of exporting to third countries. I can also show that firms with a sourcing structure that is compliant with the RoOs of the Andean Trade Preference Act did not benefit more from the nonreciprocal preferences. This finding suggests that Peruvian exporters did not have to change their global value chains to benefit from the preferential market access.

These findings contribute to the literature of nonreciprocal trade arrangements on firms' export behavior. The empirical method—a combination of an instrumental variable and a triple difference-in-differences approach—makes it possible to isolate the causal effect of nonreciprocal preferences, so far something that has not been done. Furthermore, I show that competition effects might be important for the effectiveness of nonreciprocal preferences, which has been overlooked so far. Lastly, nobody has focused the analysis on the effects of the Andean Trade and Preference Act.

Chapter 1

30 Years of Trade Policy: Evidence from 5.7 Billion Tariffs

1.1 Introduction

Tariffs are ubiquitous in international trade research. As Goldberg and Pavcnik (2016) stress, the main focus in recent academic work, both theoretical and empirical/quantitative, lies on trade costs. Therefore, one could think that tariff data were easily available for all country pairs and products, at least for recent years. However, this is not the case. As Anderson and Van Wincoop (2004) state *"the grossly incomplete and inaccurate information on policy barriers available to researchers is a scandal and a puzzle"* (p. 693); fifteen years later the situation is not substantially better. The main problem with the data is missing information, in particular for developing countries. Moreover, misreporting in the official data makes it hard for researchers to use it for analyses. Further, the recent wave of trade liberalization makes the tariff landscape messier than ever: preferential regional trade agreements (RTAs) allow for discrimination in terms of the imposed tariff across trading partners. This additional dimension exacerbates the above mentioned problems for this type of tariffs.

This paper presents a new global tariff database that makes a significant step towards giving a comprehensive overview of the tariff landscape. It covers tariffs at the six-digit product level for 197 importing countries and their trading partners for a period of 30 years, namely 1988 to 2017. It simultaneously deals with the two major issues, missing data and misreporting. By doing so, the coverage almost doubles yielding a dataset of 5.7 billion tariffs. The improvement is particularly relevant for least developed countries and developing countries: for least developed countries the share of missing data equals 56%, for developing countries it is 42%.

To reach this progress, I first complement the information present in the World Bank's World Integrated Trade Solution (WITS), the only source for global historical tariffs, with additional data from national sources for the European Union and the United States and carefully impute the missing data using the following algorithm: rather than replacing missing tariffs by linearly interpolating observations, I set the missing tariff equal to the nearest preceding observation.

For preferential tariffs the extent of corrupted data is even more pronounced than for MFN tariffs; some countries do not report any preferential tariffs for certain years, while reporting MFN tariffs, others only report them for certain preferential schemes but not for all RTAs that are in place, and others report preferential tariffs although no RTA is in place. To address these issues I first cross-validate the presence of an RTA with external databases and add detailed phasing-in schedules for 149 free trade agreements. Then, I impute using the same algorithm described above and simultaneously account for the phasing-in regime applied in the remaining RTAs. This alleviates the problems related to the additional trading partner dimension and the timing of the phasing-in of preferential tariffs.

With this novel dataset at hand, I will answer the following questions: What are the persistent patterns in tariff protectionism across countries and sectors? How and by how much did tariffs change over the past 30 years? What role did the World Trade Organization (WTO) play? How much and when do preferential tariffs liberalize trade?

To analyze whether there are persistent patterns across countries and sectors I use applied MFN tariffs for 2017, the most recent year available in my data. I find that applied MFN tariffs are distinct across countries with tariff levels and water in the tariffs correlating negatively with income. Across sectors, differences are large, too, with agricultural and textile products being protected much more. Sectors for which global value chains play a significant role or that produce primarily intermediate goods have lower levels of protection. Interestingly, the sectoral patterns are similar across countries once accounted for level-effects. Furthermore, I report two customary practices that apply to all countries: tariffs are often multiples of five or equal zero and countries tend to set the same tariff for entire tariff headings (HS4-digit) instead on a product-by-product basis potentially to facilitate the customs process and diminishing the risk of fraud.

Compared to 1988, the average applied MFN tariff almost halved in 2017 and equals 8.5%—the steepest decrease can be observed from 1994 to 2005. This period is characterized by many important changes in global trade policy, potentially important for the downward trend in tariffs: first, the Uruguay Round, the last concluded round of multilateral trade negotiations within the framework of the WTO, is known for its major achievements with respect to tariff liberalizations. However, I show that most of the decrease in applied MFN tariffs is due to African and Asian developing countries that were not bound by the tariff cuts negotiated in the Uruguay Round; instead, they lowered tariffs unilaterally. Most countries follow a specific rule when reducing tariffs, i.e. they reduce tariffs by cutting extremely high tariffs the most and already low tariffs the least. Although one can see a clear pattern within countries, across countries—even within the same income group—heterogeneity is large, indicating among others differences in political ideology, preferences, and production structures.

Second, nearly 40 countries have joined the WTO since its foundation in 1995. The data show that compared to the General Agreement on Tariffs and Trade (GATT), these new members made much larger concessions inter alia with respect to tariffs than the old members. The rampant increase in the number of RTAs is the third trend in modern trade policy. While in 1988 only 21 RTAs were in force, according to the WTO by 2017 this number skyrocketed to 296. I show that most of these RTAs liberalized trade substantially: within most RTAs, more than 90% of all trade is duty-free. For RTAs between high income countries this number is extremely asymmetric: while industrial products can essentially be traded for free, only 70% of all agricultural products are exempt from tariffs. In most cases, tariff cuts are implemented immediately when the RTA becomes effective. On average, only 25% of all tariff lines are phased-in over a 10-year period, in developing countries it takes on average a bit longer. The sectoral distribution of the prevalence of phased-in tariffs correlates strongly with the pattern of tariff protectionism reported for applied MFN tariffs. Lastly, I briefly review nonreciprocal arrangements, i.e. only one country offers preferential access.

Tariffs, and in particular changes in tariffs, have been subject to extensive empirical analysis, for example Pavcnik (2002), Caliendo et al. (2018), Topalova and Khandelwal (2011), and Trefler (2004). The policy changes analyzed in the literature can be grouped into three types of trade liberalizations: preferential RTAs, multilateral trade liberalizations due to the WTO, and episodes of unilateral tariff reductions by developing countries opening up for trade. For this body of research high quality tariff data is essential for identification, which typically relies on variation in tariffs across products within sectors. However, the scope of these papers does not lie on the trade policy itself, hence, learning about tariffs and changes thereof is just a byproduct of this research. Furthermore, these studies focus on a single country and do not aim at comparing tariff policies across countries.

In contrast, the gravity literature has had a strong focus on trade policy and its effects on trade (Baier et al. 2014; Baier and Bergstrand 2007; Yotov et al. 2016). This strand of the literature does not exploit the product-level variation in tariffs and tends to use much more aggregated data, i.e. country pair or sector (HS2 digits)-country pair level data. For tariffs, data from WITS is used. As outlined above, the data suffers from severe measurement error yielding downward-biased effects of tariffs on trade. Furthermore, the systematic measurement error—it is much bigger for developing than for high-income countries—compromises the external validity of these results: the estimated average treatment effect is in fact mostly driven by high-income countries and we know relatively little about the effects of tariffs in developing countries. If the effects are, in fact, heterogeneous cleaner tariff data could help uncover them.

Due to the lack of data, the existing literature on the landscape of tariffs is limited. The focus is either on one particular year or on specific sectors, and the analyses are mostly done for high income countries (Balassa 1965; R. E. Baldwin 1984; Bown and Irwin 2017; Irwin 2020; Bureau et al. 2019; Caliendo et al. 2015). In a recent contribution, Bown and Crowley (2016) are the first to give a comprehensive cross-country and cross-sectoral overview of tariffs in 58 countries for 1993 to 2013. However, *"for reasons of data quality, [we] do not attempt to be comprehensive. Instead, [we] focus on a sample of [58]*[1] *economies"* (p.10). The set of countries was not chosen randomly: they include the Group of 20 economies (including all 28 members of the European Union) plus an additional set of developing countries each with a 2013 population of over 40 million.

Using these data, Bown and Crowley (2016) survey also policies beyond import tariffs like temporary trade barriers of antidumping, countervailing duties, safeguards, quantitative restrictions import quotas, import licensing or trade facilitation. While the scope of my paper is restricted only to import tariffs, the new data that I constructed widens dramatically the cross-sectional and over-time coverage of tariffs and presents new facts about trade policy, especially for developing countries.[2]

The main contribution of this paper is twofold: first, it presents a novel database that deals simultaneously with the two major issues of existing tariff data, missing data and misreporting. To the best of my knowledge no other comparable database exists. The result is a unique database that increases the coverage substantially by almost doubling the number of available tariffs from 2.9 to 5.7 billion observations. Second, I am the first to document important new facts about tariffs around the world that substantially improve our understanding of how countries set tariffs.

The remainder of the paper is organized as follows. I first review the recent trends in trade policy that have changed the tariff landscape since 1988. Section 1.3 starts by listing the different official sources for tariff data and illustrating their shortcomings and problems. Then, I elaborate on how I overcome all of these issues to construct my new tariff database and compare my data to other existing data sources. Section 1.4 uses the new database to give an overview of the landscape of tariffs. First, I focus on bound and applied MFN tariffs in 2017, the most recent year covered. Second, I explore intertemporal patterns in applied MFN tariffs, lastly, preferential tariffs are reviewed. Section 1.5 concludes.

[1] 30 plus 28 EU members that they aggregate up.

[2] Tariffs imposed by activating Article XXI of the WTO ("*national security reasons*") are not included in the database. An example for these types of tariffs are the ones the United States imposed against China, the European Union, Canada, and other trade partner during the presidency of Donald Trump.

1.2 Trade Policy Shaping the Tariff Landscape since 1988

Over the past 30 years at least three global developments in trade policy have shaped the tariff landscape: first, the Uruguay Round, the last concluded round of multilateral trade negotiations within the framework of the WTO, led to significant tariff cuts in participating countries. Second, since the foundation of the WTO, 37 members joined the WTO. This entailed changes in tariffs for these countries. Third, with the standstill of multilateral trade negotiations since the Uruguay Round, regional trade agreements (RTAs) in all their forms, i.e. free trade agreements (FTAs), customs unions (CUs), partial scope agreements (PSAs), and nonreciprocal trade arrangements, are proliferating. As all of these trends are incorporated in the new tariff database, I now discuss them briefly.

The Uruguay Round was the eighth round of multilateral trade negotiations conducted within the framework of the GATT. It covered many different topics, for example some aspects of services and intellectual property rights, which had not been included before and culminated in the creation of the WTO itself. Furthermore, it was the first time that tariff negotiations included agriculture and textiles, sectors that so far had been considered to be too sensitive to reach an agreement. 123 countries were included in the negotiations, many of them developing countries. Therefore, the eighth round of multilateral trade negotiations is considered to be "*the largest trade negotiation ever*" (WTO).[3]

As in any multilateral trade negotiation, the participating countries negotiated bound MFN tariffs, instead of applied MFN tariffs. When importing goods, all negotiating parties agree not to exceed the level of the *bound MFN tariffs or bound tariffs* resulting from the negotiation process between the WTO members. In order to comply with the main principle of the WTO, namely no discrimination among WTO members,[4] the bound tariffs have to be applied to all imports from any other WTO member state, i.e. there is no partner dimension. Imposing a tariff that is higher than the bound tariff is a violation of WTO law and can be contested in court. The bound tariffs are the maximum tariffs that can be levied but typically countries actually apply much lower tariffs —the so-called *applied MFN tariffs*. Again, by WTO law, these tariffs do not have a partner dimension. The difference between the bound and the applied MFN tariff is called *water in the tariff* (or simply *water*).

Every participant of the Uruguay Round was required to provide a schedule of concessions concerning trade in goods—a first in the history of multilateral trade negotiations. While for developed countries the Uruguay Round resulted in lower levels of bound tariffs for both industrial as well as agricultural products, for many developing and least developed members

[3] See the website of the WTO, https://www.wto.org/english/thewto%7B%5C_%7De/whatis%7B%5C_%7De/tif%7B%5C_%7De/fact5%7B%5C_%7De.htm.

[4] https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm

the concessions took the form of ceiling bindings instead of changes in tariff levels. Beginning in the early 1990's, many developing countries (i.e. Brazil and India) reduced tariffs unilaterally. However, the relatively low applied tariffs were not legally bound by the WTO's framework, instead it was up to the respective country to keep the levels low (Bagwell et al. 2016). To reduce the resulting tariff uncertainty, one of the main objectives of the developed countries, vis-à-vis the developing countries, was to secure an increase in the number of bound tariffs, ideally covering all tariff lines (Hoda 2001).

The main results of the Uruguay Round in terms of changes in tariffs can be summarized as follows: for industrial products both developing countries as well as developed countries planned to reduce tariffs over the course of five years. For agricultural products the negotiating parties agreed that all boarder measures other than ordinary customs duties are required to be "tariffied" and had to be converted into tariff equivalents (Hoda 2001). Additionally, developed countries agreed to cut tariffs within six years and developing countries within ten years.[5] Lastly, over all products, the binding coverage, the share of bound tariffs of all tariff lines, was increased, significantly lowering the risk of unexpected increases in tariffs.

To sum up, while the implementation of the agreed tariff cuts took place between 1995 and 2005, the binding coverage and the tariffication efforts were put into effect immediately. As the results of the negotiations refer to bound MFN tariffs, the question arises to what extent the Uruguay Round contributes to the large reduction in applied MFN tariffs that can be observed in the data. I address this question in section 1.4.

Since the founding of the WTO, 37 new members joined. Typically, the new members have to reduce tariffs as a requirement for membership. Prominent examples of relatively new WTO members are China joining in 2001 and Russia in 2012. Compared to the GATT, members of the WTO demand much larger concessions of new members, for example much greater reductions in bound tariffs than it was the case under GATT (Hoda 2001). As I show in section 1.4, this has important implications for the observed heterogeneity across countries.

Preferential tariffs are the one major exception to the core principle of non-discrimination of the WTO. By definition, any RTA violates the non-discrimination clause as only the signing parties enjoy more favorable market-access conditions but all other trading partners are

[5] Hoda (2001) defines the covered products as follows: *"The product coverage is given in terms of the Chapters, Codes and Headings of the Harmonized System in Annex I to the Agreement on Agriculture. These are HS Chapters 1 to 24 less fish and fish products, HS Codes 2905.43 (mannitol), HS Code 2905.44 (sorbitol), HS Heading 33.01 (essential oils), HS Headings 35.01 to 35.05 (albuminoidal substances, modified starches, glues), HS Code 3809.10 (finished agents), HS Code 3823.60 (sorbitol n.e.p.),16 HS Headings 41.01 to 41.03 (hides and skins), HS Heading 43.01 (raw furskins), HS Headings 50.01 to 50.03 (raw silk and silk waste), HS Headings 51.01 to 51.03 (wool and animal hair), HS Headings 52.01 to 52.03 (raw cotton, waste and cotton carded or combed), HS Heading 53.01 (raw flax) and HS Heading 53.02 (raw hemp). While the coverage of agriculture [...] is given in the Agreement of Agriculture, there is no such list for non-agricultural products [...]. All products not covered by the list of agriculture items in Annex I are deemed to be non-agricultural products."*

excluded. These exemptions are only allowed in two contexts: first, when the RTA eliminates tariffs on *substantially all trade (GATT, Article XXIV: 8)* between the signing parties. Second, developing and LDCs enjoy a special status: when entering a Partial Scope Agreement (PSA), two or more developing countries can offer each other preferential access without extending the preferences to high-income countries. Also, WTO members can grant developing countries tariff preferences without having to extend the same treatment to high-income countries (nonreciprocal trade arrangements). Thus, whenever trade is seen as a mean to help developing countries thrive, the preferences can be discriminatory without meeting the substantially-all-trade criterion.

Especially the number of FTAs and CUs have increased significantly over the 30 years covered by the data presented in this paper. Both FTAs and CUs involve two or more countries, are reciprocal and comprehensive, i.e. all signing partners commit to substantially lower trade barriers for almost all goods. There is one major difference between FTAs and CUs. While signatory countries within an FTA maintain autonomy over their trade policy, a CU requires them to agree upon an external tariff. Prominent examples for FTAs are the United States-Mexico-Canada Agreement (USMCA), formerly known as the North American Free Trade Agreement (NAFTA), Canada-EU or EU-Japan. The European Union (EU), Mercosur, and the Common Market for Eastern and Southern Africa (COMESA) are examples of CUs.

1.3 New Global Tariff Database

Ideally, researchers as well as policy makers would like to know the tariff that is applied between any importing and exporting country for any product in any year. The respective tariff should equal the preferential tariff whenever preferential treatment is applicable (bilateral RTA like an FTA and CU or nonreciprocal arrangements for developing countries) and the MFN tariff otherwise, i.e. the effectively applied tariff. Moreover, it should not be contingent on positive trade. Thus, one would like to have product-level bilateral data on the effectively applied tariff. In theory, the World Bank's World Integrated Trade Solution (*WITS*) provides exactly this data.

WITS is the key source for global panel tariff data that is publicly available.[6] It pools data from the United Nations Conference on Trade and Development Trade Analysis Information System (*TRAINS*) and the WTO, namely the Integrated Data Base (*IDB*) and Consolidated Tariff Schedules (*CTS*). Since 2010 most of the raw data used in TRAINS come from the International Trade Center (ITC).[7] The data include information for almost 200 countries on the

[6] WITS can be accessed here: https://wits.worldbank.org/.

[7] See the WITS homepage for more information on the data providers: https://wits.worldbank.org/dataproviders.html.

6-digit product level of the common HS system with some of the data dating back to 1988.[8] Information about preferential and MFN tariffs are derived from both TRAINS as well as the IDB, while the CTS is the only provider of data concerning bound tariffs.

In reality, unfortunately, WITS entails many flaws making it very hard to use for research. When WITS-users try to download a global dataset of tariffs they receive several thousand files that have to be edited and combined. Unfortunately, besides the technical hassle, the data display many other shortcomings. In this section I elaborate on the current data situation, its problems and how the new tariff database fixes these. Further, I give details on the different steps that were necessary to improve the original data. I also briefly introduce other existing tariff databases and compare them to the one presented here.

The main goal of the my database is to provide information on a global scale covering as many years as possible. Concerning many countries, especially low and middle income countries, WITS is the only source for information on tariffs. Therefore, WITS is also the starting point for the new data I put together. The major improvements that I implement are twofold: first I combine all the existing information from WITS such that it is readily usable for research. Second, the new tariff database is the first that deals—among other improvements—simultaneously with the two major issues, missing data and misreporting. The number of observations almost doubles to 5.7 billion, the biggest improvement in coverage is made for least developed countries and developing countries. The tariff database contains bilateral tariffs (MFN and preferential tariffs) at the 6-digit level for 197 countries for 30 years (1988-2017).

Missing Data Missing data is the biggest issue in the standard sources providing tariff data. Most countries do not report tariffs every year. As Figure A3 shows, in 1988 only 11% of all countries reported at least one type of tariff, MFN or preferential; this percentage remains at a very low level until 1994. Since then, it has increased steadily.[9] Since 2006, the number of reporting countries is relatively high and ranges between 81% and 90%. Low-income countries report less frequently than high-income countries. It is important to keep in mind that an identical share of reporting countries, for example 81% in 2006 and 2007, does not automatically imply the very same set of reporting countries in both years. The exact shares of reporting and more details can be found in the Appendix (Figure A3).[10]

[8] For a few countries tariffs are even available at the tariff line. These can be accessed when downloading the data for single countries instead of using the bulk download option.

[9] The percentage is based on 197 reporting countries, that could report at least one type of tariff (MFN or preferential tariff) for at least one year between 1988 and 2017.

[10] Two events have significantly improved the availability of tariff data: first, in 1996 , for the first time, tariffs became available not only through TRAINS but also through the WTO's IDB improving the reporting pattern substantially: the share of reporting countries increased from a mere 31% to 48%. Second, in the late 1990s the suggestion was made to make the access to the IDB database conditional on reporting tariffs to incentivize compliance of not-reporting countries. Although this measure was never fully implemented, it lead to an

How should we interpret these numbers? Although the number of reporting countries is quite high in more recent years, at least three important aspects are disguised: first, any analysis using the time dimension is hard to perform because full panel data i.e. information on tariffs for each year is unavailable for most countries (cf. Figure A3 (b)). The EU-12[11] and Japan are the only countries that report tariffs for all years, all other countries provide less data. Second, the set of countries that report only sporadically is not random but rather consists mostly of developing countries. Even within developing countries the reporting improves with income. As tariffs tend to be systematically different between developing and developed countries, the non-random pattern of missing data could bias the results of any empirical analysis. For non-WTO members it is extremely difficult to find reliable tariff data as they report sporadically.

Furthermore, the problem is more pronounced for preferential tariffs; some countries do not report any preferential tariffs for certain years, but report MFN tariffs. Other countries only report preferential tariffs for certain preferential schemes but not for all RTAs that are in place. Especially with respect to LDCs the number of years in which preferential tariffs are reported amounts to less than half of the years the total number of years of the respective preferential scheme is in force. However, also the "good reporters" such as the EU, Japan, the United States or Brazil do not consistently report preferential tariffs. Furthermore, many countries report only certain preferential tariffs but not all that are in a given year in place. Again, this pattern is far from random, making it difficult to carry out any empirical analysis (for more details see Figure A3 in the Appendix).

In the database, I tackle this issue in two steps: first, I include additional information from other sources than WITS, namely from national authorities[12] and the WTO's RTA Database. Second, I develop an algorithm to impute the missing data: rather than replacing missing MFN tariffs by linearly interpolating observations, I set the missing MFN tariff equal to the nearest preceding observation. This procedure accounts for the WTO logic of notification, i.e. that countries only report policy changes. If there is no preceding observation, missing MFN tariffs are set equal to the nearest succeeding observation.

Interpolating preferential tariffs is significantly harder than MFN tariffs because FTAs are often phased-in. I account for this in two ways: first, I add the exact phasing-in schedules for 149 trade agreements, i.e. the tariffs for all tariff lines that have been agreed on in the

improvement in the reporting share which increased to 74% in 2001 (see Hoda (2001) and the WTO Document G/MA/IDB/3 for details).

[11] The EU–12 are the members of the European Union that joined prior to 1995, i.e. Belgium, France, Italy, Luxembourg, Netherlands, Germany, Denmark, Ireland, United Kingdom, Portugal and Spain.

[12] Thanks to Forero-Rojas et al. (2018) from the World Banks' research division I have access to tariff data for both MFN and preferential tariffs, for the United States and the European Union directly provided by national authorities. The years 1996 to 2016 are included.

respective RTA. This information can be found in the WTO's RTA Database.[13] Second, I have detailed information on more than 500 RTAs and their phasing-in regimes.[14] Using this information, I employ the same interpolation technique described for the MFN tariffs while carefully taking into account potential phasing-in. Appendix A.1 explains the interpolation process and all other data cleaning steps in more detail.

Mistakes in the Original Data As mentioned above, WITS is not responsible for collecting the tariff data but is merely the platform through which the data is made available to the general public; the original data stems from several international organizations (UNCTAD, ITC and WTO). One concern with the current, decentralized arrangement is whether it creates the right incentive structure to implement corrections; e.g., when users discover data problems in historical data. Typically the World Bank (WITS) is not in a position to correct the publicly provided data because it does not receive the data at first hand (Bown and Crowley 2016). Thus, the data that can be downloaded through WITS entails mistakes, especially with regard to preferential tariffs.

While many countries do not report nearly enough tariffs, some seem to report too many: for some countries WITS documents a preferential tariff although there is no corresponding RTA. For example Namibia, Swaziland, and South Africa report preferential tariffs significantly lower than the MFN tariff with the EU before any RTA was in force. Further, there are also cases when countries report a preferential tariff when in fact it is an MFN tariff, i.e. no RTA is in place and the allegedly preferential tariff is the exact same as the MFN tariff. Concerning the first type of misreporting, the problem becomes clear immediately, but also the latter is troublesome—imagine a research question for which the level of the preferential tariff does not matter but only whether preferential access exists. More generally speaking, in a "perfect" tariff database, a search query for preferential tariffs should not yield data on MFN tariffs.[15]

To eliminate this kind of misreporting, cross-validating the preferential tariffs with the existence of an RTA is an essential step. I incorporate preferential tariffs only if the list of agreements indicates that preferential market access is granted. The list of RTAs combines various sources on RTAs and nonreciprocal arrangements, see Appendix A.1 for details. Otherwise, I assume that the MFN tariff is applicable.

Irregularities in the Original Data Not only do many countries report tariffs only sporadically. Additionally, often only MFN or preferential tariffs are reported. To cause even more confusion, some countries merely report some preferential tariffs, i.e. only the unilat-

[13] rtais.wto.org/

[14] The data is provided by the Design of Trade Agreements Database (DESTA) (Dür et al. 2014).

[15] The exact shares of misreporting can be found in Figure A4 in the Appendix.

eral schemes or only certain FTAs. Such irregularities occur in TRAINS and in IDB. While in TRAINS these types of missing observations are in fact missing, this is not true for IDB.

One tariff type available through IDB, which is called *"the effectively applied tariff or AHS"*, has a rather odd feature: whenever a preferential scheme is missing, instead of being identified as a missing observation, the scheme is replaced with the corresponding MFN tariff. Thus, using the so-called effectively applied tariff provided by the IDB would lead to huge measurement error. Figure A2 in the Appendix illustrates this fact based on the example of Mexico. Therefore, I will refrain from using this data altogether for the preferential tariffs and instead entirely rely on TRAINS.

Smaller Challenges Some countries are eligible for multiple preferential tariff schemes, e.g. the U.S. offers unilateral tariff preferences to Afghanistan through the GSP and the GSP+ program. This is why TRAINS reports multiple preferential tariffs for certain country pairs. Whenever that is the case I assume that exporters choose the lowest tariff.

The Harmonized System (HS) is used as the classification for defining tariff lines. It came into being in 1988 and has slowly been adopted by an increasing number of countries since then. National tariff lines follow the HS classification and are typically defined at a more disaggregated level, which can be as disaggregated as 8-, 10- or even 12-digits. However, product classifications across countries are only harmonized up to a level of 6-digits; beyond that every country has its own product classification in order to differentiate national product varieties. As the aim of this paper to provide data that can be used for cross-country comparison, all tariffs are aggregated to the 6-digit level by averaging across the tariff lines.[16] At the 6-digit level roughly 5,000 products exist.

Over the years the HS system has undergone several changes. These changes are called revisions and entered into force in 1996, 2002, 2007, 2012 and 2017. When reporting tariff data, not all countries use the adequate HS-revision, especially developing countries adopt the revisions with a substantial delay. For example, many countries report tariffs using the revision HS-1996 or even HS-1988/92 after 2002. Therefore, before doing any cross-country analyses, the revisions need to be matched. In the database, I convert all 6-digit product-codes into the first available nomenclature, namely HS-1988/92. Besides making cross-country and intertemporal comparisons possible, a single nomenclature needs to serve as a basis to correctly interpolate missing data. Otherwise, the algorithm described above would only fill missing information within one revision but not for all years available.

[16] The simple mean is also incorporated in WITS: when using the bulk download function in WITS, tariffs are only available for products at the 6-digit level. Whenever tariffs have been reported at a finer level, WITS calculates the simple mean.

WITS covers a large number of countries: besides all WTO members, also some non-WTO members are in the database. However, many of the non-WTO countries do not report tariffs on a regular basis, but only for very few years (compare Figure A3, Panel (b)). Further, it is unclear whether a so-called MFN tariff of a non-WTO country is in fact that: an MFN tariff not discriminating across trading partners. Vice-versa, there is also a great deal of uncertainty about how WTO members treat non-WTO members, and whether it is safe to assume that the reported MFN tariff is also the effectively applied tariff for non-WTO members. Although it is informing to know more about the tariffs of non-WTO members, the data should be used with caution. In my main analysis, I exclude all countries that had not joined the WTO by 2017.

Regardless of the type of tariff—bound, MFN or preferential—a tariff can take two forms. *Ad valorem tariffs* are the most common ones. Here the customs duty is calculated as a percentage of the value of the product (for example 8%). 1.22 USD/kg or 1.22 USD/kg + 8% are examples for *non-ad valorem tariffs*. It is possible to convert non-ad valorem tariffs into ad valorem equivalents (AVEs) by dividing the non-ad valorem element of the tariff by the value of the product per unit.[17] I refrain from calculating AVEs, because reliable unit values are not available for the set of countries and years covered in the sample. Thus, the only AVEs in the data are from TRAINS, which contains AVEs-estimations, and from countries that report AVEs directly to the institutions collecting data. More details on how AVEs are calculated and included in TRAINS, IDB, and the new database can be found in the Appendix A.2.

The potentially missing AVEs are a relatively minor issue, as the vast majority of tariffs is already ad valorem.[18] Switzerland is a key exception, as its tariffs are exclusively non-ad valorem. I proxy Swiss tariffs with the average tariffs of all other EFTA members.[19] For bound tariffs a particular challenge arises: the raw data reports missing observations for any non-ad valorem tariff because the data provider—the WTO's CTS database—does not calculate AVEs.[20] Why does this matter? Non-ad valorem tariffs are particularly common for agricultural products among high income countries. Therefore, it is unfeasible to compare bound

[17] It is rather difficult to converse technical tariffs and tariff rate quotas, see Bouët et al. (2008) for a more detailed discussion.

[18] In 2017 only 14 countries reported more than 5% of tariff lines to be non-ad valorem (WTO 2018). The 14 countries (ordered by their shares) with non-ad valorem tariffs for at least 5% of their tariff lines are Switzerland (75%) , Thailand (10%), Belarus (9%), Kyrgyz Republic (9%), Russia (9%), Armenia (9%), United States of America (8%), Zimbabwe (8%), Kazakhstan(8%), Colombia (7%), Lebanese Republic (6%), Norway (6%), Ecuador (6%), and European Union (5%).

[19] I also account for the changes in EFTA i.e. Austria, Denmark, Finland, Portugal, Sweden, and the United Kingdom left EFTA to join the European Union.

[20] When downloading the tariff lines using the country-by-country function of WITS, the non-ad valorem tariff is given of the CTS database. For the European Union, for example, the bound tariff for the tariff line 01 02 90 05 equals *10.2 + 93.1 Euro/100 kg/net*. As no tariff equivalent is given, using the bulkdownload function will yield a missing bound tariff for this particular tariff line.

tariffs for agricultural products across countries. Even matching bound tariffs of the same importer with applied MFN or preferential tariffs imposes major difficulties.

Sample Coverage The new database provides the effectively applied tariffs for 197 importers and their 196 trading partners. The data covers the years 1988 to 2017 and on average tariffs are available for 4,960 products. Table A3 in the Appendix lists all countries in the sample, information on WTO/GATT membership, the number of products, the share of imputed observations for all years and the total number of observations. The algorithm used for imputing missing tariffs works best when tariffs are available before and after a missing observation. Some developing countries start reporting relatively late in the sample period potentially deteriorating the quality of the tariffs for the years prior. Thus, the later countries start reporting, the higher the probability that the reported tariffs in the first years of the sample are biased. To get a better understanding of the extent of the potential bias, Table A3 reports the first available year. Adding up all observations for the whole duration of 30 years, the sample consists of 5.7 billion observations.

Comparison to Other Existing Sources While there are a few databases available that inform about tariffs for specific countries, years or products, as for example the Agricultural Market Access Database (see Bouët et al. (2008) for a summary on alternative databases), very few databases provide information comparable to the data presented in this paper with respect to country and time coverage as well as level of disaggregation.

Covering the same set of countries, the ITC's *Market Access Map (MAcMap)* is an established source for tariff data.[21] It incorporates bound, applied MFN and preferential tariffs from 1996 onwards for 197 countries, and offers AVE-conversions for the more recent years. MAcMap provides raw data, thus, unless countries report perfectly, similar problems as in WITS can be expected, i.e. missing observations and mistakes in the original data, especially for preferential tariffs. As mentioned above, since 2010 TRAINS has supplied WITS with data on tariffs collected by the ITC. Hence, for the more recent years, the raw data used for the new database presented in this paper is identical to MAcMap. However, a major disadvantage is that MAcMap is only available for subscribers.

CEPII's *MAcMap-HS6* enhances the ITC's MAcMap by first, converting all HS6-products into one nomenclature to make intertemporal and cross-country comparisons possible. Second, there is a special focus on the calculation of AVEs. Without doubt, CEPII's *MAcMap-HS6* is the best source for non-ad valorem tariffs and in particular the AVEs of tariff rate quotas. Bouët et al. (2008) describe the exact methods used to convert all five forms of non-ad valorem tariffs to AVEs. The data only cover three years (2001, 2004, and 2007), and are publicly

[21] Available at https://www.macmap.org/.

Table 1.1: Summary of the Differences to Other Existing Sources

Source	covered Years	deals w/ missings	deals w/ phasing-in	deals w/ AVEs	checks RTAs
ITC's MAcMap	1996-today	no	no	no	no
CEPII's MAcMap-HS6	2001, 04, 07	no	no	yes	no
Caliendo et al. (2015)	1984-2011	yes	partially	no	no
New Tariff Database	1988-2017	yes	yes	no	yes

Note: The table compares the new tariff database with other existing databases that are comparable in country coverage.

available through CEPII's website.[22] Similar to the ITC, the problems of missing observations and potential mistakes in the raw data are not addressed.

Caliendo et al. (2015) have constructed a similar database to the one presented here. However, their dataset differs with respect to covered years (1984–2011) and in terms of the degree of precision of the preferential tariffs. Additionally to the tariffs provided by WITS, they add data from three other sources: manually collected tariff schedules published by the International Customs Tariffs Bureau, U.S. tariff schedules from the US International Trade Commission, and U.S. tariff schedules derived from detailed U.S. tariff revenue and trade data provided by the Center for International Data at UC Davis. The imputation algorithm used in the two databases is very similar most likely resulting in very similar MFN tariffs. To account for phasing-in of preferential tariffs Caliendo et al. (2015) include information on approximately 100 FTAs and their phasing-in regimes, i.e. whether most tariff lines are cut immediately or if phasing-in is common. In my database, I implement a considerable improvement by including detailed phasing-in schedules on the tariff line level for 149 FTAs. For the agreements, for which this information is not available, similar to Caliendo et al. (2015) the information on the phasing-in regime is used to construct missing preferential tariffs.

Table 1.1 summarizes the three other existing sources with a comparable country coverage and compares them to the new tariff database. To the best of my knowledge, the data presented here are the first dealing simultaneously with the missing tariffs, accounting explicitly for the phasing-in schedules of RTAs, and cross-validating information to minimize error in the original data. The main contribution of the new tariff database is twofold: first, the coverage in terms of number of countries and years available is unique. Second, the level of precision of the preferential tariffs is much higher than in other existing databases.

[22] The available years correspond with the releases of the GTAP database which CEPII's data on tariffs. The data can be downloaded at http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=12.

1.4 Three Decades of Tariffs across the World

The tariff data have a country pair, product and time dimension, resulting in 5.7 billion observations. To make things tractable, for much of the analysis in the remainder of this paper, I will aggregate tariffs over products, sectors, countries, or all of the above. Following Bown and Crowley (2016), I only show simple average tariffs. The alternative trade-weighted average can suffer from a downward bias due to products with high tariffs receiving low weights because of small import volumes.[23]

For most bilateral relationships the MFN tariff is applied, while preferential tariffs are relatively rare. Changes in the simple average are therefore almost exclusively driven by changes in the MFN tariff. Only changes in preferential tariffs involving many bilateral links, like the EU enlargement in 2004, visibly alter the simple average. To make the exposition as clear as possible, I differentiate between the two types of tariffs in the remainder of this paper. In the following section, I focus on the MFN tariffs $t_{ijk,t} = t_{ik,t}$ for all countries j not subject to preferential tariffs. Afterwards, I elaborate on the preferential tariffs denoted as the ad valorem tariff $t^*_{ijk,t}$ imposed by country i against imports from country j of product k in year t. In the analysis, all countries that did not join the WTO by 2017 are excluded. Moreover, Switzerland is excluded as all of its tariffs are imputed, resulting in a sample size of 162 countries.

1.4.1 Status Quo: MFNs across Countries and Sectors in 2017

In this section, I analyze cross-country and cross-sectional variation for 2017, the most recent year of available data to help to establish whether there are persistent patterns in tariff protectionism along these dimensions.

Heterogeneity in Tariff Protectionism Table 1.2 summarizes the average applied MFN and bound tariff overall and across different types of products. The average applied MFN tariff equals 8.54% across all products and countries. Countries protect agricultural products much more than industrial ones. More specifically, the average applied tariff for agricultural products is more than double of the MFN tariff for industrial products (15.76% and 7.37%, respectively). Agricultural products are defined as products of Section I to IV of the HS-nomenclature, the remaining ones are industrial products. The same patterns can be observed for bound tariffs. However, the amount of water in the tariffs is for agricultural products

[23] In a series of papers, Anderson and Neary (1992, 1994, 2007, 2003) propose a different and theoretically-grounded way of aggregating up tariffs, namely the *Overall Trade Restrictiveness Index (OTRI)*. It answers the following question: what is the uniform tariff that if imposed on home imports instead of the existing structure of protection would leave aggregate imports at their current levels? One major drawback of the empirical implementation of the OTRI is that one needs country-specific product-level import-demand elasticities, which are note readily available. This is the main reason why I abstain from using the measure.

almost twice as much as for industrial products, leaving room for tariff increases that are in full compliance with WTO law.[24]

Table 1.2: Average Applied MFN and Bound Tariff (2017, in %)

	Applied MFN			Bound		
	all	ind.	agri.	all	ind.	agri.
	(1)	(2)	(3)	(4)	(5)	(6)
All Types	8.54	7.37	15.76	25.81	22.38	44.98
Intermediate Products	7.54	6.29	15.73	25.23	21.74	45.43
Final Products	13.74	13.06	15.89	30.77	26.06	44.36

Note: The table shows the average applied MFN and bound tariff for the year 2017 across different product groups. End-use categories taken from the BEC.

Products can be further differentiated by the end-use, i.e. intermediate inputs and final goods (for consumption). To group products, I follow the UN Broad Economic Categories (BEC) classification. Intermediate goods have a much lower tariff than final goods, a phenomenon known as *tariff escalation*. This is entirely driven by industrial products, as for agricultural products virtually no tariff escalation can be observed. When it comes to agricultural products, LDCs and low- and middle-income (LoM) countries protect intermediates of the sector prepared foodstuff much more than final goods, offsetting the tariff escalation that is in fact prominent among the remaining agricultural products.

To analyze differences in tariffs across countries, I regress the applied MFN tariff t_{ik} on dummy variables I^G that distinguish countries i by income groups G, i.e. LDCs, LoM countries in Africa, the Americas, Asia, Europe and high-income countries (HICs).

$$t_{ik} = \sum_{G=1}^{6} \beta_G I^G + u_{ik}, \text{ with } I^G = 1 \forall i \in G. \tag{1.1}$$

[24] Keep in mind that the bound tariffs with non-ad valorem tariffs are downwards-biased. Thus, these numbers are a very conservative estimate.

Table 1.3: Heterogeneity in Tariffs across Income Groups

	MFN				**Water**		**P**		**Same within**		**No. Unique t**
	all	ind.	agri.	B&C	all	all	$\frac{t}{5} \in \mathbb{N}$	$t=0$	HS4	HS2	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
LDCs	6.63***	7.66***	0.22	5.12***	37.46***	40.24***	0.70***	-0.26***	0.19***	0.00	-519.18***
	(0.05)	(0.03)	(0.32)	(0.09)	(0.13)	(0.13)	(0.00)	(0.00)	(0.00)	(0.01)	(45.53)
LoM Africa	6.33***	6.83***	3.22***	7.97***	20.81***	20.89***	0.52***	-0.06***	0.11***	-0.01	-456.44***
	(0.13)	(0.05)	(0.85)	(0.51)	(0.16)	(0.15)	(0.00)	(0.00)	(0.01)	(0.01)	(50.39)
LoM Americas	4.18***	4.95***	-0.59*	5.58***	32.68***	31.30***	0.50***	-0.15***	0.05***	-0.06***	-432.70***
	(0.05)	(0.03)	(0.33)	(0.07)	(0.06)	(0.06)	(0.00)	(0.00)	(0.00)	(0.01)	(47.90)
LoM Asia	2.78***	3.38***	-0.97*	4.58***	17.15***	21.96***	0.51***	-0.12***	0.12***	0.06***	-411.13***
	(0.08)	(0.04)	(0.51)	(0.11)	(0.08)	(0.08)	(0.00)	(0.00)	(0.00)	(0.01)	(52.74)
LoM Europe	0.15***	1.21***	-6.42***	0.29***	0.08***	13.93***	0.30***	-0.04***	0.05***	-0.04***	-363.33***
	(0.05)	(0.03)	(0.31)	(0.06)	(0.03)	(0.07)	(0.00)	(0.00)	(0.01)	(0.01)	(63.08)
WTO after 1995						-16.33***					
						(0.07)					
HICs (Ref. Group)	5.04***	3.30***	15.87***	5.35***	1.57***	4.05***	0.04***	0.37***	0.46***	0.12***	566.67***
	(0.04)	(0.01)	(0.27)	(0.04)	(0.02)	(0.02)	(0.00)	(0.00)	(0.00)	(0.01)	(45.19)
Observations	808,069	695,695	112,374	275,784	569,621	569,621	808,069	808,069	808,069	808,069	162

Note: The table shows the regression output of $y_{ik} = \sum_{G=1}^{6} \beta_G I^G + u_{ik}$. The dependent variable y_{ik} equals the applied MFN tariff (column (1) to (4)), the bound MFN tariff (column (5) to (6)), the probability that the MFN tariff is a multiple of five (column (7)), equals zero (column (8)), is the same within HS-4 digit products (column(9)), is the same within HS-2 digit industries (column (10)) and the number of unique tariffs for each country (column(11)). Columns (2) and (6) uses the countries defined in Bown and Crowley (2016). Robust standard errors in parentheses. In column (9) errors are clustered by importer-HS4-product, in column (10) by importer-HS2-product. ***/**/* indicate significance at the 1%/5%/10% level.

The country grouping is based on Table A3. HICs are the reference group in these types of regressions—the coefficients of the remaining income groups equal the difference between HICs and the respective income group. As column (1) of Table 1.3 shows, the differences across countries are stark: while HICs have an average applied MFN tariff of only 5%, it equals 11.6% for LDCs, and ranges between 5.1% and 11.3% for LoM countries, respectively. Thus, tariffs correlate negatively with income, i.e. HICs set lower tariffs than LoM countries, which in turn, set lower tariffs than LDCs. Even within the group of LoM countries, a clear ordering can be observed. This pattern is more pronounced for industrial products; for agricultural products, tariffs are universally high and do not differ much across income groups. European LoM countries apply the lowest tariffs to agricultural products. Within income groups agricultural products are much more protected than industrial products.

So far, the reported results confirm the results reported by Bown and Crowley (2016) when extending the set of countries from 58 to 162. A priori, similar results are not necessarily expected as the additional countries are systematically different—the Bown and Crowley (2016) (B&C) sample covers mostly large and economically important countries.[25] Column (4) estimates Equation 1.1 again for the B&C-sample. Similar to the results depicted in column (1), tariffs correlate negatively with income. As expected, the largest changes in coefficients can be observed for income groups that are underrepresented in the B&C-sample—LDCs and LoM countries.

Next, I analyze how water in the tariffs differs across income by regressing the difference between the bound and the applied MFN tariff of 2017 on the six income group dummies. As column (5) shows, the amount of water in the tariffs correlates negatively with income, too. While HICs have virtually no water, LDCs can increase applied tariffs by 39.1%-points without violating WTO law. The picture for LoM countries is a bit more nuanced: compared to the reference group as well as in absolute terms, water is high for countries in Africa, the Americas and Asia, but low for European LoM countries; applied tariffs do not match these large discrepancies. None of the European LoM countries are founding members of the WTO. Compared to GATT, members of the WTO have demanded much larger concessions of new members, inter alia, reductions in bound tariffs to much lower levels (Hoda 2001). In column (6) I control for date of accession by including a dummy variable that equals one if the country joined the WTO after 1995 and zero otherwise. The coefficient is negative, large and affects mostly the results for European LoM countries confirming that new WTO members have, in fact, been treated differently than old ones with respect to the levels of bound tariffs.

[25] The set of countries comprises the Group of Twenty (G20) and an additional set of developing countries each with 2013 population of over 40 million.

How do countries set tariffs? Some Customary Practices In theory, tariffs can take on any non-negative level. As I show next, in practice there are some persistent patterns in the levels of tariffs. Column (7) of Table 1.3 shows the results of regressing the probability of the MFN tariff to equal a multiple of five other than zero $P\left(\frac{t_{ik}}{5} \in \mathbb{N}\right)$ on the income group dummies.

For HICs multiples of five other than zero are a rare event, while for all other groups the opposite is true: LDCs set with a probability of 74% MFN tariffs that equal a multiple of five, for African, Latin-American and Asian the probability equals roughly 54% and for European LoM countries 34%, respectively. The probability of a zero tariff, on the other hand, correlates positively with income, as column (8) indicates.

Columns (9) and (10) of Table 1.3 examines the probability of occurrence of the same MFN tariff within all tariff headings (HS4-digits, column 10) and within all tariff chapters (HS2-digits) (column 11). In these types of regressions, the dependent variable equals one if the tariff is the same within the respective product group. Otherwise the dependent variable equals zero. With an average probability of 46% HICs have the same tariff within a tariff heading. For LDCs and LoM countries this probability is 5 to 19%-points higher. Hence, instead of applying product-specific tariffs, many countries set the same tariff for entire tariff headings (HS4). This does not hold true anymore for tariff chapters (HS2). The positive coefficient for HICs in column (11) is mostly driven by the three free ports Macao, Hong Kong and Singapore.[26] The results of the country-level analysis can be found in the Appendix (Figure A6).

There are at least two potential explanations why countries might prefer setting the same tariff for entire tariff headings (HS4). First, the probability that a multi-product exporter sells similar products, i.e. all belonging to the same tariff heading, is high. Therefore, same tariffs for all products within HS4 heading might expedite the customs process if exporters as well as customs officers checking the shipment do not have to do so for every single product. Second, fraud by misclassification of imports from higher-tariff categories to lower-tariff ones might be significantly easier when defrauding exporters have to only re-classify from one HS6-product to another; HS6-products might exhibit a higher degree of similarity than across HS4-digits making cheating easier. Thus, avoiding tariff evasion might be an objective of the government when setting tariffs. It might be an explanation why we observe such a high share of similar tariffs especially in lesser developed countries where corruption and less efficient handling of customs matter are more common, making the loss of tariff revenues more likely.[27]

[26] Macao and Hong Kong have zero tariffs for all products, Singapore is essentially a free port, too, with no tariffs on more than 99% of all HS6-products.

[27] The differences in the share of same tariffs within HS4-digit across countries can actually explain the different findings in the literature on the evasion of import tariffs. While Fisman and Wei (2004) find evidence for misclassification in the context of Hong Kong and China, Javorcik and Narciso (2008) cannot confirm these results for trade between Germany and ten Eastern European transition countries. The differences in the share

Both, the fact that countries have a preference for certain tariff levels, i.e. multiples of five and zero, as well as the fact that countries often set the same tariff for entire tariff headings, yield to a relatively low number of unique tariffs. For HICs it equals on average 567, which is compared to a total number of 5,018 HS6-products relatively low. Further, it decreases significantly with income resulting in on average only 48 unique tariff levels in LDCs (compare column (11)). Even the country with the largest number of unique tariffs, Liechtenstein, only has 1,710 unique levels; the European Union has the second highest number of unique tariffs (670), the United States place third (662), and China only has 360 unique levels. A third of all countries have at most 50 unique levels of tariffs. For many of the LDCs and LoM countries the three most frequently used unique MFN tariffs constitute 80% or more of all 5,018 HS6-products (compare Figure A7 in the Appendix for details on the country-level analysis).

Sectoral Heterogeneity Next, I investigate the sectoral differences in applied MFN tariffs. Figure 1.1 shows the average and the 95%-confidence intervals for the different income groups across 21 sectors. The purpose of this figure is to analyze whether countries protect similar sectors once level-effects are accounted for. To do so, I demean all MFN tariffs with the income group average MFN tariff. To account for the stark differences between agricultural and industrial products, I demean separately for the two. Section 1 to 4 are agricultural products and the remaining sections 5 to 21 represent industrial products.

Indeed, the sectoral pattern is similar across income groups; while across sections and within the same income group the differences are distinct and often significant, within the same section the differences between income groups are often very small. For most sectors, the confidence intervals are very narrow, indicating little variation within income group across countries. For vegetable products, fats and oils tariffs are lower than the income group average for agricultural products, and tariffs are the highest for food, beverages and tobacco.[28]

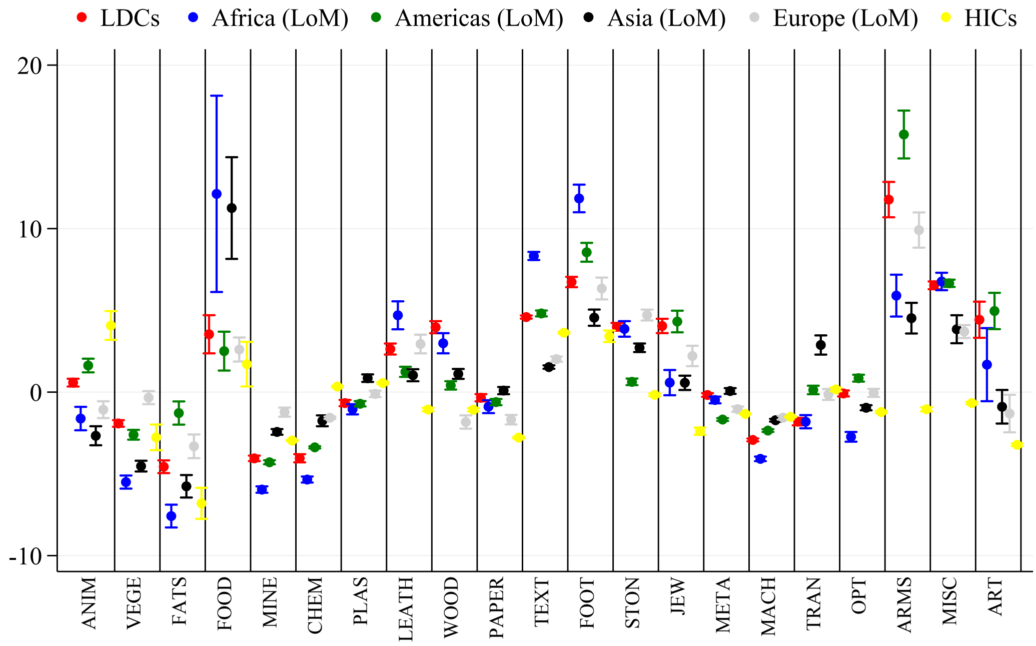
The MFN tariffs for mineral products, chemicals, and machinery are the lowest relative to the average of all industrial products across all income groups. The tariffs for plastics, paper, and base metals are also lower than the average group tariff. The sections with the highest tariffs are textile, footwear, and, to a somewhat lesser extent, leather goods. The tariffs on arms, miscellaneous manufactured articles and art are mixed across income groups.

Summing up, on the one hand applied MFN tariffs are distinct across countries with tariff levels and water in the tariffs correlating negatively with income. On the other hand I report

of same tariffs within HS4-digit industries might be the reason for the discrepancies. In fact, for the year 2003, one year before Poland joined the European Union and two years after China acceded the WTO, the share of same tariffs within HS4-digit industries equals 64% for Poland, but only 26% for China.

[28] Many countries have high tariffs on section 4 products for social reasons. For example, as an Islamic country, in which alcohol consumption is restricted, Egypt levies prohibitively high tariffs ranging between 1200 and 3000% for alcoholic beverages to make imported alcohol more expensive.

Figure 1.1: Average MFN Tariffs and Confidence-Intervals across Sectors by Income Groups



Note: The graph shows the mean and the corresponding 95% confidence interval across sectors by income groups. The country specific averages are subtracted from the original MFN tariff. Table A4 in the Appendix gives a full description of the sections.

two customary practices that apply to all countries: tariffs are often multiples of five or zero and countries tend to set the same tariff for entire tariff headings (HS4-digit) instead on a product-by-product basis potentially to facilitate the customs process and diminishing the risk of fraud. Tariffs vary significantly across sectors but are similar across income groups once level-effects are accounted for.

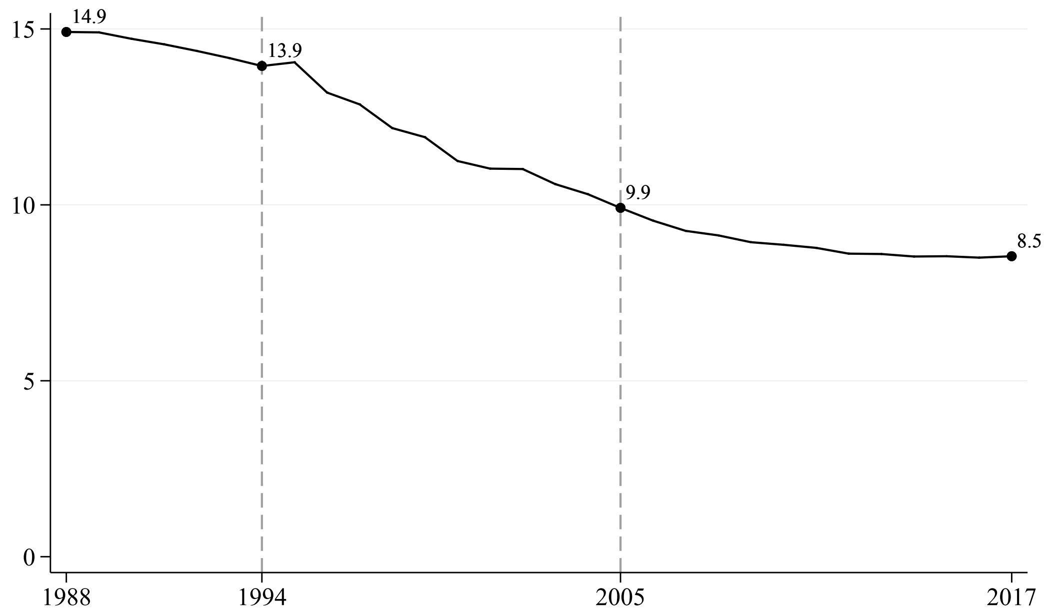
1.4.2 Most Favored Nation Tariffs over Time

Over the past 30 years, the average applied MFN tariff was globally on a clear downward trend (cf. Figure 1.2). Compared to 1988, the level almost halved and equaled 8.5% in 2017 — the steepest decrease can be observed from 1994 to 2005. The reduction is not due to compositional changes of the sample, neither with respect to countries nor products, as the algorithm used to fill the missing data fully balances the panel.[29] In this section, I will investigate this trend of decreasing applied MFN tariffs. First, I will show cross-country variation in the changes

[29] Nevertheless, for many countries only few data are available in the earlier year, i.e. up until the mid 1990's. In these cases, information from subsequent years is used to impute missing MFN tariffs, yielding potentially biased MFN tariffs. Assuming a decreasing time trend in tariffs, the bias leads to underestimated MFN tariffs (lower than the real value).

of tariffs. Second, the implications of the Uruguay Round for applied MFN tariffs is analyzed. Lastly, I will shed some light on how countries cut tariffs.

Figure 1.2: Average Applied MFN Tariffs over Time



Note: The figure shows the average applied MFN tariff over time using the new tariff database.

Heterogeneity across Countries in Changes in applied MFN Tariffs Although the average applied MFN tariff decreased significantly over the past 30 years, there is large heterogeneity in the timing as well as with regard to the amount of the reduction across countries. Column (1) of Table 1.4 regresses the difference between the MFN tariff in 2017 and 1988 on the income group dummies for industrial products.[30] HICs reduced tariffs on average by 4.39%-points, the change for LoM countries in Europe is not significantly different from this coefficient, for LoM countries in the Americas the reduction in tariffs is slightly smaller than for HICs. LoM countries in Africa and Asia implemented the largest tariff liberalizations; they reduced tariffs in the period 1988 to 2017 by 12.54%-points and 11.32%-points, respectively. LDCs reduced on average tariffs by 5.67%-points. In HICs, African and Asian LoM countries, most of these cuts happened in the period 1994 to 2005 (compare columns (2) to (4)). Thus, the large reductions between 1994 and 2005 are mostly driven by African and Asian LoM countries.

[30] Keep in mind that for countries that did not report tariffs for the year 1988, this tariff corresponds to the first available year of data, which can be found in Table A3.

For agricultural products, roughly the same pattern can be observed (compare Table A5 in the Appendix), i.e. most of the tariff cuts since 1988 took place in LoM countries in Africa and Asia. With regard to HICs, many of the tariffs are AVEs, which are a function of world prices. When world prices decrease, the AVEs increase and vice-versa. As prices for agricultural goods have increased since 2005, the seemingly apparent reduction in tariffs for HICs, from 2005 to 2017, might be entirely unrelated to changes in trade policy.[31] The tariffication efforts in the Uruguay Round and the resulting high non-ad valorem tariffs might help explain the positive coefficient for HICs for the period from 1994 to 2005.

Even within income groups, there is a lot of heterogeneity across countries: some decrease tariffs later, some keep tariffs stable throughout the period, and some even increase tariffs. Details for the country-level analysis can be found in Figure A9. Three observations stand out: first, almost all large tariff cuts, i.e. the cuts of more than 5%-points, took place in the period from 1994 to 2005. Second, increases in tariffs are often the result of newly formed customs unions and members adapting to the new, higher common external tariff. This pattern can be observed for many countries joining the European Union but also for members of Mercosur or the African customs unions. Third, very high tariffs, i.e. more than 15%-points, are rare in 2017. One notable exception is the Customs and Economic Union of Central Africa with an average external MFN tariff of 18% points.

The Role of Multilateral Trade Agreements The large reductions in the aggregate between 1994 and 2005 are mostly driven by African and Asian LoM countries. However, also HICs substantially reduced tariffs in this period. This time period coincides with the phasing-in years of the Uruguay Round. As mentioned above, countries negotiated bound, not applied, MFN tariffs. Thus, the question arises to what extent the Uruguay Round contributed to the large reduction in applied tariffs that can be observed in the data. To answer this question, let B indicate a binding bound tariff resulting from the negotiations of the Uruguay Round. More precisely, $B = 1$ if $\tilde{t}_{ik} \leq t_{ik}^{before}$, and zero otherwise with $\tilde{t}_{ik}$ denoting the bound tariff and t_{ik}^{before} the applied MFN tariff in 1994, one year prior to the implementation of the tariff cuts negotiated in the Uruguay Round.

Column (5) of Table 1.4 reports $P(B)$ for the six income groups; the sample is restricted to countries that joined the WTO before 1995. When it comes to HICs, the bound tariff undercuts the applied tariff level of 1994 in 77% of all industrial products. This indicates that most of the reductions in applied MFN tariffs between 1994 and 2005 can be attributed to the multilateral trade negotiations. With respect to the remaining income groups, the probability ranges between 5 and 22%-points. Thus, the negotiated bound tariffs in the Uruguay Round did not force LoM countries and LDCs to liberalize, instead the large cuts that can be observed, espe-

[31] http://www.fao.org/worldfoodsituation/foodpricesindex/en/

Table 1.4: Change in MFN Tariffs across Income Groups (Industrial Products)

	$\Delta T_0^1 = t_1 - t_0$				$B = 1$ if $\tilde{t}_{ik} < t_{ik}^{before}$		
	ΔT_{88}^{17}	ΔT_{05}^{17}	ΔT_{94}^{05}	ΔT_{88}^{94}	P(B)	P(B)	$\Delta T_{88}^{17} \vert B = 0$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LDCs	-1.28***	-1.23***	-0.07*	0.03	-0.72***	-0.53***	-4.31***
	(0.08)	(0.04)	(0.04)	(0.05)	(0.00)	(0.00)	(0.14)
LoM Africa	-8.15***	-2.02***	-7.07***	0.94***	-0.55***	-0.35***	-8.96***
	(0.13)	(0.04)	(0.08)	(0.10)	(0.00)	(0.01)	(0.19)
LoM Americas	0.80***	0.27***	0.73***	-0.19***	-0.74***	-0.45***	-2.31***
	(0.05)	(0.02)	(0.03)	(0.04)	(0.00)	(0.01)	(0.12)
LoM Asia	-6.93***	-0.53***	-5.08***	-1.32***	-0.58***	-0.14***	-5.78***
	(0.14)	(0.05)	(0.06)	(0.12)	(0.00)	(0.00)	(0.17)
LoM Europe	0.06	-1.41***	-0.02	1.48***	0.00	0.09***	0.12
	(0.06)	(0.03)	(0.05)	(0.05)	(.)	(0.00)	(0.14)
HICs (Ref. Group)	-4.39***	-0.61***	-2.90***	-0.88***	0.77***	0.62***	-1.17***
	(0.04)	(0.01)	(0.02)	(0.04)	(0.00)	(0.00)	(0.12)
Observations	695,129	695,129	695,129	695,129	537,621	157,508	473,042
joined WTO					< 1995	> 1995	all

Note: The table shows the regression output of $y_{ik} = \sum_{G=1}^{6} \beta_G I^G + u_{ik}$. In columns (1) to (4) the dependent variable y_{ik} equals the absolute change in the MFN tariff ΔT_0^1 for different time intervals. In column (5) and (6) the dependent variable is the probability of having a binding bound tariff P(B), in column (7) it is the change in MFN tariffs between 1988 and 2017 for products with a binding bound tariff. See the main text for the definition of B. Robust standard errors in parentheses. ***/**/* indicate significance at the 1%/5%/10% level.

cially for African and Asian LoM countries, are entirely due to unilateral tariff liberalizations, i.e. increases in tariff water.[32]

As mentioned above, countries that joined the WTO after 1995 faced strict reductions in bound tariffs resulting from multilateral negotiations. Next, I will check if the negotiated bound tariffs were binding for new WTO members. B is defined as before with the slight modification that t_{ik}^{before} now equals the tariff one year prior to the WTO accession. For example for China, that joined the WTO in 2001, $B = 1$ if $\tilde{t}_{ik} < t_{ik}^{2000}$. Column (6) shows, that for new WTO members the probability of a binding bound tariff is higher than for countries that joined the WTO prior to 1995. This is true for all income groups except HICs. Asian LoM countries display particularly diverging probabilities: while for countries joining the WTO before 1995, the probability of a binding bound tariff equals only 19% it is 48% for new WTO members.

Lastly, I check how the pattern across income groups in ΔT_{88}^{17} changes when excluding products that are subject to a binding bound tariff, i.e. $\Delta T_{88}^{17} | B = 0$. Small differences from the full sample (see column (1)) would indicate that products with a binding tariff play a minor

[32] For agricultural products the results are qualitatively the same. Due to large measurement error in the bound tariffs (see Section 1.3 for details) of agricultural products it is hard to correctly quantify the coefficients.

role in the global reduction of applied MFN tariffs since 1988. The results are mixed: for HICs, the coefficient is much smaller. The differences for the remaining income groups are less pronounced confirming the results of the analysis of $P(B)$: when it comes to HICs and new WTO members, the binding commitments made in multilateral trade negotiations also matter for applied MFN tariffs. For LDCs and LoM countries that joined the WTO before 1995, on the other hand, this cannot be said. This is due to the fact that for the latter group of countries the focus during the Uruguay Round was to increase the coverage of bound tariffs instead of enforcing lower bound tariffs. As the globally decreasing applied MFN tariffs are mostly driven by LoM countries, one has to be careful to not overestimate the role of multilateral trade negotiations in the general downwards trend of the past 30 years.

Patterns of Reduction Countries can reduce tariffs in many different ways. Assuming that changes in tariffs are governed by the objective of increasing welfare, the literature puts forward two types of tariff reforms (for example Neary (1998)). Countries can either implement a uniform *radial* reduction (reduce all tariffs by the same proportion) or a *concertina* reform (reduce the highest tariff rates). The concertina reform compresses the tariff structure—lower and more uniform tariffs are the result of reducing the extremely high tariffs the most and making only small cuts to the already low tariffs. In case of a radial reform, the tariff structure remains the same. In multilateral tariff negotiations both reforms are applied, albeit the concertina reform has become more popular in recent years (Hoda 2001).[33] According to Amiti (2005) the concertina reform was also a guiding principle for the tariff reforms in developing countries in the 1970s and 1980s.

Having these two concepts in mind, I check if the countries in the sample follow either one of the two. To do so, I fist calculate country-specific deciles of the initial tariffs in 1988 denoted by D_i^c with $c = 1, 2, ..., 10$ across all products k. The deciles D_i^c vary among the countries. Countries with few unique tariffs have less than ten deciles. Then, ten dummy variables I_i^c, that equal one if $D_i^{c-1} \leq t_{ik,0} \leq D_i^c$ and zero otherwise are defined, and are used to explain the changes in applied MFN tariffs, $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. y either equals the absolute change in tariffs $\Delta t_{ik} \equiv t_{ik,2017} - t_{ik,1988}$ or to the relative change $\Delta t_{ik} \equiv \frac{t_{ik,2017} - t_{ik,1988}}{t_{ik,1988}}$. The focus of the analysis lies on industrial products and on countries that reduced tariffs on average. Regressing on dummy variables does not impose any functional form and is therefore the most flexible approach.

[33] While in the Kennedy Round (1964-67) the general agreement was to simply cut tariffs by 50%, in the Tokyo Round (1973-79) negotiating parties agreed on much more sophisticated formulae (Hoda 2001). One example is the Swiss formula, which was accepted eventually, and was implemented by most high income countries participating in the Tokyo Round. It is defined as follows: $Z = \frac{AX}{A+X}$, with A = coefficient (14, 15, 16), X = initial rate of duty, Z = resulting rate of duty. All of these formulae can be traced back to the concertina reform as they compress the tariff structure, i.e. lower and more uniform tariffs by cutting the extremely high tariffs the most, and the already low tariffs the least.

The type of tariff reform—radial or concertina—can be identified by combining the β coefficients for the relative and absolute changes: When a country follows the concertina reform, the β coefficients for the absolute change as well as the coefficient for the relative change will increase in size with the initial tariff level. Thus, connecting the respective coefficients for the absolute and relative changes would result in two downward-sloping curves. In this case, the tariff structure is compressed, i.e. it changes with respect to the initial year. When the tariff reductions are carried out using a radial reform, on the other hand, the coefficients for the absolute changes in the level of the initial tariff increase again, the coefficients for the relative changes remain constant. The tariff structure remains the same, there is only a level-effect, i.e. all tariffs are reduced by a certain percentage.

The results of estimating $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$ are displayed in Figures A10 to A15. The β coefficients for the absolute changes are highlighted in red, the coefficients for the relative reduction are marked in blue. The deciles D_i^c are displayed on the x-axis. Most importantly, the analysis shows that there is large heterogeneity across countries even within the same income group. Both types of reforms can be found in various countries independent of the income group. Examples for the implementation of concertina reforms are Bangladesh, Botswana, Cuba, India, Malaysia, Russia, Ukraine, Bulgaria, Island, and New Zealand. Radial reforms are somewhat less common and more prevalent in LDCs and African LoM countries compared to the remaining income groups (i.e. Malawi, Nepal, Nigeria, Brazil, and Thailand).

Some countries implement tariff reforms using a elements of both the concertina and radial reform. For example, Egypt, China, Indonesia, and Vietnam apply the concertina reform to lower initial levels, but after a certain threshold level they adapt a radial reform. The analysis reveals another frequent pattern of reduction, I call it the *cross-reform*, i.e. when the absolute magnitude of coefficients of the absolute change increase, while the coefficients of the relative change decrease with the initial tariff. For this type of tariff reform, connecting the β coefficients for the absolute and the relative change, results in two lines that intersect. For example the United States, Kenya and Costa Rica changed tariffs according to this pattern. The cross-reform results in overall lower tariffs but—similar to the radial reform—the tariff structure remains unchanged.

1.4.3 Preferential Tariffs

Preferential tariffs are the one major exception to the core principle of non-discrimination of the WTO. Any RTA violates the non-discrimination clause by definition as only the signing parties enjoy more favorable market-access conditions, but all other trading partners are excluded. Four different types of RTAs can be distinguished: FTAs, CUs, PSAs, and special and nonreciprocal arrangements. In this section, the substantially all trade criterion, the legal basis of FTAs and CUs, will be discussed first. Second, I will show how tariff cuts are implemented across FTAs. Lastly, I will briefly review nonreciprocal arrangements. I use Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008) to distinguish between the different types of trade agreements.[34]

Interpretation of the Substantially all Trade Criterion in Practice Article XXIV of the GATT stipulates the rules for the formation of FTAs and CUs. More specifically it states that *"duties and other restrictive regulations of commerce (...) are eliminated on substantially all the trade between the constituent territories"* (GATT, Article XXIV: 8). However, the interpretation of the substantially all trade criterion is not straightforward (Lydgate and Winters 2019). Table 1.5 gives an overview of how Article XXIV is interpreted in practice. Countries in an FTA levy on average tariffs of 1.4%. 79% of the trade between country pairs is on average not subject to any tariffs corresponding to 84% of all HS6-products. The shares are larger for industrial than for agricultural products. For customs unions the average preferential tariff is somewhat lower and the shares of free trade and HS6-products with zero tariffs higher, respectively. Summing up, many countries seem to interpret Article XXIV as basis for eliminating tariffs on 80 to 90% of all trade within both FTAs and CUs.

Table 1.5: Preferences and the Substantially all Trade Criterion across Country Pairs for Agreements Notified under Article XXIV

	All			North-North			South-South			North-South		
	all	ind.	agri.	all	ind.	agri.	all	ind.	agri.	all	ind.	agri.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A) Pairs with FTA												
Pref. Tariff	1.4	0.8	4.3	1.6	0.1	10.7	0.6	0.4	1.7	1.5	1.0	3.8
Trade | t=0	78.9	80.3	71.6	93.9	98.0	70.0	90.4	91.5	84.1	75.2	76.1	69.9
HS-6 | t=0	84.1	86.1	74.2	92.1	97.0	68.2	88.8	89.6	85.1	82.2	84.0	73.3
B) Pairs with Customs Union												
Pref. Tariff	0.4	0.3	0.7	0.0	0.0	0.0	0.7	0.6	0.9	1.3	0.0	7.8
Trade | t=0	91.9	92.3	91.0	100.0	100.0	100.0	82.5	82.7	82.4	96.4	100.0	68.6
HS-6 | t=0	86.1	86.4	84.7	100.0	100.0	100.0	74.5	74.6	74.2	91.0	98.8	52.5

Note: The table shows the average preferential tariff applied to trade between member countries, the average trade that was not subject to any tariffs as a share of the total trade between the respective country pair, and the average number of 6-digit products with a zero tariff as a share of the total number of products of both countries. In this analysis all high income countries are called "North", all other countries (LoM countries and LDCs) are called "South".

In practice, the interpretation of the substantially all trade criterion is—again—characterized by heterogeneity across countries. For FTAs between two high-income countries (North-

[34] The advantage of Mario Larch's database is that it uses the WTO's legal definition to classify RTAs, i.e. whether an agreement has been notified under the enabling clause or the Article XXIV. Thus, all FTAs and CUs are notified under Article XXIV, while all PSAs in the database are notified under the enabling clause.

North), tariffs on industrial products have been eliminated for almost all HS6-products. Whereas for the agricultural sector only 70% of all trade is exempt from tariffs. When it comes to FTAs between two LoM countries and/or LDCs (South-South), the coverage of the FTAs is much more similar for industrial and agricultural products than for North-North pairs resulting in 90% of all trade to be tariff free. Within FTAs between HICs and LoM countries or LDCs (North-South), on the other hand, only 75% of all trade is tariff free. Investigating each pair of the North-South FTAs demonstrates that most of the FTAs with a share of free trade below 90% are relatively recent ones (cf. Figure A16) that most likely are not fully phased-in yet; typically the South country is granted relatively long transition periods.

The elimination of tariffs within the different CUs varies across country pairs as well. The only countries included in column (4) to (6) are the members of the European Union, for which all trade is free. In the CU between the European Union and Turkey, which is the only CU included in columns (10) to (12), all trade and almost all industrial HS6-products are duty free, while many agricultural products are exempted. This results in large asymmetries between the two sectors. The remaining CUs between South-South countries include Mercosur, Caricom (15 Caribbean nations), various African CUs, the CU between the Gulf states, and the Eurasian CU. Preferential tariffs are very low within these CUs indicating that goods, which are subject to a preferential tariff, can move freely. However, the share of duty-free trade is only 82% and the average share of HS6-products with zero tariffs equals 74%. Thus, trade in these CUs is less integrated than in the European context.

Phasing-In in FTAs According to Baier and Bergstrand (2007) "*virtually every FTA is phased-in, typically over 10 years*" (p. 89–90). Phasing-in has potentially important implications for the effects of FTAs. It might be the reason why the impact on trade flows takes so long to fully unfold. Baier and Bergstrand (2007) were the first to use lagged FTA terms to identify the role of phasing-in on aggregated trade flows, which indeed yields positive and statistically significant effects on bilateral trade. Countries decide on a product-by-product basis whether the respective tariff is phased-in. Surprisingly, empirical evidence exploiting this variation is scarce: to the best of my knowledge, Besedeš et al. (2019) are the only ones to explore this matter so far. In the context of NAFTA, they show that phasing-in cannot explain the delayed reaction of trade. The lack of readily available data might be one reason for the scarce empirical evidence on phasing-in.

In the new tariff database I include detailed phasing-in schedules from the WTO's RTA database.[35] Unfortunately, they are not available for all RTAs but only for 149 FTAs. The

[35] In 2006 the General Council established a new transparency mechanism for all RTAs that is supposed to help ensure that RTAs fulfill the requirements of Article XXIV and V, respectively. As a result so-called "factual presentations" have to be distributed among WTO members. One part of the factual presentation is the tar-

Table 1.6: Average Share of Tariff Lines with Final Preferential Tariff (in %)

	All			**North-North**			**South-South**			**North-South**		
	all	ind.	agri.	all	ind.	agri.	all	ind.	agri.	all	ind.	agri.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Entry into Force	75	74	76	87	89	73	74	73	78	73	73	74
EiF+5	84	84	84	94	95	84	83	82	85	83	84	82
EiF+10	95	95	93	98	99	94	96	96	95	94	94	91
EiF+15	100	100	99	100	100	99	99	100	98	100	100	99

Note: The table shows the share of tariff lines with the final preferential tariff at different points of time, i.e. the year of entry into force (EiF) and 5, 10, and 15 years after the year of implementation. Thus, the first row equals the probability of tariff cuts being implemented immediately when the FTA enters into force. The data is only available for 149 FTAs, thus the sample changes compared to the baseline.

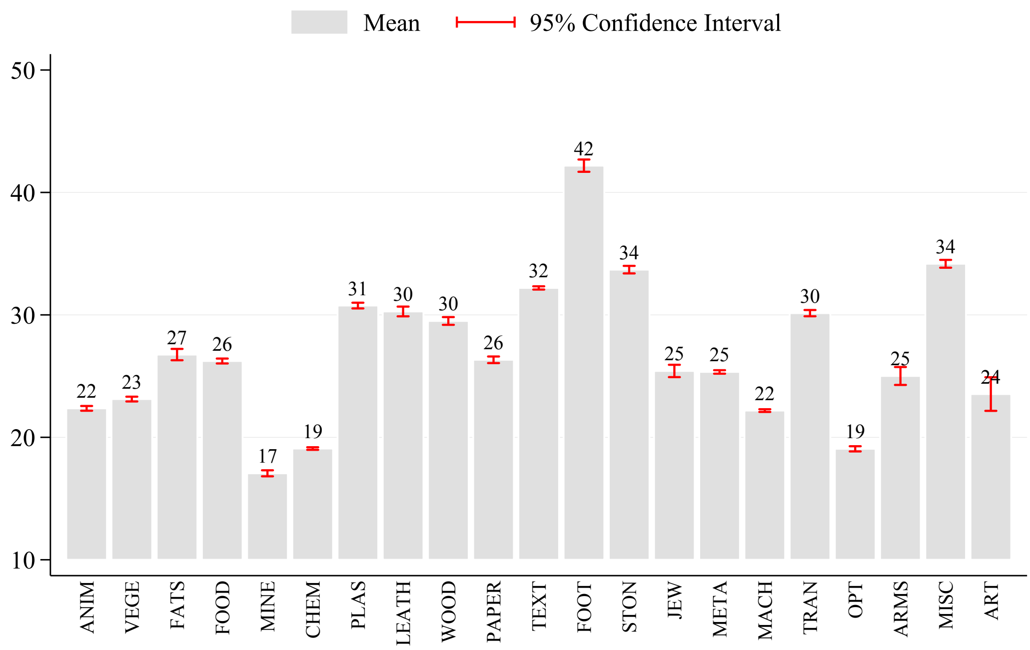
subset includes mostly recent FTAs. Next, I analyze how frequently countries use phasing-in and check for cross-country and sectoral heterogeneity.

Table 1.6 shows the average share of tariff lines with the final preferential tariff (typically zero) at different points in time: the first row (Entry into Force, EiF) reports the average probability for an immediate tariff cut, immediately after the FTA enters into force. The remaining rows present the average shares of fully phased-in tariffs after 5, 10, and 15 years, respectively. On average, countries cut tariffs immediately for 75% of all tariff lines. 9% are being phased-in within the first five years, 6% between the 5^{th} and the 10^{th} year. 15 years post-EiF, all tariff cuts are fully implemented. Phasing-in is less common in FTAs with two North countries involved. However, agricultural products are more heavily protected by phasing-in than industrial ones. Tariffs for North-North countries are almost completely implemented 10 years post-EiF. In the case of the remaining pairs, it takes longer. The relatively long phasing-in periods for North-South pairs is mostly due to the LDCs/LoM countries that are granted more time to adapt to the new tariff regime. Figure A17 in the Appendix reports the average probability for each importer in the sample.

With respect to agricultural and industrial products, the probability of phasing-in is similar. However, within the two types of products, there is heterogeneity across sectors (cf. Figure 1.3). While for agricultural products (Anim-Food) the probability of phasing-in ranges between 22 and 27%, for the industrial sectors, it is much more dispersed. It is lowest for minerals, chemical products, and optics and highest for footwear, textiles, and stones and glasses. These broad trends also hold when allowing for heterogeneity across income groups (Figure A18 in the Appendix). The sectoral pattern is similar to the pattern of MFN tariffs displayed in

iff schedule that includes all phasing-in schemes (cf. https://www.wto.org/english/tratop_e/region_e/trans_mecha_e.htm for details). The tariff schedules are mostly available for more recent FTAs.

Figure 1.3: Probability of Phasing-In across Sectors



Note: The graph shows the probability of Phasing-In across sectors. See Table A4 for a full description of the sectors. The sample is different from the one used in the main analysis because the underlying information is not available for all FTAs but only for 149 FTAs.

Figure 1.1, indicating that phasing-in might be a different form of protectionism, i.e. countries try to protect the respective sectors as long as possible.

Nonreciprocal Arrangements in Practice The missing reciprocity is what distinguishes nonreciprocal arrangements from FTAs, CUs and PSAs: instead of bilateral tariff concessions, only one country, typically a high-income country, offers preferential access, while the other country continues to impose MFN tariffs—the formal goal of nonreciprocal arrangements is to foster economic growth in developing countries through trade (Ornelas 2016). Due to the comprehensive coverage in terms of beneficiary countries and products, they are an essential part of international trade policy. As of 2017, the WTO reports 22 importing countries granting unilateral preferences.[36] The General System of Preferences (GSP) is the most widely spread arrangement. There are additional programs: for example, the United States offers preferential treatment through the African Growth and Opportunity Act (AGOA) and the European Union through the Everything-but-Arms scheme. Both of these programs focus on LDCs and are more generous than the GSP. Ornelas (2016) offers an excellent overview of this special type of trade agreement.

[36] http://ptadb.wto.org/

Table 1.7 reports the shares of trade covered under the nonreciprocal arrangements by the importer granting the trade preferences. I distinguish the respective applied tariffs, i.e. MFN tariff of zero ($t_{ik} = 0$), preferential tariff of zero ($t^*_{ijk} = 0$), preferential tariff greater than zero (t^*_{ijk}), and nonzero MFN tariffs are denoted by t_{ik}. At least three observations are striking: first, beneficiaries either mostly export goods for which no MFN tariff is imposed or they are granted preferences. Especially for HICs, i.e. the countries listed first in the Table, the share that is imported under nonzero MFN tariffs is low. With the exception of the European Union (row (3)) nonzero preferences are not very common among HICs, When it comes to LoM countries offering nonreciprocal preferences, i.e. China, India, Russia, Turkey, the shares of covered trade in this category are higher. Second, the preferences for LDCs are on average more generous than for LoM countries, as columns (5) to (12) illustrate. One exception here are the United States imposing nonzero MFN tariffs on 53% of exports by LDCs while this share is a mere 6% for LoM countries.

Third, columns (13) to (16) highlight an interesting fact: some new member states of the European Union (Bulgaria, Cyprus, Czech Republic, Hungary, Malta, Poland, Romania, Slovakia, and Slovenia) are being granted preferences through nonreciprocal arrangements although they joined the customs union. Australia, Japan, New Zealand, Russia and Kazakhstan do so. The shares that fall under the nonreciprocal arrangements for these countries are small but it illustrates an interesting point: the countries granting preferential treatment have high degree of freedom in deciding who receives nonreciprocal trade preferences and who does not.

Table 1.7: Shares of Trade Covered under Nonreciprocal Arrangements (2017, in %)

	All				**Least Developed Countries**				**Low & Middle Income C's**				**New EU Members**			
	$t=0$	$t^*=0$	$t^*>0$	$t>0$	$t=0$	$t^*=0$	$t^*>0$	$t>0$	$t=0$	$t^*=0$	$t^*>0$	$t>0$	$t=0$	$t^*=0$	$t^*>0$	$t>0$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
AUS	60	23	7	11	19	81	0	0	62	23	5	10	18	1	40	40
CAN	50	43	3	4	10	90	0	0	52	41	2	5				
EUN	40	44	14	1	18	82	0	0	42	40	16	1				
JPN	69	13	8	9	26	72	2	0	69	12	9	10	76	7	11	6
KOR	21	43	7	29	14	60	9	17	18	41	7	35				
NZL	41	34	5	21	16	84	0	0	52	26	7	15	29	0	2	68
USA	33	59	1	7	10	35	2	53	31	62	2	6				
ISL	99	1	0	0	98	1	0	0	99	1	0	0				
NOR	83	10	3	4	29	71	0	0	84	8	3	5				
CHN	35	55	4	6	72	23	2	3	25	68	3	4				
IND	35	22	26	16	29	14	37	20	38	19	26	17				
RUS	24	53	10	13	5	24	0	71	25	59	11	6	11	0	4	85
TUR	36	33	22	9	36	46	0	18	37	32	22	9				
ARM	31	19	8	41					31	19	8	41				
CHL	0	94	6	0					0	94	6	0				
KAZ	26	19	5	50	4	19	0	77	27	20	6	48	1	0	1	98
MAR	0	98	1	1	0	31	1	68	0	99	1	0				
MNE	50	50	0	0					50	50	0	0				
THA	53	47	0	0	79	19	2	0	52	47	1	0				
TJK	1	99	0	0	0	0	100	0	1	99	0	0				

Note: The table shows the average preferential tariff applied on trade between member countries, the average trade that was not subject to any tariffs as a share of total trade between the respective country pair, and the average number of 6-digit products with a zero tariff as a share of the total number of products of both countries. All high income countries are called "North", all other countries (LoM countries and LDCs) are called "South".

1.5 Conclusion

In this paper I presented a new global tariff database covering tariffs at the 6-digit product level for 197 importing countries and their trading partners for 30 years, namely 1988 to 2017. It deals simultaneously with the two major issues, missing data and misreporting. By doing so, the coverage almost doubles yielding a dataset of 5.7 billion tariffs. The improvement is particularly relevant for least developed countries and developing countries (share of imputed data equals 56% and 42%, respectively). With this novel dataset at hand, I tried to answer the following questions: What are the persistent patterns in tariff protectionism across countries and sectors? How and by how much did tariffs change over the past 30 years? What role did the WTO play? How much and when do preferential tariffs liberalize trade?

I find a striking amount of heterogeneity across countries with respect to tariff levels and also changes in tariffs. These differences across countries are even observable within the same income group indicating that other factors like the countries' production structures, political ideology, protection for sale considerations or terms-of-trade objectives might play a role. In this paper I completely abstract from these important factors determining the level of tariff protectionism around the world leaving it up to future research to test these well-known concepts with the new tariff data. The role of the WTO is very different across countries: while multilateral trade negotiations determined applied MFN tariff levels in some countries it had no impact in others. The reason is the high amounts of water in the tariffs for many countries. Therefore, future WTO negotiations have still very much room of improving the conditions of trade by focusing on a relatively clear task: reducing the bound tariffs to applied levels around the world.

Chapter 2

Rules of Origin and the Profitability of Trade Deflection

2.1 Introduction

Traditionally, trade economists are skeptical of free trade agreements (FTAs) because of their preferential nature.[1] FTAs grant advantages to some trade partners but withhold them from others. In that way, they lead to harmful trade diversion. Amongst regional trade agreements, customs unions (CUs) are usually preferred over FTAs, because the former create as much trade as the latter but typically divert trade less (Krueger 1997). Moreover, CUs are less likely to be stumbling blocks for further trade liberalization (Missios et al. 2016). Nonetheless, only 9% of all trade agreements signed since 1945 are CUs (Dür et al. 2014).

While CUs usually have a common external tariff (at least for a subset of products), this is not the case with FTAs, at least formally. For this reason, in contrast to CUs, FTAs require rules of origin (RoOs) that define under which conditions a good is said to originate from a member country of the FTA so that it can benefit from a preferential tariff. Complying with these rules causes costly red tape.[2] Moreover, they can distort firms' input sourcing (Conconi et al. 2018; Krishna and Krueger 1995). They reduce preference utilization rates (PURs) to less than 100%, sometimes substantially so (Keck and Lendle 2012). RoOs are, therefore, the unsavory sauce to Bhagwati's (1995) spaghetti bowl of bilateral trade agreements. According to advocates of RoOs, without them each imported commodity would enter the FTA through the country with the lowest tariff. In the absence of transportation costs, this arbitrage activity, often referred

[1] In this paper, we follow WTO definitions. Regional trade agreements (RTAs) are reciprocal preferential trade agreements between two or more partners. They take the form of free trade agreements (FTAs) and customs unions (CUs). In contrast, preferential trade arrangements are unilateral i.e. non-reciprocal trade preferences.

[2] See Anson et al. (2005), Cadot et al. (2006), Carrère and Melo (2006), and Estevadeordal (2000) for attempts towards quantifying these costs.

to as trade deflection, would have the consequence that the FTA member with the lowest tariff de facto sets a common external tariff for all FTA members.

Similarly, RoOs are also imposed on exporters from developing countries benefiting from unilateral tariff preferences granted by rich countries under preference schemes like the Generalized System of Preferences (GSPs). By burdening poor countries with red tape, they have the effect of counteracting the trade-creating effects; in some of the arrangements PURs are as low as 66% (Keck and Lendle 2012).

Surprisingly, so far, no study has asked whether trade deflection is actually realistic empirically. If it is not, the existence of hundreds of pages of text on RoOs in modern FTAs would be indicative of rent seeking rather than necessary due to the inherent logic of a trade agreement (which may be questioned per se on other grounds).

In this paper, we use a newly compiled data set of MFN (most favored nation) and preferential tariffs at the 6-digit level. We document a fact that, to the best of our knowledge, has been overlooked so far: for most country pairs in FTAs, trade deflection is unprofitable. The reason for this is that tariffs are generally low, countries in a common FTA tend to have similar external tariff levels, and when tariff levels differ, deflection is profitable at most for one country in the pair. When preferences are granted unilaterally by a rich country to a poor one, trade deflection is almost never profitable by design: the poor countries maintain their (often high) external tariffs *erga omnes* so that goods from third countries can rarely be profitably transshipped through them to the rich country or through the rich country to them.

The upshot is that FTAs or GSP arrangements should not require proof of origin by default, except for those few products where differences in external tariffs are larger than some threshold level (determined by the additional transportation costs that would arise if firms attempt to exploit tariff differences).

Concerns with RoOs and their side effects is wide-spread in the literature. It is a key ingredient in Bhagwati's (1995) "Spaghetti Bowl" parable. In his words, RoOs are "*inherently arbitrary*". They make "*the occupation of lobbyists who seek to protect by fiddling with the adoption of these rules and then with the estimates that underlie the application of these rules ... immensely profitable at our expense.*" More generally, as also highlighted by R. Baldwin (2016), with the spread of international production networks, it is increasingly problematic to operate trade policy on the assumption that one can cleanly identify the nationality of a product. As a consequence, FTAs are "*tying up trade policy in knots and absurdities facilitating protectionist capture* " (Bhagwati 1995).[3]

[3] These concerns apply mostly to tariffs; however, they also apply to other provisions in FTAs which are meant to be preferential (such as mutual recognition agreements). The arguments in this paper carry over to these cases.

RoOs come in a multitude of forms. All regimes require that a product undergoes "substantial transformation" in the originating country. This could be a minimum value added content requirement, a change in tariff classification, or a combination of these. For example, the text of a modern trade agreement, the Canada-EU Trade Agreement (CETA), defines the following RoOs for a food product falling under HS heading 19.01 ("Malt Extract"): "*A change from any other heading, provided that: (a) the net weight of non-originating material of heading 10.06 or 11.01 through 11.08 used in production does not exceed 20 per cent of the net weight of the product, (b) the net weight of non-originating sugar used in production does not exceed 30 per cent of the net weight of the product, (c) the net weight of non-originating material of Chapter 4 used in production does not exceed 20 per cent of the net weight of the product, and (d) the net weight of non-originating sugar and non-originating material of Chapter 4 used in production does not exceed 40 per cent of the net weight of the product.*" Needless to say, if countries are members to different FTAs, they have to comply with potentially different and conflicting RoOs.[4]

In the recent revision of the North American Free Trade Agreement (NAFTA) between Canada, Mexico, and the United States, a lot of political capital was invested into tightening RoOs, in particular for autos. By requiring the minimum share of regional value added to increase from 62.5% to 75%, the new agreement squeezes out third country input suppliers with the objective to protect domestic suppliers.

The theoretical literature points to three reasons why RoOs lead to costs for businesses and welfare losses. First, the detailed and highly complex product-by-product criteria make them hard to meet. Exporters need to build up (legal) know-how to comply with the rules. Second, exporters face different RoOs depending on the export-destination due to multiple FTAs with little overlap in the design of the RoOs.[5] Third, if exporters need to adjust their global supply chains to meet RoOs requirements, trade patterns and investment flows are distorted (Krishna and Krueger 1995; Krishna 2006). This can have extreme implications. In a simple model, Deardorff (2018) shows that, even when every country has an FTA with every other country, due to RoOs, the level of welfare in such a situation can be lower than in the situation where no FTA was present and only MFN tariffs apply.

The empirical evidence confirms the negative effects of complying with RoOs. The compliance costs associated with meeting RoOs requirements range from 3-15% of final product prices depending on the method used to measure the restrictiveness of RoOs (Carrère and Melo 2006; Anson et al. 2005; Estevadeordal 2000; Cadot et al. 2006). Andersson (2015), Bombarda and Gamberoni (2013), and Augier et al. (2005) use the liberalization of the EU's RoOs

[4] To be fair, there have been numerous attempts towards simplifying RoOs-regimes, e.g., by allowing for various ways of cumulation. However, the general necessity of RoOs is rarely questioned by trade policy practitioners.

[5] Estevadeordal and Suominen (2006) review the types of RoOs used around the world and find significant heterogeneity with respect to the exact requirements as well as the level of restrictiveness.

as a natural experiment and find a positive effect on total trade. Constructing a new database on NAFTA RoOs, Conconi et al. (2018) show that in the absence of RoOs, Mexican imports of intermediates from third countries relative to NAFTA partners would have been 45% higher. Further, firm-level evidence suggests heterogeneity across firms as mostly larger firms actually comply with the RoOs while smaller firms have difficulties doing so (Demidova et al. 2012; Cadot et al. 2014). Firm surveys show that RoOs hinder firms use of FTA preferences (Wignaraja et al. 2010; Suominen and Harris 2009). Also, preference utilization rates of less than 100% indicate high fixed costs associated with RoOs (Keck and Lendle 2012).[6]

There is also a theoretical literature on the choice between FTAs and CUs. In FTAs, participating countries do not have to delegate policy making authority to a common institution, which should facilitate concluding the agreement. Facchini et al. (2013) provide arguments why FTAs might yield higher welfare for the prospective member countries when voters strategically choose a very protectionist representative to conduct the negotiations. Appelbaum and Melatos (2012) model the conditions under which members in FTAs choose similar external tariffs; a situation they describe as "camouflaged" CUs. Lake and Yildiz (2016) also endogenize the choice between FTAs and CUs and explain why CUs are only intra-regional while FTAs are inter- and intra-regional.

Section 2.2 of the present paper presents the simple analytical conditions under which trade deflection is profitable. This analysis guides our empirical analysis. Section 2.3 presents the data. Besides tariff data and information about trade agreements we also need bilateral transportation costs. In this section, we construct pair-product specific transportation costs using disaggregated data on cif/fob imports for the USA and use a simple econometric model to provide out-of-sample predictions for all other product-pair combinations. We validate our approach using data from New Zealand.

Section 2.4 uses the data to assess countries' scope for trade deflection, which is surprisingly low. For countries in the same FTA, in 29% of all country-pair$\times$product$\times$third-country combinations for the year 2014, countries set identical external tariffs. Trade deflection means taking advantage of arbitrage possibilities. Therefore, by definition trade deflection could be profitable for one of the members of a pair, while for the other it cannot be profitable; this is the case for 38% of candidate cases. For 4% of all cases, external tariffs are different but the preferential tariff between ij is still high so that deflection is not profitable. So, in only 29% of all cases, the tariff situation could make trade deflection profitable if there were no transportation costs. In 16% of all cases, the tariff savings are smaller than additional transportation costs. Hence, in sum, for fully 86% of all cases, in FTAs, trade deflection is not profitable.

[6] For example, in the EU's most advanced bilateral trade agreement in force (with Korea), five years after entry into force of the agreement, the preference utilization rate is 71% (European Commission 2017).

In non-reciprocal preferential trade arrangements (GSP), only in 7% of all cases are tariffs such that trade deflection could work in the absence of transportation costs. Factoring in the latter, the fraction falls to a mere 2%. Note that these numbers are conservative because we consider only transportation costs, disregarding other trade costs such as those related to writing and enforcing contracts, exchange rate risk, management costs, and so on.

Our analysis suggests that, in a large number of cases, there is no economic rationale for RoOs. Section 2.5 draws policy conclusions. The most important is that exporters should be required to prove the origin of goods only when trade deflection is a real possibility which is quite often not the case. More specifically, we suggest that, in new FTAs, negotiators should agree on a full set of RoOs for all products, but that the requirement to prove origin be activated only if external tariffs of FTA members differ by some minimum amount. In the case of non-reciprocal preferential trade arrangements (GSP), RoOs should be activated only for those products where the beneficiary country undercuts the MFN tariffs of the preference granting country. Our proposal could disentangle Bhagwati's spaghetti bowl a bit. It would create incentives for countries to align their external tariffs, thus emulating CUs. It could also help dealing with the exit of countries from long established CUs, such as Britain's or Turkey's potential exits from the EU's customs union.

2.2 On the Profitability and Scope of Trade Deflection

2.2.1 The Profitability of Arbitrage

Consider an importing country $i = 1, ..., N$, and an exporting country $c = 1, ..., N$. Denote the ad valorem tariff applicable on a good $k = 1, ..., K$ in factor form by $t_{ick} \geq 1$ (so that $(t_{ick} - 1) \times 100\%$ is the ad valorem tariff in percent). When useful, we distinguish between preferential tariffs t^*_{ick} and MFN tariffs $\tilde{t}_{ick} = \tilde{t}_{ik}$ for all c not subject to preferential tariffs.

Suppose countries i and j conclude a free trade agreement (FTA). They grant each other preferential tariffs such that $t^*_{ijk} \leq t_{ick}$ and $t^*_{jik} \leq t_{jck}$ for all third countries c. For now we assume that countries i and j do not have an FTA with third countries c.

This constellation opens the possibility for trade deflection if $t_{ick} \neq t_{jck}$.[7] Suppose $t_{jck} < t_{ick}$. Then, without further provisions, a good originating from country c could enter country i through country j with the result that its tariff protection against imports from country c would be undercut as j's tariffs are lower than its own and trade between i and j is tariff-free. To avoid such trade deflection, for the granting of preferential treatment, all FTAs require a

[7] The term *trade deflection* is not uniquely defined in the literature. For example, besides its meaning in the FTA literature, it is also used to describe a situation where a country's use of an import restricting trade policy distorts a foreign country's exports to third markets (see, e.g., Bown and Crowley (2007)).

proof of origin. Such a document testifies that, to be eligible for tariff-free trade from j to i, the good actually originates from country j and not from some third country c.

Generally, whenever $t_{ick} \neq t_{jck}$, in the absence of transportation costs, without RoOs, there is scope for arbitrage leading to a situation where countries i and j de facto are in a customs union, since products from c enter both countries at the common effective tariff rate $t_{ck} = \min\{t_{ick}, t_{jck}\}$. When $t_{ick} = t_{jck}$, there is no scope for such an arbitrage activity. Nonetheless, for tariff-free intra-trade agreement transactions, exporters are legally required to document that their products satisfy the RoOs.

Let there be a fixed cost f_k of respecting the RoOs for good k, either in the form of bureaucratic effort or because the RoOs require a firm to deviate from an otherwise optimal international sourcing policy.[8] The tariff applicable to a transaction between i and j will be $\tilde{t}_{ik}$ instead of t^*_{ijk} whenever the preference margin $\tilde{t}_{ik} - t^*_{ijk}$ is low, f_k is large and/or the value of a transaction net of tariffs is small. For this reason, bureaucratic RoOs can explain the empirical fact that not all firms within an trade agreement make use of preferential tariffs but some apparently prefer to remain subject to the MFN tariff. RoOs can therefore act as de-facto trade barriers and diminish the value of trade agreements, in particular for smaller firms. When they distort the sourcing decision of firms they also have direct implications for third countries because they exacerbate the discrimination inherent in any preferential trade agreement. Conconi et al. (2018) present an excellent recent empirical investigation of NAFTA, which provides clear evidence of this point[9]

So, the question arises: when is trade deflection profitable and therefore a valid concern in an FTA? Let $\tau_{ijk} \geq 1$ denote the *minimum* iceberg transportation costs between i and j. Then, by construction, $\tau_{ijk} < \tau_{ick}\tau_{jck}$, where $c \neq i, j$ is any third country. Also, for simplicity, assume a market structure (perfect competition, or monopolistic competition with CES preferences) such that consumers bear all trade costs. Then, the delivery price p_{ick} in country i of a good k produced in country c will be $p_{ick} = p^0_{ck} t_{ick} \tau_{ick}$ where p^0_{ck} is the factory gate price of good k. Similarly, its price in country j would be equal to $p_{jck} = p^0_{ck} t_{jck} \tau_{jck}$. Shipping that good through j to i would lead to additional transportation costs. Transshipping the good from c through j and onwards to i would make sense only if

$$p^0_{ck} t_{ick} \tau_{ick} > p^0_{ck} t_{ijk} \tau_{ijk} t_{jck} \tau_{jck}. \tag{2.1}$$

Now, let us assume that i and j have an FTA so that $t_{ijk} = t^*_{ijk}$, but elsewhere MFN tariffs apply, assuming for simplicity for now that country i and j do not have an FTA with country

[8] RoOs may also affect variable costs by incentivizing firms to switch to more costly suppliers.

[9] See Krishna and Krueger (1995) for a more detailed analysis of the hidden protectionism in RoOs.

c. We will relax this assumption later on. Then, there are arbitrage possibilities if and only if

$$1 > \frac{\tau_{ick}}{\tau_{ijk}\tau_{jck}} > \frac{t^*_{ijk}\tilde{t}_{jk}}{\tilde{t}_{ik}}.$$

Clearly, a necessary condition is that $\tilde{t}_{jk} < \tilde{t}_{ik}$, i.e., country j must apply a lower MFN tariff to the good than country i, otherwise trade deflection through j to i will never be profitable. In the case of an FTA with $t^*_{ijk} = 1$, trade deflection is profitable if and only if

$$\frac{\tilde{t}_{ik}}{\tilde{t}_{jk}} > \frac{\tau_{ijk}\tau_{jck}}{\tau_{ick}} > 0,$$

i.e., the tariff savings must be larger than the additional transportation costs (both in %) . If both countries i and j had the same MFN tariffs, $\tilde{t}_{ik} = \tilde{t}_{jk}$, there are no tariff savings, and the above inequality would be immediately violated.[10]

So far, we have restricted our analysis to a world where the third country c does not have an FTA with either of the two countries i and j. However, reality is more complicated. For example while the United States and Mexico may have the US-Mexico-Canada Agreement (USMCA, formerly NAFTA) in place, both Mexico and Canada have FTAs with the European Union, too. When we also allow for FTAs with third countries c it is not enough to focus only on MFN tariffs. Even though countries i and j might have the same MFN tariff ($\tilde{t}_{ik} = \tilde{t}_{jk}$) it could still be possible that country c and j have an FTA, leading to $\tilde{t}_{ik} > t^*_{jck}$. If this were the case and proof of origin were not required, trade deflection would be profitable even though the MFN tariffs are the same. Thus, ignoring the preferential tariffs will understate the real potential for trade deflection. Furthermore, because of phasing-in the tariffs between FTA members might not always be zero, i.e. $t^*_{ijk} > 1$. Therefore, the inequality that determines whether arbitrage is profitable or not has to be modified to

$$\frac{t_{ick}}{t_{ijk}t_{jck}} > \frac{\tau_{ijk}\tau_{jck}}{\tau_{ick}} > 0, \tag{2.2}$$

where t_{ick} equals to the effectively applied tariff that country i imposes against country c for good k. This tariff equals the MFN tariff, unless an FTA is in effect, and then t_{ijk} is the preferential tariff that country i imposes against country j.

[10] We do not allow for pricing to market. In this case, factory gate prices may be specific to the destination market and $p^o_{ick} \neq p^o_{jck}$. Writing $p^o_{ick} = \mu_{ick}k_{ck}$, where μ_{ick} is a variable markup, equation (1) would be $\mu_{ick}k_{ck}t_{ick}\tau_{ick} > \mu_{jck}k_{ck}t_{ijk}\tau_{ijk}t_{jck}\tau_{jck}$. A necessary condition for the inequalities discussed above is $\mu_{ick} \geq \mu_{jck}$, i.e., the markup in the high-tariff country i should not be smaller than the markup in the low-tariff country j. Empirically, at the country level, there is a negative correlation between average tariffs and the price level (compare Table B1 in the Appendix), so that our assumption seems largely innocuous.

Proof of origin is not only required in reciprocal FTAs but also in non-reciprocal preferential trade arrangements such as GSPs, which is the most prominent example for these types of arrangements.[11] The missing reciprocity in GSPs is the main difference between the two types of trade agreements: instead of bilateral tariff concessions, only one country, typically a developed country, offers preferential access, while the other country keeps imposing MFN tariffs. To determine the profitability of trade deflection and thus the economic justification of RoOs the same reasoning as above applies, i.e. trade deflection is only profitable if Equation 2.2 is fulfilled. In our empirical analysis we will focus on both types of trade agreements, FTAs and GSPs.

2.2.2 Measuring the Scope for Trade Deflection

For our empirical analysis, we need a measure of the scope for trade deflection in the absence of RoOs. For this purpose, based on inequality (2.2), for every country pair ij relative to a third country c for product k, we define the transportation-cost augmented difference in external tariffs as

$$\Delta T_{ijk,c} \equiv \max\left\{0, T_{ick} - T^{j}_{ick}\right\}, \text{ with } T_{ick} \equiv t_{ick}\tau_{ick} \text{ and } T^{j}_{ick} \equiv t_{ijk}t_{jck}\tau_{ijk}\tau_{jck} \tag{2.3}$$

where T_{ick} and T^{j}_{ick} measure transport-cost augmented tariffs on the direct route from country c to i and on the indirect one, where the good is transshipped through country j (denoted by the superscript). In expression (2.3), we allow tariffs between i and j and with the third country c to be MFN or preferential.[12] If $\Delta T_{ijk,c} = 0$, no profitable arbitrage possibilities exist.

In absence of transportation costs, (2.3) simplifies to

$$\Delta t_{ijk,c} = \max\{0, t_{ick} - t^{j}_{ick})\}, \text{ with } t^{j}_{ick} \equiv t_{ijk}t_{jck}, \tag{2.4}$$

where the costs of servicing market i with a product from c through j, t^{j}_{ick}, is the product of country $j's$ tariff on good k from c, t_{jck}, and the tariff that country i applies on good k from country j, t_{ijk}. Note that t_{ijk} does not have to be necessarily equal to 1 as tariffs in FTAs and GSPs are often being phased-in or remain larger than zero on certain products. In some parts of our analysis, we work with this "simple" measure, because it characterizes a useful necessary condition for the profitability of trade deflection.[13]

[11] Our analysis is not restricted to the General System of Preferences (GSPs) but includes all sorts of non-reciprocal preferential trade arrangements like GSP+, Everything but Arms or the African Growth and Opportunity Act. Whenever we write "GSPs" we mean the broader definition.

[12] Note the slight abuse of notation as $\Delta T_{ijk,c}$ is not a difference in the conventional sense since we replace it with zero whenever the difference is negative and trade deflection is not profitable.

[13] Moreover, the simple measure can be directly measured in the data, while the more general measure requires the estimation of transportation costs.

The goal of this paper is to measure the potential for trade deflection in FTAs and GSPs. Therefore, we are only interested in those cases where the preferential tariff that country i imposes against country j is less than $i's$ MFN tariff since otherwise arbitrage is not possible. We exclude all the cases where this is violated.

Although the measures of the scope for trade deflection are very intuitive, calculation is subject to a major practical challenge. In our data, for the year 2014 we have $5,729$ country pairs ij, on average $2,640$ products k, and 170 third countries c so that the number of observations is equal to more than 2 billion per year. A meaningful analysis of data of that size runs into severe computational issues.

We deal with this problem by focusing only on the 20 most important third countries c that export product k to i.[14] Although this baseline measure covers 98% of the trade for the countries in the sample i.e. for which we have information on tariffs and transportation costs and 86% of world trade, it might suffer from selection bias. A third country's exports to i might be too low to qualify as one of the 20 most important exporters because of high import tariffs t_{ick}. However, it is exactly in those cases that arbitrage is most likely to be profitable (see equation 2.2).

To eliminate this type of bias we define the maximum potential for trade deflection. Assume that there are no transportation costs and that $t_{ijk} = t_{jik} = 1$. Further, let $t_{ick} > t_{jck}$. Then it would pay to ship from c to j and from there to i. Next, let there be another third country c' for which $t_{ic'k} = t_{jc'k}$ so that there is no scope for trade deflection with respect to that country. However, one can imagine that firms from c' ship their product to c first, and from there through j onwards to i. More generally, if the tariff difference between i and j were maximum with respect to third country c, in the case of no tariffs (and other transportation costs) between any c' and c, all shipments from c' would be profitably directed through c. We define a measure of maximum trade deflection

$$\Delta T_{ijk}^{\max} = \max_{c \neq i,j} \left[\max \left\{ 0, T_{ick} - T_{ick}^{j} \right\} \right], \tag{2.5}$$

and analogously $\Delta t_{ijk}^{\max}$ for $\Delta t_{ijk,c}$.

This procedure selects the third party relation with the largest scope for trade deflection, independently of actual trade flows. This leads to overestimation because routing shipments from any fourth country c' to c and from there through i to j involves transportation costs and possibly also tariffs, and this remains unaccounted for in $\Delta T_{ijk}^{\max}$. However, $\Delta T_{ijk}^{\max}$ serves as a conservative upper bound to our estimates of the scope for trade deflection.

[14] We consider the top 20 exporters mostly for computational reasons. Moreover, the median number of exporters of a specific good to a certain destination is exactly equal to 20.

As another alternative to deal with the dimensionality problem, we randomly draw 20 countries out of all third countries c. Finally, we also average over the third country dimension such that $\Delta T_{ijk}^{avr} = \frac{1}{N-2} \sum_{c \neq i,j} \max\left\{0, T_{ick} - T_{ick}^{j}\right\}$ and analogously for the simple measure (with transportation costs set to zero).[15]

2.3 Data

For our empirical analysis, we require data on (applied) product-level tariffs, MFN and preferential, for all country pairs. We also need information on transportation costs by product for each country pair, and on RTAs. Since we have tariff data until 2014 we will do our analysis for this year.

2.3.1 Tariffs

One could think that tariff data were easily available for all country pairs and products, at least for recent years. However, this is not the case. Anderson and Van Wincoop (2004) state *"the grossly incomplete and inaccurate information on policy barriers available to researchers is a scandal and a puzzle" (p. 693)*; with some minor qualifications, this statement still applies today. There is a lot of missing information, in particular for developing countries. Moreover, rich countries also do not report yearly to the WTO or the United Nations (who maintain tariff data bases). Besides, there are many mistakes in official data.

To the best of our knowledge no comprehensive and cleaned tariff data set on the product level is publicly available for recent years.[16] Therefore, to carry out our analysis, a massive investment into data cleaning and imputation is needed. More specifically, we need to impute missing data, in particular when tariffs are phased in over time, complement the official data with country-level information and with data from RTAs, to deal with measurement error (see Appendix B.1 for details).

[15] In the working paper version of this article, we used the averaging method as our baseline measure. However, this procedure does not put enough weight on trade links where a preferential tariff is applicable. When looking at all 170 third countries c in our sample most countries have preferential access to very few markets, and for the vast majority the MFN tariff is imposed. Therefore we believe that focusing the analysis on the 20 most important third countries c is a better way to deal with the dimensionality problem and to measure the potential for trade deflection. However, the main results are not very sensitive to this modification.

[16] Caliendo et al. (2015) have constructed a similar database which is, however, not publicly available yet. The imputation algorithm is very similar to ours with the drawback that they only have information on approximately 100 FTAs and their phasing-in regimes (we account for about 500 FTAs). CEPII's MacMap (Guimbard et al. 2012) is another comparable database. However, it does not deal with missing data at all and the most recent data are only from 2007.

2.3.2 Transportation Costs

The second key variable entering equation (2.3) is a measure of transportation costs. As surveyed by Anderson and Van Wincoop (2004), across a large number of countries and goods, transportation costs make up a trade cost equivalent of 21%, about half of which is attributable to the direct freight costs and the other half to the time value of goods in transit. However, the same survey also makes very clear that other border-related trade barriers are at least twice as important as transportation costs, not to mention retail and wholesale distribution costs. Thus, focusing on transportation costs underestimates the additional non-tariff trade costs that arise when trans-shipping a good through some third country.

Anderson and Van Wincoop (2004) propose industry or shipping firm information to be the first best source of data for transportation costs. However, such data are scarce. Alternatively one can infer the costs of international transportation from detailed data on imports by using the ratio of transaction values denoted in cif (cost, insurance, freight) terms relative to the transaction values in fob (free on board) terms. In theory, this ratio should be identical to τ_{ijk} and satisfy $\tau_{ijk} \geq 1$. Unfortunately, only few countries report disaggregated transaction data in both cif and fob terms.[17] We proceed as follows: first, using US data, originally provided by the US Census and cleaned and regularly updated by Peter Schott (Schott 2008), we measure bilateral ad-valorem transportation costs between the US and all its trade partners for every product k. The data include information on the import value in fob and cif terms at the ten-digit HS level by exporter country and entry-port for the years 1989 until 2016. This allows constructing a US specific measure of transportation costs at the 6-digit level for every product-exporter combination. We want to minimize measurement error induced by outliers. To do so, we add four years (two years before 2014 and two years after) and then calculate the median for every exporter$\times$product (6-digits) combination.

In a second step, we use the cif/fob ratios of the US to predict transportation costs for all other product-pair combinations. We assume transportation costs to be a function of distance D_{ij} such that $\tau_{ij}^k = \alpha^k \left(D_{ij}\right)^{\delta^k}$ with $\delta^k \in (0,1)$ so that non-tariff trade costs are an increasing, strictly concave function of geographical distance.[18]

Thus, it is possible to estimate the parameters α^k and δ^k for every product k for the US using $\tau_{US,i}^k$ and the bilateral distances between the US and its trading partners i, $D_{US,i} \geq 1$.[19] Taking logs makes OLS a feasible estimator. The regression equation equals $\ln(\tau_{US,i}^k) =$

[17] Records of global trade data do not report cif and fob transactions at the sector-level; the Direction of Trade Statistics of the IMF do so for aggregate trade, but the resulting cif/fob ratios take on very implausible values.

[18] Assuming strictly concave transportation costs implies that stopping over in country j for customs reasons is always more costly than shipping a good straight from c to i even if $D_{ic} = D_{ij} + D_{jc}$.

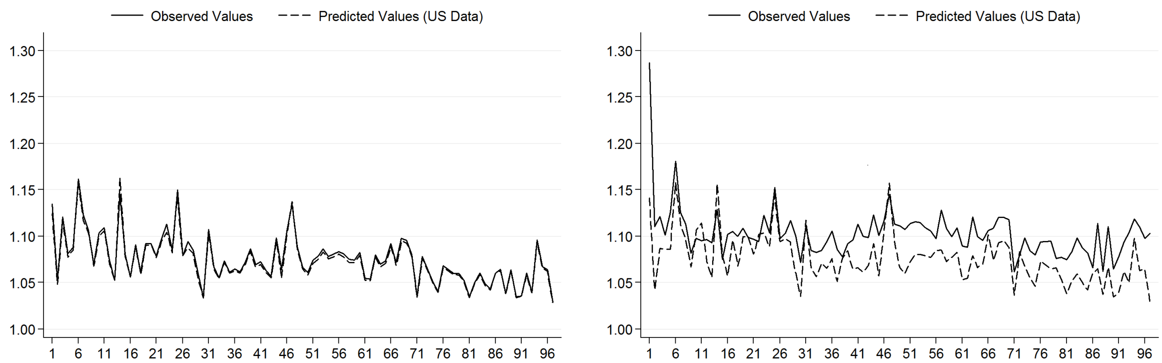
[19] Information on bilateral distances comes from CEPII.

$\ln \alpha^k + \delta^k \ln(D_{US,i}) + u^k$. We regress the cif/fob ratios on the bilateral distance for every product separately to allow for product-specific constants.[20]

Next, for every country-pair and for every product k we predict a measure of transportation cost $\hat{\tau}_{ij}^k = exp(\hat{\alpha^k} + \hat{\delta}^k ln(D_{ij}))$. For 2014, this procedure provides us with transportation costs for 3,853 products (out of the available 4,455 tariff lines). Figure 2.1(a) shows the observed values of the transportation costs for the US and the predicted values for every 2-digit product. There is virtually no difference between the two lines indicating a good in-sample prediction.[21] The estimated transportation costs equal on average 6%, which squares very well the evidence cited in Anderson and Van Wincoop (2004).[22]

Figure 2.1: Predicting Transportation Costs

(a) In-Sample Prediction: USA (b) Out-of-Sample Prediction: New Zealand



Note: The graphs show the observed cif/fob ratios and the predicted values for the United States (a) $\hat{\tau}_{US,j} = exp(ln(\hat{\alpha}) + \hat{\delta} ln(D_{US,j}))$ and New Zealand (b) $\hat{\tau}_{NZ,j} = exp(ln(\hat{\alpha}) + \hat{\delta} ln(D_{NZ,j}))$. We aggregate by taking the average over the two-digit products (listed on the x-axis of the graphs). The data stem from the US Census, Statistics New Zealand and CEPII.

Besides for the US, cif/fob data are also available for New Zealand.[23] We use these data to check how well the prediction based on US data performs. Figure 2.1(b) shows the observed and the predicted values for New Zealand. Overall, the fit is reasonably good although the pre-

[20] Following Hummels (2007), we have added the weight/value-ratios as an additional explanatory factor in the transportation cost function ($\tau_{ij}^k = \alpha^k \left(D_{ij}\right)^{\delta^k} \left(w/v_{ij}^k\right)^{\gamma^k}$). This approach increases the explanatory power of the regressions slightly, but it lowers the number of estimated pair-product transportation costs significantly as weight/value-ratios are available only when countries actually trade.

[21] Alternatively, we could estimate bilateral, product specific trade costs exploiting a structural gravity model of bilateral trade using the methodology proposed by Jacks et al. (2008). We do not use this method because it may very well overestimate trade costs by attributing any deviation from the gravity norm to frictions instead of differences in tastes. Thus, our focus on transportation costs represents a very conservative approach, which generally stacks the cards in favor of trade deflection and against our argument.

[22] In Appendix B.2, we provide information on the distribution of estimated parameters $\hat{\alpha}, \hat{\delta}$ and their relation as well as a histogram of estimated $\hat{\tau}_{ij}^k$.

[23] These are provided by Statistics New Zealand at http://www.stats.govt.nz/browse_for_stats/industry_sectors/imports_and_exports/overseas-merchandise-trade/HS10-by-country.aspx

dicted values tend to be somewhat lower than the observed ones.[24] Figure B3 in the Appendix confirms this pattern when we plot the differences between the predicted and the observed transportation costs without aggregating up to 2-digit products.

2.3.3 Data on Trade Agreements

Trade deflection is an issue only in FTAs and in the non-reciprocal trade arrangements (GSP), but not in customs unions where all members have identical external tariffs by definition. Therefore, we are only interested in country pairs that are in an FTA or a GSP. Although our tariff data can tell us about the existence of a preferential tariff it remains unclear whether the respective agreement is actually of interest. Therefore, we need detailed information about the type of the agreement. Further we want to be able to differentiate between unilateral trade arrangements like the GSP—where RoOs are also relevant but that are of a very different type than the bilateral FTAs.

In addition, all third-countries that belong to the same FTA as the pair ij should also be excluded, since here no potential for trade deflection exists. For example, in the case of Canada and the United States we exclude Mexico from the set of third countries c.[25] To do so, we need information about the members of all FTAs.

Table 2.1: Summary Statistics

	Mean	SD	Median	FTA	GSP	Δ
Δt_{ij} (in %)	1.07	11.12	0.00	2.05	0.30	1.76***
ΔT_{ij} (in %)	0.51	11.34	0.00	1.05	0.09	0.96***
t_{ij} (in %)	0.85	4.41	0.00	1.12	0.63	0.49***
t_{ic} (in %)	3.30	12.94	0.00	5.15	1.85	3.30***
t_{jc} (in %)	10.11	14.88	7.50	6.44	13.00	-6.56***
τ_{ij} (in %)	6.25	3.62	5.69	6.07	6.38	-0.31***
τ_{ic} (in %)	5.52	5.11	5.29	5.86	5.25	0.61***
τ_{jc} (in %)	6.34	3.50	5.77	6.30	6.37	-0.07***
Year of Entry into Force	1,994.10	15.40	2,001.00			
GSP [0,1]	0.56	0.50	1.00			
New Agreement [0,1]	0.16	0.37	0.00			

Note: The number of observations equals 117,509,125. The tariff data stem from WITS, the trade costs are based on own calculations using data from Schott (2008) and CEPII, the year of entry into force of the trade agreements is based on own research, while the information on the presence of PTAs is from Dür et al. (2014) and Baier et al. (2014).

[24] One potential explanation for this pattern is that the US is actually an outlier in that it pays much less for transportation than other countries (Hummels 2007). Therefore, we expect the estimated transportation costs to understate the observed ones, which—as explained above—will work against us.

[25] We do so after determining the 20 most important third country exporters.

Our analysis builds on the DESTA database provided by Dür et al. (2014).[26] It comprises over 600 regional trade agreements (FTAs and CUs) and the corresponding accessions and withdrawals.[27] In 2014, the probability of a country-pair having an FTA equals 40%, while it equals 6% for having a CU.[28] For the unilateral arrangements (GSP), we use Baier et al. (2014) and update the data to 2014 ourselves. In our analysis we distinguish FTAs by their vintage. All FTAs that entered into force after 2008 are considered to be new FTAs, all others belong to the group of old ones. 16% of FTAs in the sample are thus classified as 'new' ones.

Table 2.1 provides summary statistics. It shows that, for 2014 the average simple measure for the scope for trade deflection between country pairs is 1.07%, the average of the transportation-cost augmented measure is 0.51%. Comparing FTAs and GSPs we can see that in GSPs the scope for trade deflection is much lower than in FTAs. We will analyze this finding in more detail below.

2.4 The Scope for Trade Deflection

This section presents new evidence on the scope for trade deflection across different country pairs and heterogeneity across types of FTAs, regions, and industry sectors. We show cross-sectional data at the 6 digit product-level for 2014.

2.4.1 Limited Potential for Trade Deflection

To draw cumulative distribution functions (C.D.F.s), we refer to our measures (2.3) and (2.5). We start by ignoring transportation costs; see Panel (a) of Figure 2.2 (solid line). In 2014, without accounting for transportation costs, for 83% of all country-pair$\times$product$\times$third-country combinations, trade deflection cannot be profitable. This number refers to the 20 most important exporting countries c, which cover almost all trade. Panel (b) allows for transportation costs and finds that for 93% of all cases trade deflection cannot be profitable. In 10% $(93\% - 83\% = 10\%)$ of all cases, there is tariff savings but it does not exceed the additionally arising transportation costs.

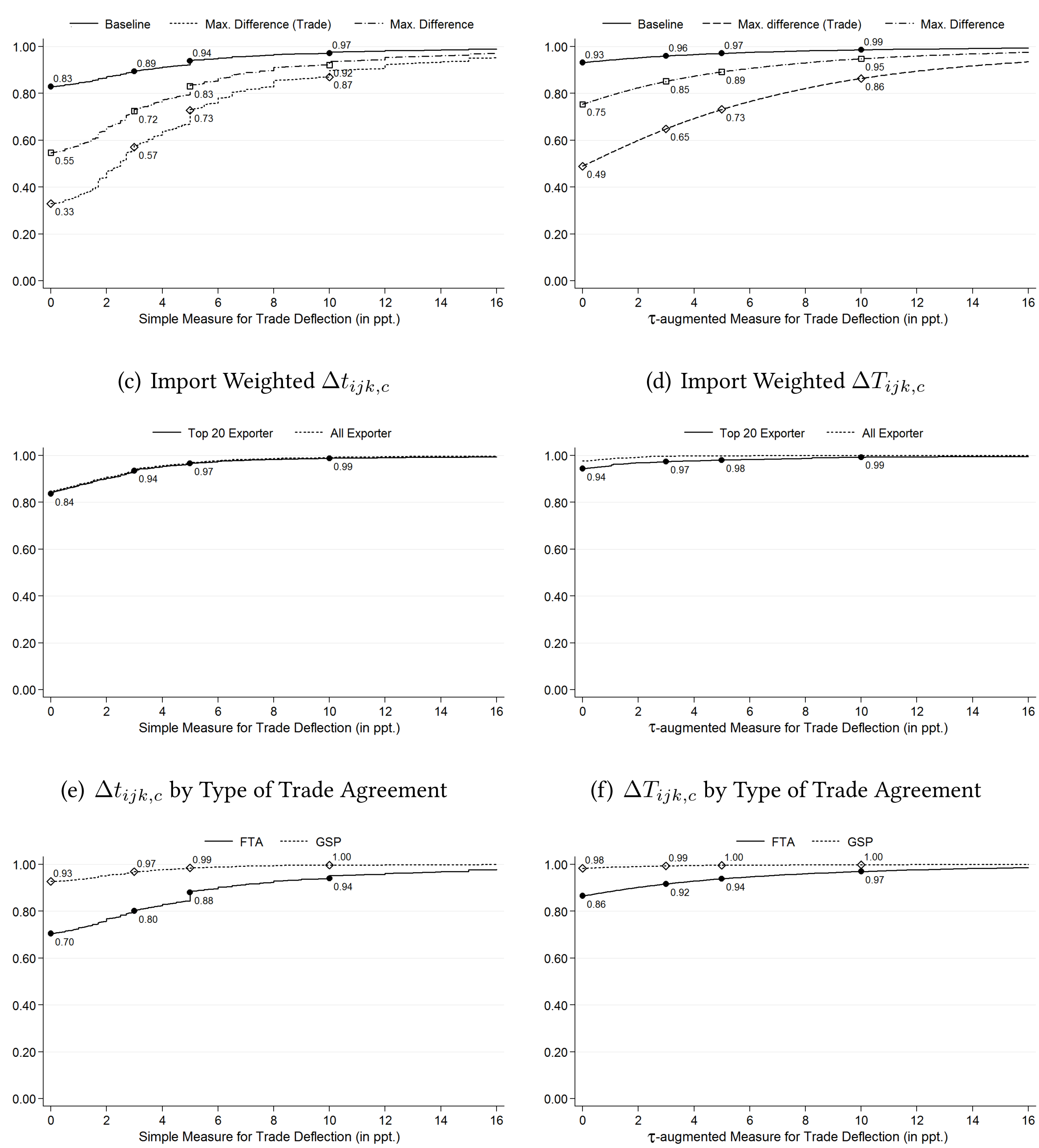
Out of these 83%, in 18% trade deflection is unprofitable because country i and j impose the same tariff against the third-country c. In 63% of all cases trade deflection is unprofitable

[26] We use the version of 27th of June 2016. https://www.designoftradeagreements.org/

[27] The database keeps track of regional trade agreements that are superseded by more recent – and typically more ambitious – versions, such as the Canada-US FTA (signed in 1998) by NAFTA (in 1994), or the Europe Agreements of Middle and Eastern European countries by full EU membership.

[28] One shortcoming of the DESTA data is that they do not include information on whether the agreement is still in place. This problem is especially pronounced for CUs. Therefore, we cross-check the DESTA data with the regional trade agreement dataset provided by Baier et al. (2014) and use their data to determine whether a CU is in place.

Figure 2.2: C.D.F.s of the Potentials for Trade Deflection, 2014



(a) Simple Measures $\Delta t_{ijk,c}$ and $\Delta t_{ijk}^{\max}$

(b) τ-augmented Measures $\Delta T_{ijk,c}$ and $\Delta T_{ijk}^{\max}$

(c) Import Weighted $\Delta t_{ijk,c}$

(d) Import Weighted $\Delta T_{ijk,c}$

(e) $\Delta t_{ijk,c}$ by Type of Trade Agreement

(f) $\Delta T_{ijk,c}$ by Type of Trade Agreement

Note: $\Delta t_{ijk,c}$, $\Delta t_{ijk}^{\max}$, $\Delta T_{ijk,c}$ and $\Delta T_{ijk}^{\max}$ are defined in Section 2.2.2. All graphs are truncated to values $\leq$ 16. All results are based on our baseline sample with the 20 most important third countries c that export product k to i. In Panel (c) and (d) we add the results for the full sample. In Panel (e) and (f) we differentiate between bilateral FTAs and GSPs.

because country j's tariff t_{jck} is higher than country i's t_{ick}. In the remaining 2% the preferential tariff that i grants j is not low enough to make trade deflection profitable, although $t_{ick} > t_{jck}$. This decomposition is summarized in Table 2.2, column (1).

Table 2.2: Decomposing the Potential for Trade Deflection

	all (1)	**GSP** (2)	**FTA** (3)	**old** (4)	**new** (5)
$\Delta T = 0$	93	98	86	94	88
$\Delta T > \Delta t$	10	6	16	9	17
$\Delta t = 0$	83	93	70	85	71
$t_{ic} < t_{jc}$	63	82	38	66	44
$t_{ic} = t_{jc}$	18	10	29	17	22
$t_{ic} > t_{jc} \| t_{ij} >> 1$	2	1	4	2	4

Note: The table decomposes the scope for trade deflection into the following cases: (i) the tariff savings do not exceed the additionally arising transportation costs ($\Delta T > \Delta t$), (ii) the tariff that country i imposes is lower than the one of country j ($t_{ic} < t_j c$), (iii) the tariffs of i and j are equal ($t_{ic} = t_{jc}$), and (iv) the preferential tariff that i grants j is not low enough to make trade deflection profitable, although $t_{ic} > t_{jc}$. The results are based on our baseline sample with the 20 most important third countries c that export product k to i. All numbers are in % of country-pair$\times$product$\times$third-country combinations.

Panels (c) and (d) in Figure 2.2 show the cumulative share of imports as a function of the two measures for the potential of trade deflection. Besides the results for the baseline sample i.e. restricting the number of third countries to the 20 most important exporting countries c, we also show the import shares when including all exporting countries (dotted line). The two lines are very close to each other indicating that results are unbiased when focusing on the top 20 exporters instead of all exporting third countries c. In 2014, for 84% of global imports no scope for trade deflection between the trade partners exists; for 94% $\Delta t_{ijk,c}$ is no more than 3%-points, and for 97% it amounts to at most 5%-points. When we account for transportation costs, the pattern is even more pronounced: for 94% of world trade trade deflection is unprofitable. So, the largest share of trade takes indeed place within country pairs and products with very little scope for trade deflection.

One drawback of our baseline measure is that we induce some selection bias by focusing only on the potential for trade deflection for only the 20 most important origin countries of imports to country i and disregarding those ic relationships where tariffs are prohibitively high which, in principle, increases incentives for arbitrage. We use $\Delta t_{ijk}^{\max}$ and $\Delta T_{ijk}^{\max}$defined in Section 2.2.2 to address this issue. Over all third countries, the measure selects the one with the largest scope for trade deflection regardless of whether a third country c exports to i. We calculate two versions of the measure: one that, over all third countries, picks the one with the largest scope for trade deflection independent of whether a third country c exports to i or not; and another which disregards all third countries c that do not export to i.

In the graph the curve in the middle corresponds to the trade-weighted measure, the lower dashed line picks over all third countries the one with the largest scope for trade deflection. Necessarily, both lie below the 83% reported above. Very often, tariff differences are zero with most third countries and non-zero for very few; the $\Delta t_{ijk}^{\max}$ picks exactly those cases. In 33% of all cases, maximum tariff differences between two countries relative to any third country are zero. It abstracts from any additional transportation costs or tariffs that might have to be paid when transshipping through this third country c. $\Delta t_{ijk}^{\max}$, therefore, is an extremely conservative measure.

Accounting for transportation costs affects the maximum measure of trade deflection $\Delta t_{ijk}^{\max}$ much more than the baseline measure. As Panel (b) shows, the tariff savings do not exceed the additionally arising transportation costs in 16% of all cases for the $\Delta t_{ijk}^{\max}$ measure that includes all third countries. This finding shows that in many cases where tariff savings are relatively large the additionally arising transportation costs make trade deflection unprofitable: countries with high differences in external tariffs also tend to be far apart geographically.

Even when using the extremely conservative measure $\Delta T_{ijk}^{\max}$, we find that trade deflection is unprofitable in half of all candidate cases. Therefore, we are confident that our baseline results are not simply due to selection bias. More importantly, for all those trade flows that can actually be observed, trade deflection is almost never profitable.

2.4.2 Heterogeneity in the Scope for Trade Deflection

The evidence presented so far documents surprisingly little scope for trade deflection. Now, we want to explore heterogeneity across different dimensions. First, we categorize the types of FTAs into different groups; second, we check for differences across different regions; and third, we show differences across sectors.

Making use of the enabling clause of GATT (Article XVIII) members of the WTO can offer non-reciprocal preferential access to developing countries. Typically the latter keep their MFN tariffs against the developed countries in place to protect their domestic industries against foreign import competition. The main goal of these programs is to foster export-led growth. In 1971 the first program - the General System of Preferences (GSP) - was established. Since then many variants of the program have entered into force. Prominent examples are the "Everything but Arms (EBA)" through which the European Union grants least developed countries tariff-free access for almost all products, and the "African Growth and Opportunity Act (AGOA)", which is the United States' counterpart.

Many critics of the unilateral trade arrangements agree that strict RoOs hinder developing countries from using the preferences and thus decrease the gains from the unilateral trade arrangements (Ornelas 2016). Indeed, in 2014 the preference utilization rates for using the EU's GSP arrangements were extremely low for Iraq (3%), Somalia (5%), Liberia (12%) and

Sierra Leone (16%).[29] For 88% of all Liberian exports the exporting firms decided against filing the necessary paperwork to be granted the preferential tariff and instead were willing to pay the higher MFN tariff. But is there actually any substantial danger of trade deflection in those unilateral preferential trade agreements?

We calculate the cumulative distribution functions (C.D.F.s) of measures of the potential for trade deflection for different trade policy environments such that $P(\Delta t_{ijk,c} \leq c | type_{ij} = 1)$ and $P(\Delta T_{ijk,c} \leq c | type_{ij} = 1)$, with $type_{ij}$ indicating a bilateral FTA or a GSP arrangement. Figures 2.2 (e) and (f) present the findings for $\Delta t_{ijk,c}$ and the transport cost augmented $\Delta T_{ijk,c}$ for 2014. The scope for trade deflection is very low for pairs with a unilateral trade agreement: in 93% of all cases trade deflection is not profitable; when accounting for transportation costs this number increases to 98%.

The reason for this result is straightforward: Typically, country i is a developed country with lower overall levels of tariffs, while country j is a developing country with high tariffs. Therefore, the necessary condition for profitable trade deflection $t_{jck} \leq t_{ick}$ is violated in most cases, making arbitrage unprofitable. Table 2.1 reports the average tariff levels conditional on the type of trade agreement and makes this point explicit. In FTAs, external tariffs are on average relatively similar (5% and 6%); this is different in non-reciprocal preferential trade arrangements (GSPs) (2% and 13%). In fact, the developed countries have much lower tariffs towards third countries than the preference-receiving developing countries. As columns (2) and (3) in Table 2.2 show, the share of identical tariffs for pairs in a bilateral agreement equals 29% and is much higher than for pairs with a unilateral agreement (10%). Also, only in 1% of all cases, the preferential tariffs t_{ij} are not low enough to make trade deflection profitable. So, the main reason for unprofitable arbitrage in unilateral trade agreements is simply the violation of the necessary condition $t_{jck} < t_{ick}$.

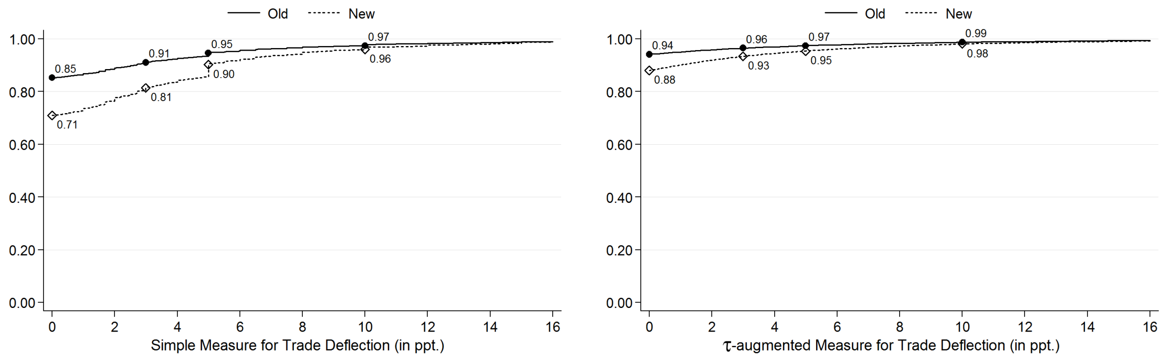
Furthermore, we can differentiate FTAs and GSPs with respect to their vintage. Whenever an agreement entered into force from 2009 onwards it is considered to be 'new'. For the simple measure of the scope for trade deflection we find that for country pairs with an old agreement the profitability of trade deflection is less than for those with a new agreement. The same is true when we account for transportation costs. Now, for pairs with an old agreement, trade deflection is not profitable in 94% of all cases and for pairs with a new one it is unprofitable in 88% of all cases. There are at least two explanations for this pattern. First, many of the GSPs have entered into force before 2009. As explained above those type of agreements tend to have a lower scope for trade deflection and therefore drive down the overall scope for trade deflection for older agreements. Second, more recent deals seem to have more ambitious tariff cuts, making trade deflection more profitable.

[29] We calculate these numbers based on data provided by Eurostat through ComExt. The data can be accessed using the following link: http://epp.eurostat.ec.europa.eu/newxtweb/.

Figure 2.3: Heterogeneity in the Potentials for Trade Deflection across different Trade Agreements, 2014

(a) $\Delta t_{ijk,c}$ by Vintage of Trade Agreement

(b) $\Delta T_{ijk,c}$ by Vintage of Trade Agreement



Note: $\Delta t_{ijk,c}$ and $\Delta T_{ijk,c}$ are defined in Section 2.2.2. All graphs are truncated to values ≤ 16. The results are based on our baseline sample with the 20 most important third countries c that export product k to i. All trade agreements that entered into force after 2008 are considered to be "new" agreements.

Next, we check for heterogeneity across regions and across products. Table 2.3 shows conditional cumulative probabilities for the simple measure $\Delta t_{ijk,c}$ and the transportation cost augmented measure $\Delta T_{ijk,c}$. A number of interesting facts stand out. First, North-South country pairs have significantly less scope for trade deflection than other pairs, with North-North pairs having somewhat lower scope for trade deflection than South-South pairs; see Panel (a) of Table 2.3. In North-South pairs, $\Delta t_{ijk,c}$ is in 87% zero; accounting for transportation costs, in 96% of all cases there is no scope for trade deflection. That number falls to 83%-85% of cases in pairs containing only Northern or only Southern countries. These facts are mostly a reflection of unilateral trade agreements.

Second, transportation costs reduce the profitability of trade deflection for North-North pairs much more than in pairs involving the South. While for the north pairs additionally arising transportation costs exceed the tariff savings in 23% of the cases, for the other pairs this number ranges only between $9\% - 15\%$. The Australia-Canada FTA, the Australia-New Zealand FTA, the Australia-US FTA, USCMA, Canada-EFTA are a few examples of FTAs between north pairs. Third, the difference in the scope for trade deflection between old and new FTAs is largest for South-South countries and it is also prevalent when using the transportation-cost augmented measure.

Figure 2.4 explores heterogeneity across 21 product sectors for the year of 2014. It shows the bottom and top 5% percentiles of our deflection measures and the means by sector. Then we plot the means within each section. Both, for the simple measure $\Delta t_{ijk,c}$ and for the transport cost augmented measure $\Delta T_{ijk,c}$, we observe that the potential for trade deflection varies quite substantially across sectors. The products with the largest scope for trade deflection

Table 2.3: Heterogeneity across Regions and Types of RTAs (2014)

	Simple Measure $\Delta t_{ijk,c}$						**τ-Weighted Measure $\Delta T_{ijk,c}$**					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\bar{c}$:	0	3	6	9	12	max	0	3	6	9	12	max
(a)*Regions*												
North-North	62	76	91	95	97	100	85	93	96	98	99	100
North-South	87	93	97	98	99	100	96	98	99	99	99	100
South-South	68	76	87	91	94	100	83	89	93	95	97	100
(b)*North-North*												
Unilateral	.	.	.	.	.	.	.	.	.	.	.	.
Bilateral	62	76	91	95	97	100	85	93	96	98	99	100
Old FTA	60	76	93	97	99	100	86	94	97	99	99	100
New FTA	67	77	86	92	94	100	83	89	93	95	97	100
(c)*North-South*												
Unilateral	93	97	99	100	100	100	99	99	100	100	100	100
Bilateral	75	85	93	96	97	100	90	95	97	98	99	100
Old FTA	89	94	97	98	99	100	96	98	99	99	99	100
New FTA	77	87	95	98	99	100	92	96	98	99	99	100
(d)*South-South*												
Unilateral	84	91	96	98	99	100	95	98	99	99	100	100
Bilateral	63	72	85	89	93	100	80	86	91	94	96	100
Old FTA	71	78	88	92	95	100	85	90	93	95	97	100
New FTA	57	68	84	89	94	100	78	86	91	94	96	100

Note: The table shows the shares of tariff lines (in %-points) whose measures for trade deflection lie below a certain threshold c. In the different panels, we focus on heterogeneity across regions and types of RTAs and show data on the simple measure $\Delta t_{ijk,c}$ in column (1)-(6), and when accounting for transportation costs $\Delta T_{ijk,c}$ in column (7)-(12). Panel (a) shows the distribution of the measures for potential trade deflection for North-North, North-South, and South-South country pairs. We use the UN definition to determine the development status of a country. Developed countries (North) are Australia, Canada, the member countries of EFTA and the European Union, Japan, New Zealand, and the US. All others belong to the group of developing countries (South). In Panels (b)-(d) we look at the different regional and RTA types simultaneously. We use data for 2014. The results are based on our baseline sample with the 20 most important third countries c that export product k to i.

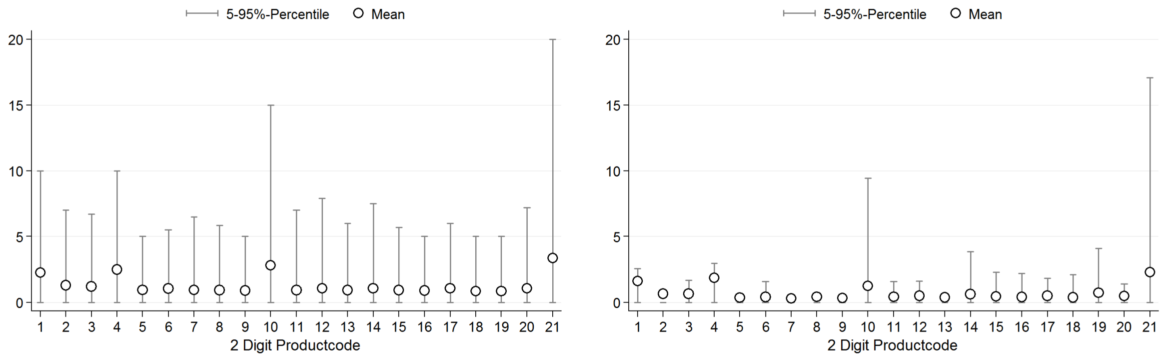
belong to the agricultural sector, pulp and paper, and the sector of works of art. In contrast, for mineral products, wood products, machinery and electrical equipment, and optics $\Delta t_{ijk,c}$ never exceeds 5%-points. Accounting for transportation-costs does not change the general picture.

2.4.3 Sensitivity Analysis

Bound tariffs. To exclude the possibility that countries with "water in the tariff", i.e. higher bound MFN tariffs than applied MFN tariffs, might later change the applied tariffs and make trade deflection profitable, when it was not under the tariffs in our data, we have conducted the analysis described above using bound MFN rates. The picture remains broadly the same. In 79% of all cases, there is no scope for trade deflection even if transportation costs are ignored;

Figure 2.4: Heterogeneity across Sectors, 2014

(a) Simple Measure for Trade Deflection $\Delta t_{ijk,c}$ (b) τ-Weighted Measure for Trade Deflection $\Delta T_{ijk,c}$

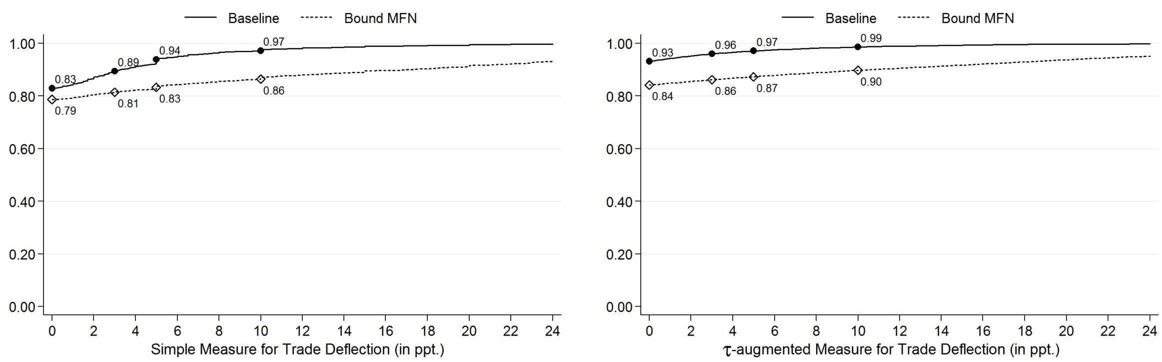


Note: Sectors: 1 *Live Animals* (01-05); 2 *Vegetable Products* (06-14); 3 *Fats and Oils* (15); 4 *Food, Bev. & Tobacco* (16-27); 5 *Mineral Products* (25-27); 6 *Chemicals* (28-38); 7 *Plastics* (39-40); 8 *Leather Goods* (41-43); 9 *Wood Products* (44-46); 10 *Pulp and Paper* (47-49); 11 *Textile and App.* (50-63); 12 *Footwear* (64-67); 13 *Stone and Glass* (68-70); 14 *Jewelery* (71); 15 *Base Metals* (72-83); 16 *Mach. & Elec. Eq.* (84-85); 17 *Transportation Eq.* (87-89); 18 *Optics* (90-92); 19 *Arms & Ammun.* (93); 20 *Misc. Manufactured Articles* (94-96); 21 *Works of Art.* (97-98). Δt_{ijk} and ΔT_{ijk} are defined in Section 2.2.2. We show data for 2014. The results are based on our baseline sample with the 20 most important third countries c that export product k to i.

when the latter are accounted for, the share of product$\times$country pairs where trade deflection is conceivable, shrinks even further; see Figure 2.5. Hence, our analysis and conclusions do not depend on the use of applied tariffs.

Figure 2.5: C.D.F.s of Measures of Scope for Trade Deflection: Bound MFN Tariffs

(a) Simple Measure for Trade Deflection Δt^B_{ijk} (b) $\tau-$Weighted Measure for Trade Deflection ΔT^B_{ijk}



Note: Δt^B_{ijk} and ΔT^B_{ijk} are defined as the baseline measures (see Section 2.2.2) but instead of the applied tariff we use the bound MFN tariff that country i imposes for product k. The results are based on our baseline sample with the 20 most important third countries c that export product k to i and the data are for 2014.

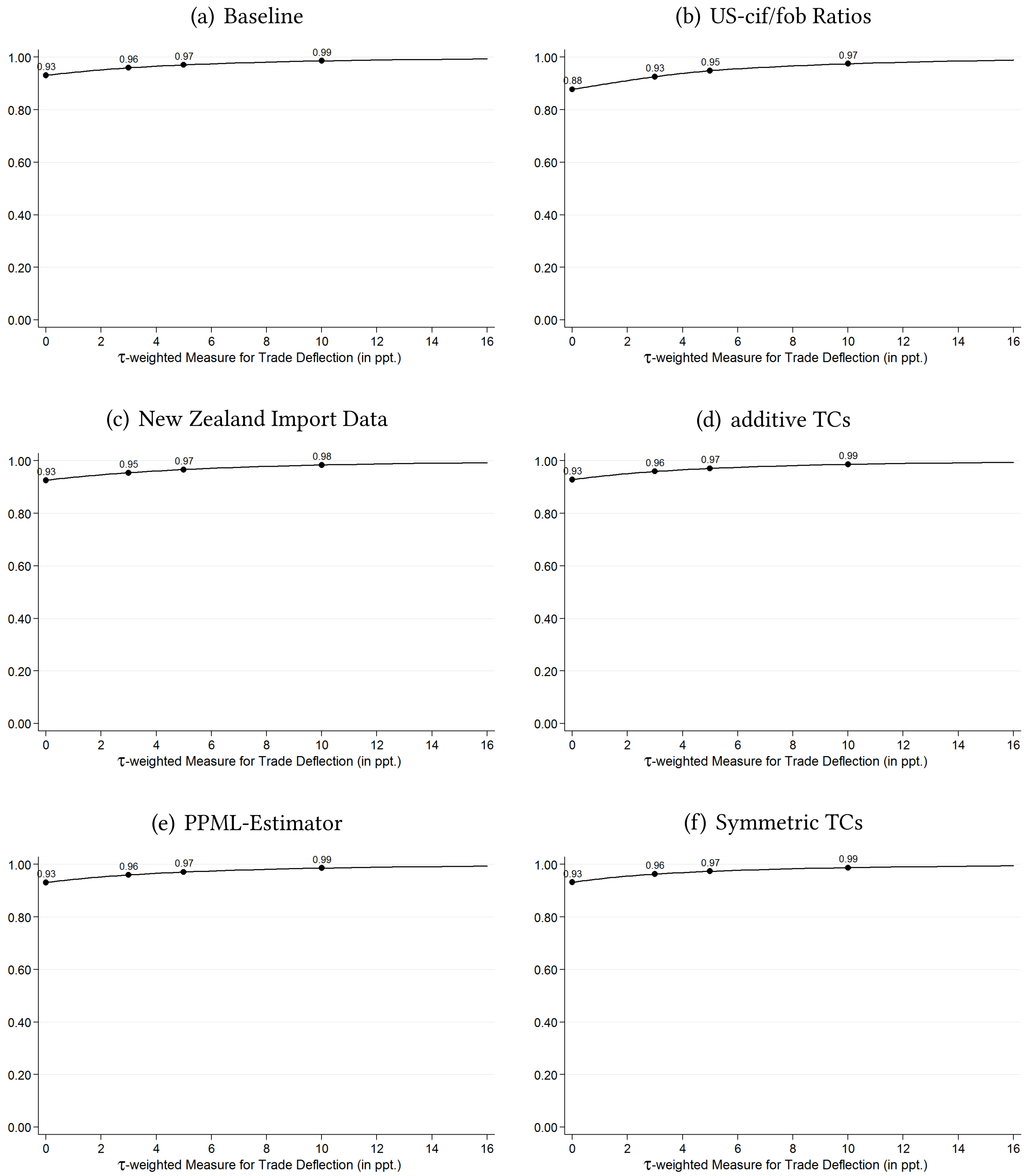
Alternative measures for transportation costs. We have based our estimation of product-level transportation costs on US data and on a very simple econometric model to predict values for other country pairs. Instead of using predicted values, one could simply use the observed US cif/fob ratios, or use data from another country (New Zealand) to proxy transportation cost for our sample. One could also assume that transportation costs are additive rather than multiplicative. Further, instead of using OLS we estimate coefficients using the Poisson-Pseudo-Maximum-Likelihood (PPML) estimator. Finally, we assume symmetric transportation costs, $\tau_{ick} = \tau_{jck}$.

Figure 2.6 shows that our main results are not sensitive to the construction of transportation costs. Proxying transportation costs around the world using observed US values slightly increases the scope for trade deflection, because the US exhibits relatively low transportation costs compared to the rest of the world leading to lower transportation costs than in our baseline.

Due to New Zealand's peculiarities - especially in terms of its size and remoteness - exporting might be systematically more expensive than to other countries, leading to upwards biased transportation costs. Figure B2 in the Appendix shows the in-sample and out-of-sample fit when using imports for New Zealand. If an upwards bias were present, we would expect the predicted values to be higher than the observed ones. Indeed, for the US $\hat{\tau}_{ijk}$ are always higher than the actual ones. Assuming concave transportation costs, i. e. the direct transportation costs are always less than when cross-hauling, overstated transportation costs would lead us to underestimate the potential for trade deflection which, in our context, could lead to wrong conclusions. However, as Panel(c) shows, results do not change much, when using New Zealand data. We prefer using the US data for another practical reason: The US is a much larger importer than New Zealand and imports many more products. Therefore, we can extract many more product-specific transportation costs from these data than from the New Zealand's. Moving to additive transportation costs, symmetric transportation costs as well as using PPML leaves the scope for trade deflection roughly the same as when we use our preferred measure.

Selection Bias. As discussed in Section 2.4.1 the baseline measure for the scope for trade deflection might suffer from selection bias. Focusing on those third countries c that are the most important exporters to country i might focus on those links that have low levels of tariffs and therefore by construction less scope for trade deflection. Using the most conservative measures for the profitability of trade deflection $\Delta t^{\max}_{ijk,c}$ and $\Delta T^{\max}_{ijk,c}$ we can show that trade deflection is not even profitable in these extreme cases. Another way of checking whether selection biases our results is to draw third countries randomly rather than choosing them conditional on their exports to i. Figure 2.7 shows that the baseline results do not change drastically when 20 random third countries are drawn. The scope for trade deflection increases

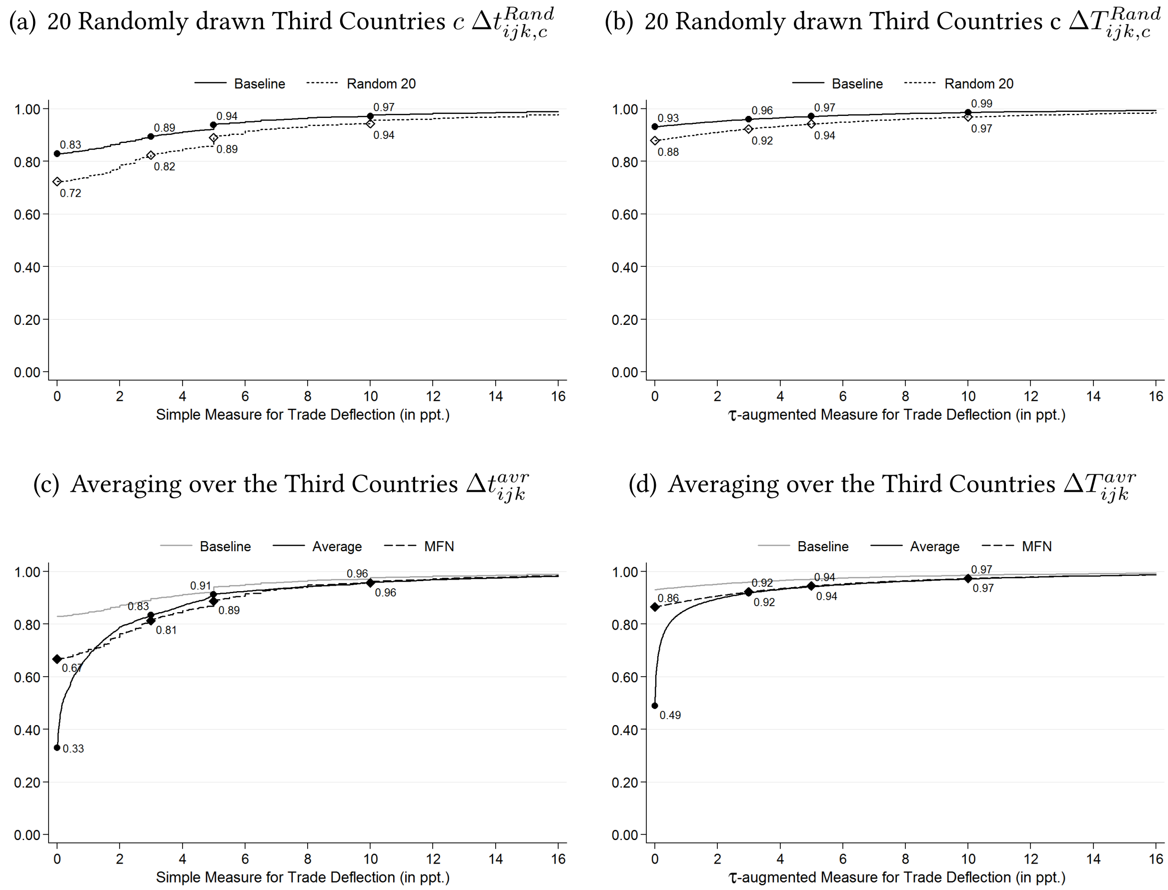
Figure 2.6: C.D.F.s of Measures of Scope for Trade Deflection: Alternative Proxies for Transportation Costs, 2014



Note: $\Delta T_{ijk,c}$ is defined in Section 2.2.2. Panel (a) shows the baseline way of constructing the transportation costs, in Panel (b) we use the import data of New Zealand in order to predict the transportation costs. Panel (c) uses the observed US cif/fob-ratios as a proxy for all other product-pair combinations and in Panel (d) we assume additive instead of iceberg transportation costs. Panel (e) uses the Poisson-pseudo-maximum-likelihood (PPML) estimator instead of OLS and in Panel (f) we assume that the transportation costs between i and c and j and c respectively are the same ($\tau_{ick} = \tau_{ick}$). The data are for 2014. The results are based on our baseline sample with the 20 most important third countries c that export product k to i.

a bit (from 17%$(=100-83)$ in the baseline to 28%) but the general picture remains the same. Taking these pieces of evidence together we are quite confident that our results are not biased due to selection.

Figure 2.7: C.D.F.s of Measures of Scope for Trade Deflection: Alternatives of Dealing with the Third-Country Dimension



Note: $\Delta t^{Rand}_{ijk,c}$ and $\Delta T^{Rand}_{ijk,c}$ are defined as the baseline measures (see Section 2.2.2) but instead of restricting the number of third countries c by only keeping the 20 most-important exporters we now draw 20 third countries randomly. In Panel (c) and (d) we show Δt^{avr}_{ijk} and ΔT^{avr}_{ijk}, which are defined in Section 2.2.2. Additionally, we show in Δt^{MFN}_{ijk} and ΔT^{MFN}_{ijk}, which are defined exactly as the baseline measures (see Section 2.2.2) but instead of the applied tariff we use the applied MFN tariff that country i imposes for product k.

Averaging over Third Country Dimension. Finally, to deal with the dimensionality problem we can also average over the third country dimension, i.e. $\Delta T^{avr}_{ijk} = \frac{1}{N-2}\sum_{c\neq i,j}\Delta t_{ijk,c}$, and for Δt^{avr}_{ijk} analogously. Figure 2.7 Panels (c) and (d) show the C.D.F.s of this measure of the scope for trade deflection. A couple of interesting facts stand out: First, the overall picture remains the same. Also when using this variant of the measure for trade deflection, it is in most of the cases unprofitable. Second, the share of product-pair combinations for which Δt^{avg}_{ijk} and ΔT^{avg}_{ijk} are equal to zero corresponds to the one of $\Delta t^{\max}_{ijk}$ and $\Delta T^{\max}_{ijk}$ that we introduced in section 2.2.2, 33% for the simple measure and 49% for the transportation cost augmented measure, respectively. However, with increasing scope for trade deflection the average scope for trade deflection converges to the measure of trade deflection when using MFN tariffs, the dashed line in the graph. The explanation for this pattern is straightforward: The number of RTAs is relatively low compared to the number of pairs where the MFN tariff is still applicable. Therefore, when averaging over all third countries c, those few preferential tariffs have very little weight, resulting in a measure that is similar to the one when only using MFN tariffs. The disadvantage is that one could understate the real potential for trade deflection as preferential tariffs might make trade deflection profitable. Our baseline measure does not have this bias and is therefore superior.

Aggregation Bias. We conduct our analysis on the 6-digit level. However, tariffs are often defined at a much finer level, i.e. the 8-, 10- or even 12-digit level. At such a disaggregated level, data coverage is very low, and nomenclature is not harmonized so that we cannot compare across countries. Nevertheless, it could be possible that, although on the 6-digit level countries' potential for trade deflection is very limited, this is not true for the more disaggregated products within 6-digit categories. The original tariff data provided by the IDB report the standard deviation of tariffs within 6-digit product categories. Scope for greater trade deflection than we estimate only exists when the standard deviation of tariffs within 6-digit product categories is larger than zero in a country-pair ij. In 2014 this is only the case in 1.36% of the product-pair combinations, indicating that aggregation bias most likely does not bias our results.

2.5 Policy Conclusion

Economists have long been skeptical of free trade agreements (FTAs) and have preferred customs unions (CUs). Rules of origin (RoOs) make sure that members of FTAs can in effect set independent trade policies with respect to third parties. Otherwise, in the absence of transportation costs, due to trade deflection, the member with the lowest external tariff would de-facto determine the common one. The problem is that RoOs involve burdensome red tape and that they distort supply chains.

Our empirical exercise shows that, in practice, the scope for trade deflection is generally low in FTAs. The reason is that countries set relatively similar external tariffs, and tariffs are low on average. Where tariffs against third parties differ, transportation costs further reduce the profitability of trade deflection. Trade deflection is almost never profitable in non-reciprocal preferential trade arrangements (GSPs) where high MFN tariffs and a lack of ambitious FTAs of beneficiary countries mute arbitrage possibilities.

Across all country pairs in regional trade agreements (FTAs or GSPs), according to our estimates, trade deflection is profitable only in 7% of country-pair×product×third-country combinations considered. That share is 2% in GSPs and 14% in FTAs. Within FTAs, differences in external tariffs allow for profitable trade deflection in 30% of all cases, but in more than half of these candidate configurations trade costs are too high to make arbitrage deals worthwhile.

In 'new' trade agreements, the likelihood for profitable trade deflection is somewhat larger than in 'old' ones, reflecting more ambitious tariff cuts in more recent deals. Interestingly, North-South FTAs are less prone to trade deflection than North-North ones as higher geographical distance drives up transportation costs in the former constellation. In North-South non-reciprocal agreements, trade deflection is worthwhile only in 1% of all cases considered, while in South-South GSPs that share is five times as high.

These findings are robust to alternative ways of dealing with the third-country dimension and to definitions of transportation costs. They are unlikely to be driven by aggregation bias, and they are not driven by our specific sample. It follows that RoOs can rarely be justified by the objective of avoiding trade deflection.

Nonetheless, even in modern trade agreements such as the EU-Canada agreement (CETA) hundreds of pages are devoted to defining complicated RoOs. Exporters regularly complain about their complexity and the cost of compliance. They are cited as the most important reason why preference utilization rates are often below 100% (Keck and Lendle 2012). Moreover, RoOs distort input choices. Hence, to some extent, the fact that all FTAs unconditionally require proof of origin to grant preferential access is a sign of a protectionist bias in FTAs.

Our analysis suggests a fundamental re-thinking of the use of RoOs in FTAs and GSPs, as one could substantially relax the requirements to prove the origin of goods in many trade agreements without risking any trade deflection. More specifically, we suggest that, in new FTAs, negotiators should agree on a full set of simple RoOs for all products, but that the requirement to prove origin should be activated only if external tariffs of FTA members differ by some minimum amount. This threshold could be product-specific in order to reflect different transportation costs and actual tariffs should be periodically evaluated against it, since applied tariffs may change over time. In GSPs, RoOs should be activated only for those products where the beneficiary country undercuts the MFN tariffs of the preference granting country.

In this paper, we have focused on the role of RoOs in the context of preferential tariffs. However, RoOs also matter in determining whether a product is subject to a bilateral mutual recognition agreement. Complex rules could lead to firms not using such provisions, thus wasting resources. In contrast to the case of tariffs, with product standards, whether RoOs are in fact necessary is not easily checked.

Clearly, besides the efficiency gains stressed in this paper, relaxing the requirement to prove origin would have distributional effects.[30] First, RoOs make sure that goods shipped from a third country through one FTA party to the other generate tariff revenue in both FTA members. Without RoOs, such transactions generate income only for the FTA member through whom the product first enters, the final destination country loses out. To deal with such configurations some tariff sharing agreement would be needed. Second, when one FTA member aligns a higher tariff downwards to its partner's level, so that RoOs are no longer applicable according to our proposal, it deprives the partner of tariff income. In our context, this is welcome from a global efficiency point of view, but such a move has obvious distributional consequences. Finally, RoOs can effectively sustain market segmentation by increasing transaction costs. Thus, abolishing them typically lowers producer surplus while consumer surplus can rise (but need not if the producer stops serving the market).

Also, it should be noted that, in complex bargaining situations, RoOs could actually be necessary to facilitate tariff concessions in the first place, since they may help deal with conflicts of interest between final and intermediate input producers within countries. We leave it to future research to develop a better understanding of the political economy of RoOs.

While we do not want to appear naive as to the real-world chances of seeing our proposal through, making the proof of origin conditional on actual tariff differences would go some way toward disentangling Bhagwati's spaghetti bowl. It could also help dealing with the exit of countries from long established CUs, such as Britain's from the EU.

[30] We thank James Lake and Maurizio Zanardi for pointing this out to us.

Chapter 3

On the Effects of Nonreciprocal Trade Arrangements on Firms: Evidence from Peru

3.1 Introduction

The GATT/WTO agreements contain *special and differential treatment* for developing countries. It gives developing countries the right to deviate from the defining principle of the GATT/WTO, i.e., no discrimination across trading partners—the so-called most-favored-nation (MFN) principle. Nonreciprocal trade arrangements are one cornerstone of the special and differential treatment of developing countries. Under these arrangements high income countries grant developing countries preferential market access conditional on them implementing reforms like complying with international labor standards or enforcement of intellectual property rights. The main idea of these trade arrangements is to use trade for aid: lower trade costs increase trade, which helps to alleviate poverty in developing countries and creates jobs.

Nonreciprocal trade arrangements have had a longstanding tradition in the world's trading system with the General System of Preferences (GSPs) being implemented in 1971. Since then, many other programs like Everything but Arms (EBA) or the African Growth and Opportunity Act (AGOA) have become effective.[1] Virtually all high income countries have at least one nonreciprocal trade arrangement. Many differentiate by income and offer least devel-

[1] See Ornelas (2016) for an excellent overview of special and differential treatment for developing countries in general, and its history in particular.

oped countries (LDCs) more generous preferences. Recently some developing countries (for example China, India and Russia) also started to offer preferential market access to LDCs.[2]

So far, it is still unclear if the nonreciprocal trade preferences have in fact a trade promoting effect and if so, along which margins they operate. The literature finds conflicting evidence depending on the specific trade arrangement, the level of aggregation, and the period of observation. Furthermore, it is difficult to find causal effects because the products that become eligible for preferences might be chosen endogenously. Donor countries can choose the set of products, eligible for preferential treatment. Hence, the probability of a product becoming eligible for nonreciprocal preferences might correlate with the comparative advantage of the beneficiary country for the respective good. Lastly, so far, no evidence exists on how receiving nonreciprocal preferences affect firms' export-performance.

This paper studies how the expansion of the Andean Trade Preference Act in 2002—a program that improves access to the American market for firms from Bolivia, Colombia, Ecuador and Peru— affected Peruvian firm-level exports to the United States. I use nonreciprocal preferences granted by the United States to sub-Saharan countries under the African Growth and Opportunity Act (AGOA), as an instrument for the set of eligible products in the Peruvian context to address endogeneity. Then, I make use of the disaggregated nature of the export data to account for omitted variables by employing a triple difference-in-differences approach. I compare the export growth of the same firm to the same destination across products. Hence products eligible for preferences and those that are not. One objective of nonreciprocal arrangements is to generate positive spillover effects: by facilitating trade to the donor country, firms can learn important skills that they can then use to also serve other markets. I explicitly account for third country effects to identify such a mechanism.

I find that firms increase exports of eligible products to the United States relative to ineligible products on average by 25%. However, this increase goes in line with a strong trade diversion effect, i.e. a shift of exports away from third countries towards the United States resulting in a net increase of 5%. Most interestingly the results on the intensive margin are almost entirely driven by exporters that rearrange export destinations after facing fiercer competition in the European Union due to the eastern enlargement. The extensive margin is not driven by this event. While an increase in the probability of exporting eligible products relative to ineligible products can be observed for the United States, nonreciprocal preferences do not affect the probability of exporting to third countries. The results hold when controlling for the phasing-out of the Multifiber Arrangement.

[2] A complete list of all nonreciprocal trade arrangements currently in place can be retrieved through the WTO's Preferential Trade Arrangements database: http://ptadb.wto.org/ptaList.aspx.

I also contribute to the literature on rules of origin (RoOs). Nonreciprocal arrangements require RoOs that define under which conditions a good is said to originate from the beneficary country so that it can benefit from the preferential tariff.[3] Compliance with these rules is costly. The costs of RoOs can be categorized into direct costs reducing exports from Peru to the U.S. and indirect costs that affect trade flows of third countries to Peru. Direct costs result from red tape, for example, the fee exporters have to pay for the certificate of origin or building up legal know-how. Instead, indirect costs arise due to changes in the global supply chains to comply with the RoOs. The Peruvian context allows to test if the latter played a role for the effects of nonreciprocal trade preferences: firms with a pre-sourcing structure that is compliant with the rules of origin of the Andean Trade Preference Act should benefit more than those that have to readjust supply chains. I do not find evidence that sourcing matters. This finding is relevant because it helps us to better understand the nature of the costs of RoOs.

The existing empirical literature on the effect of nonreciprocal preferences on exports is inconclusive. Its results depend crucially on the level of aggregation, the sample definition, the empirical method and the concrete nonreciprocal arrangements that is being analyzed. Rose (2004) was the first to "accidentally" estimate the effect of nonreciprocal preferences under the GSP on trade flows: his work tries to shed light on the the effect of the WTO on trade but he includes a control for GSP-status and finds that it raises trade by over 100%. Subramanian and Wei (2007), X. Liu (2009), Chang and Lee (2011), and Tomz et al. (2007) confirm this result. In contrast, Herz and Wagner (2011) find a positive short-run effect of GSP on exports that turns negative in the long-run. None of these papers properly control—simultaneously—for multilateral resistance and time-invariant country-pair heterogeneity, which is crucial for the identification of causal effects as we know from the structural gravity literature (Head and Mayer 2014; Piermartini and Yotov 2016).

Both Eicher and Henn (2011) and Gil-Pareja et al. (2014) use state-of-the-art methods from the gravity literature and control for multilateral resistance and time-invariant country-pair heterogeneity by including importer-time, exporter-time and pair fixed effects. However, their results are still ambiguous: Eicher and Henn (2011) find significantly negative effects, while Gil-Pareja et al. (2014) find significantly positive results.

Why are the results at the aggregated level so unstable? First, aggregation leads to downward biased results because nonreciprocal agreements usually exclude products. Second, the measure of the availability of nonreciprocal arrangements is very noisy (see Ornelas and Ritel (2019) for a discussion of the issues concerning the data). Third, heterogeneity in the treatment effect plays a major role: Gil-Pareja et al. (2014) are the first to estimate the effect of

[3] In fact, RoOs also apply to free trade agreements.

all nonreciprocal trade arrangements separately—not just the GSP-effect as previous work has done—and find large heterogeneity across arrangements. While the average treatment effect is positive, they find for some arrangements large and significantly negative effects. Ornelas and Ritel (2019) show even more nuanced results: nonreciprocal trade arrangements have strong effects on the exports of beneficiaries when they are members of the WTO and very poor. Not-so-poor beneficiaries also expand foreign sales, but only if they are not WTO members, for all others, the average export effects of nonreciprocal trade arrangements are mute.

There is a still relatively small literature that estimates the trade effects of specific nonreciprocal trade preferences using product-level bilateral trade data. Frazer and Van Biesebroeck (2010) and Fernandes et al. (2019) study the African Growth and Opportunity Act (AGOA) and find positive effects. Thelle et al. (2015) and Gnutzmann and Gnutzmann-Mkrtchyan (2017) confirm these results for European nonreciprocal trade arrangements, Hakobyan (2017, 2020) for the U.S. GSP program. Typically, these studies exploit the richness of their data and employ a triple difference-in-differences (DiD) to identify effects: they compare export growth across products (eligible vs. ineligible products, first difference), across destinations (nonreciprocal preferences applicable or not, second difference), and over time (pre vs. post period, third difference). Using these finer level of aggregation and the more sophisticated identification strategy seems to yield stable and positive effects.

However, the literature so far has focused on the large programs of the European Union and the United States. From Gil-Pareja et al. (2014) we know that there is large heterogeneity across programs making it far from obvious that the above mentioned positive effects also translate to other settings. Although the triple DiD accounts for many unobservables, it does not address endogeneity of nonreciprocal trade preferences. Hence, it does not account for the fact that donor countries choose the set of products that becomes eligible for preferential treatment potentially correlating with omitted variables. Therefore, it is hard to claim causality.

To the best of my knowledge, there is only one other paper that looks at nonreciprocal preferences on firm outcomes. Albornoz et al. (2020) study the American GSP exploiting a partial suspension of Argentina's preferences starting in 1997. As they look at a suspension of preferences, other effects than just removing the preferential market access like trade policy uncertainty might play a big role. Thus, my findings contribute to the literature of nonreciprocal arrangements on firms' export behavior. Further, I contribute methodologically by combining an IV with a triple difference-in-differences approach to isolate a causal effect. The instrument, I propose, could be used in other settings, too. I am also the first to show that competition effects might be important for the effectiveness of nonreciprocal preferences. Lastly, I am the first to analyze the effects of the Andean Trade and Preference Act.

The remainder of the paper is organized as follows. I first give some background information on the Andean Trade and Preference Act, the nonreciprocal arrangement used for identification, and I briefly present the data. Section 3.3 discusses the empirical strategy. The main results including robustness checks, and heterogeneity analyses are presented in Section 3.4. Section 3.5 concludes.

3.2 Background and the Data

This section focuses on the trade policy environment that Peruvian firms face when exporting to the United States. First, I review the United States' trade policy vis-à-vis Peru with a particular focus on the Andean Trade Preference Act, the nonreciprocal trade arrangement under which Peru and three other Andean countries were granted preferential access from the early 1990's onwards. Then I will present the data used in the analysis.

3.2.1 The Andean Trade Preference Act

Peruvian firms have had preferential access to the U.S. market for a long time. Authorized by the Trade Act of 1974, the U.S. Generalized System of Preferences (GSP) came into effect on January 1, 1976 and granted preferential duty-free treatment for over 3,500 products to Peru as well as a wide range of other designated beneficiary countries (USITC 2019). The program was designed to promote economic growth in the developing world through facilitating trade. In addition, the Andean Trade Preference Act (ATPA), concluded at the end of 1991 under the George H. W. Bush administration, authorizes the President to grant unilateral preferential trade benefits to Bolivia, Columbia, Ecuador, and Peru for eligible products. The President proclaimed preferential duty treatment for Bolivia and Colombia on July 2, 1992, for Ecuador on April 13, 1993, and for Peru on August 11, 1993.

All of the four ATPA beneficiaries are also GSP beneficiaries and many products can enter the United States duty free under either program. The main advantage of the ATPA compared to the GSP is a broader product coverage and more lenient rules of origin (Okun et al. 2004). Rules of origin (RoOs) determine the national origin of a product: only when an exporter can prove that the bulk of the production took place domestically the good can enter under the respective trade agreement. Both programs require 35% of the product value to be sourced domestically. However they differ substantially in the definition of "domestically": while under GSP the inputs have to be entirely from the beneficiary countries, under ATPA also inputs from all four ATPA countries, the United States and 24 Caribbean countries qualify.[4]According to Okun et al. (2004), the more lenient RoOs led to a shift away from using GSP to using ATPA.

[4] The Caribbean countries are Antigua, Aruba, Bahamas, Barbados, Belize, British, Virgin Islands, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica,

The ATPA was part of the U.S. administration's *war on drugs*: its objective was to foster economic development in the Andean countries outside the drug business. Similar to other nonreciprocal trade arrangements, in the ATPA the beneficiary status is conditional on taking measures to comply with internationally recognized worker rights and to provide effective protection of intellectual property rights. In addition, beneficiary countries have to meet the criteria for U.S. narcotics cooperation certification in order to be eligible for ATPA preferences. Bolivia's removal from the agreement in 2008 due to failure to cooperate in counternarcotics efforts illustrates that the U.S. administration took the main objectives seriously: the ATPA was implemented to help to reduce drug protection and trafficking using trade liberalization as a tool.

Table 3.1: Timeline of U.S. Trade Policy vis-à-vis Peru

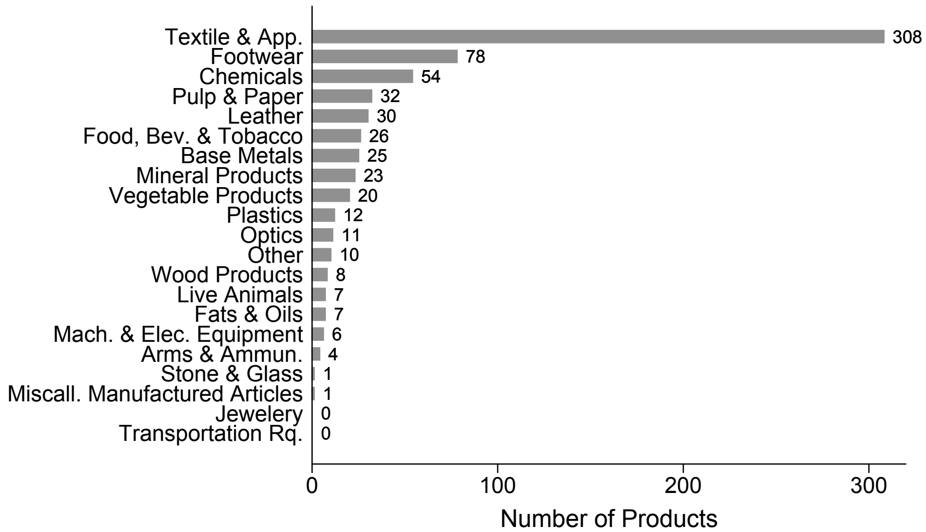
Jan 1976	GSP comes into effect, Peru is a beneficiary country
Dec 1991	ATPA enacted (Bolivia, Colombia, Ecuador, and Peru)
Aug 1993	ATPA enters into force for Peru
Dec 2001	ATPA expires
Jan-July 2002	ATPA not in effect → MFN duties
Aug-Oct 2002	ATPA temporarily renewed
Nov 2002	**ATPDEA is implemented (more than 600 additional products are now eligible)**
November 2008	Bolivia is suspended for failure to cooperate with the US on counternarcotics efforts
Feb 2009	US-Peru TPA enters into force
May 2012	US-Colombia TPA enters into force
June 2013	Ecuador unilaterally renounces ATPDEA preferences

The original ATPA expired after ten years in December 2001 and was not in effect thereafter until July 2002. The suspension of the preferences was very much unexpected as the extension of the ATPA program had already passed the House of Representatives early December but the U.S. Senate did not vote to pass the bill. During the months of suspension exporters had to pay MFN duties. Duties paid on such articles were eligible for refund after the ATPA became operative again; however, the relatively long time period imposed serious cash flow burdens for some firms resulting in lower exports. U.S. imports from ATPA countries decreased by 13% during January and July 2002 compared to the same period of the previous year, stressing the importance of the preferential access to the US market for exporters from the ATPA countries. During August and October 2002 the original ATPA was back in place resulting in a quick recovery of the export volumes of ATPA countries.

Montserrat, Netherlands Antilles, Nicaragua, Panama, St Kitts-Nevis, St. Lucia, St Vincent and Grenadines, and Trinidad and Tobago.

On October 31, 2002, the program was renewed as the Andean Trade Promotion and Drug Eradication Act (ATPDEA). The new program expanded the number of eligible tariff lines by more than 600 products. Figure 3.1 shows how the newly eligible products are distributed across sections. The number of eligible products varies quite a lot across sections. While almost half of all treated products belong to the section Textile & Apparel, none or very few belong to the sectors Arms & Ammunition, Miscellaneous Manufactured Articles, Stone & Glass, Transportation and Jewelery. Other sections with numerous treated products are Footwear and Chemicals with 78 and 54 treated products respectively. The remaining sections range somewhat in between.

Figure 3.1: Number of Eligible Products (8-Digit) across Sections



Note: The figure shows the number of products that became newly eligible with the amendment of the ATPA in 2002 across different sections. Details on the sources can be found in the main text.

Although it was known that the United States planned to extend the product scope in the ATPDEA with respect to its preceding nonreciprocal preference program, it was unclear which exact products would be included. Furthermore, resistance in the U.S. Senate made it uncertain if the planned extension of the preferences to include also textiles would actually take place. Hence, from the perspective of an Peruvian exporter it was far from obvious if and which products would become eligible for preferences. To evaluate how nonreciprocal trade agreements affect firms, I leverage the change in the ATPA in November 2002 when more than 600 products became newly eligible. Following the approach by Frazer and Van Biesebroeck (2010), I compare these to products that were already eligible for preferential treatment before, either under GSP or the original ATPA.

What happened after the period of uncertainty of 2002? The ATPDEA was signed for five years and got renewed multiple times. However, the Andean countries successfully pushed for a more permanent solution: in spring 2004 the United States initiated free trade agreement negotiations with Colombia, Ecuador, and Peru, with Bolivia participating as an observer. For Peru and Colombia the ATPDEA preferences were replaced by free trade agreements (FTAs), which were implemented in 2009 and 2012, respectively. In July 2013 Ecuador unilaterally renounced ATPDEA trade preferences and in July of the same year the President's authority to provide duty-free treatment under ATPDEA expired. As already mentioned above, Bolivia got suspended in 2008, thus currently the ATPDEA is not in effect anymore (cf. Williamson et al. (2016) for a detailed time line of the events).

3.2.2 Data

To evaluate how nonreciprocal trade agreements affect firms I use two data sets: information about the eligibility for nonreciprocal preferences and customs data for Peruvian firms.

Peruvian exporters faced three different tariff regimes: GSP, ATPA/ATPDEA, and MFN. There are three distinct groups or products: i) no preferential tariff applies, i.e. the product is subject to MFN tariffs for the whole period of observation, ii) eligible for preferential treatment under GSP or ATPA preferences, duty-free access for the whole period of observation, and iii) only eligible for ATPDEA, i.e. preferential status changes. I define groups such that eligibility under ATPA and ATPDEA is mutually exclusive because ATPDEA comprises only those products that become eligible in 2002.[5]

The U.S. International Trade Commission (USITC) provides information on tariffs on the 8-digit level for all trade relationships of the United States for chapters 1 to 97 of the HTS.[6] Using this database I identify which 8-digit products are eligible for GSP and ATPA. Furthermore, approximately 250 8-digit products that became eligible for nonreciprocal preferences under ATPDEA can also be found in these yearly tariff lists.

For ATPDEA the provisions for textiles and some other sensitive goods like tuna are specified under chapter 98, subchapter XXI. This subchapter indicates other chapter 1 to 97 8-digit products that are eligible when the exporter complies with stricter rules of origin that are outlined in this subchapter. To figure out which 8-digit products become eligible for ATPDEA due to these special provisions I use tariff preference utilization rates. They stem from US-import data originally provided by the US Census and cleaned by Schott (2008). Whenever the preference utilization rate for a 8-digit product is greater than zero, the product is considered

[5] This is technically not correct: in November 2002 the ATPA was amended and entered as ATPDEA into force. Thus, all products, also those that were already eligible before 2002, are in fact eligible under ATPDEA, not ATPA. However, the sloppy terminology makes is easier to distinguish between the groups, which matters for the empirical analysis.

[6] https://www.usitc.gov/tariff_affairs/tariff_databases.htm

to become eligible for nonreciprocal preferences under the ATPDEA. Together with the 250 products from the USITC tariff lists, I end up with 663 ATPDEA products.

I combine this information with Peruvian customs data from the national customs office (SUNAT). The data have the usual features of customs trade data in that it is possible to create flows of exports by product and destination for all Peruvian exporters. To combine the information on tariff preferences with export data, I have to aggregate up to the HS6-digit level; this is the most disaggregated product-level that is comparable across countries. I follow the method developed by Pierce and Schott (2012) to concorde the different product nomenclatures consistently over time. The sample period includes the years 1997 to 2007.

3.3 Empirical Strategy

This section describes the empirical strategy used to identify the effect of nonreciprocal trade policy on firm-level outcomes. The main identification challenge is to deal with a potentially endogenous change in trade policy: the choice of products that became eligible for preferential treatment under ATPDEA might have not have been exogenous to Peruvian firms. It might have been driven by certain economic developments, i.e., the United States chose exactly those products for which Peru has a comparative advantage or disadvantage. Blanchard and Matschke (2015) show that in the United States, nonreciprocal trade preferences are influenced in part by multinational firms and their FDI decisions: when a multinational owns export-oriented affiliates abroad, the U.S. government has an incentive to improve the market for imports from those foreign affiliates, for the simple reason that greater market access means higher rates of return to the government's MFN constituents resulting in lower tariffs. Also political economy motives could pose a threat to identification if Peruvian firms lobby in the U.S. for preferential market access.

I address this problem with an instrumental variable (IV) approach exploiting the following institutional detail in U.S. trade policy: since October 2000 the African Growth and Opportunity Act (AGOA) allows almost all goods produced in AGOA-eligible countries to enter the U.S. market duty-free. This nonreciprocal trade arrangement has a special focus on textiles, too. Similarly to ATPA, they are activated through chapter 98 and special RoOs apply. In fact, AGOA serves as a blueprint for the textile preferences granted to the Andean countries starting in 2002, making it a relevant instrument. The political process to install AGOA started in 1996, years before the ATPA expired (Africa Policy Information Center 1997).[7] Although the choice of eligible products under AGOA is potentially endogenous with respect to sub-Saharan African countries, as the same arguments apply that are listed above, due to the timing and

[7] The African Growth and Opportunity Act was introduced in 1996 by Representatives Crane, Rangel and McDermott (Africa Policy Information Center 1997).

also scope—it was about sub-Saharan African countries, not Andean—they are orthogonal to Peruvian firms and their economic development.

To identify the list of products that became eligible for nonreciprocal preferences under AGOA, I use again the USITC tariff lists and cross-check it with the information on the eligible products available through the official AGOA website.[8]

One might still be worried that the choice of eligible products correlates with the comparative advantage of the U.S. If the United States' comparative advantage is different between sub-Saharan countries and Andean countries, the IV should account for it. However, if the U.S. choose predominantly products in labor intensive sectors where both sub-Saharan countries and Andean countries might have a comparative advantage, then the IV would be biased. Following Frazer and Van Biesebroeck (2010), I address these concerns with a triple difference-in-differences (DiD) strategy while making use of the firm-level data: I compare export outcomes within the same firm-destination-product variety between treated and untreated products (first difference) for exports to the United States and the rest of the world (RoW) (second difference) before and after the change in the ATPA was in effect (third difference). Furthermore, the triple DiD controls for omitted variables like firm characteristics (for example management skills) and heterogeneity in demand and supply shocks. I estimate the following model:

$$\begin{aligned} x_{fjkt} =& \beta_{RoW} \left(T_k \times Post_t\right) + \beta_{US} \left(T_k \times Post_t \times US_j\right) + \\ & \alpha_1 MFA_{kt} + \alpha_2 \left(MFA_{kt} \times US_d\right) + \lambda_{fjk} + \mu_{jt} + \epsilon_{fjkt}, \end{aligned} \tag{3.1}$$

where x_{fikt} is either the log of firm f's exports in USD of a given product k to destination d (intensive margin, denoted as $ln\left(x_{fjkt}\right)$) or the probability $P\left(X_{ijkt}\right)$ that an exporting firm enters a product-destination market (extensive margin) in year t, for all ATPDEA products T_k is one and zero otherwise, $Post_t$ equals one from 2002 onwards and zero otherwise, and US_d is a dummy taking value one if the destination is the United States. λ_{fjk} and μ_{jt} are firm-destination-product and destination-time fixed effects, aiming to capture all the time invariant heterogeneity in the supply of firms' exports (the former) and all changes in demand (the latter). Errors are clustered on the firm-level. As in Frazer and Van Biesebroeck (2010) I compare products that were already eligible for nonreciprocal preferences to those that became eligible under ATPDEA. Thus, I exclude products that were subject to MFN duties for the whole period.

[8] The website can be accessed here https://agoa.info/about-agoa/products.html.

Furthermore, I control for changes in the Multifiber Arrangement (MFA). The MFA and its successor, the Agreement of Textile and Clothing, regulated the exports of clothing and textile products from developing countries to the Untied States, European Union, Canada, and Turkey (Khandelwal et al. 2013). Within the scope of the Uruguay Round, it was agreed to phase out the quotas over four phases, namely in 1995, 1998, 2002, and 2005 with the biggest bulk being liberalized in 2005 (Brambilla et al. 2010). Hence, the MFA removed bilateral non-tariff-barriers. As Brambilla et al. (2010) show, China was particularly constrained under the regime and as quotas lifted, China's exports grew disproportionately.

This has also important implications for Peruvian exporters as the end of the MFA might lower trade costs and at the same time increase competition in the U.S. market. As the two effects go in opposite directions it is unclear how not accounting for the MFA biases the effect of nonreciprocal preferences. The MFA quotas vary over time and most likely affect firms exporting the ATPDEA products more. These are mostly textile products as well. Hence, it is an omitted variable that I need to control for; MFA_{kt} does so by indicating in which year the MFA lifted the quota for the respective product. I also allow for potential heterogeneity across destinations ($MFA_k \times US_d$). The product-level information on the removal of the MFA is taken from Brambilla et al. (2010).

By differentiating between destinations, I allow firms to be affected differently by the non-reciprocal preferences, conditional on their export-destination. By doing so, I can identify potential spillover effects. Why does this matter? One of the goals of nonreciprocal trade preferences is to help firms in developing countries learn how to export and hence to facilitate exports to other destinations. Furthermore, the ATPA's main objective was to foster economic development in the Andean countries outside the drug business to help with the U.S. administration's war on drugs. Therefore, the goal is trade creation, not trade diversion. Thus, to evaluate the effectiveness of the ATPDEA preferences I have to net out the third country effects estimated by β_{RoW}. A positive and significant β_{US} coefficient tells that the firm-product exports grew more to the US relatively to third countries. But only a positive net effect, i.e. $\beta_{RoW} + \beta_{US}$ means that firms exports actually grew due to the nonreciprocal preferences.

Equation 3.1 gives the second stage of the IV, with $T_k \times Post_t$ and $T_k \times Post_t \times US_d$ being treated as endogenous. As described above, I model the first stage as

$$\begin{aligned} T_k \times Post_t = &\gamma_0 \left(AGOA_k \times Post_t\right) + \gamma_1 \left(AGOA_k \times Post_t \times US_d\right) + \\ &\delta_1 MFA_{kt} + \delta_2 \left(MFA_{kt} \times US_d\right) + \lambda_{fjk} + \mu_{jt} + u_{fjkt} \end{aligned} \tag{3.2}$$

and

$$\begin{aligned} T_k \times Post_t \times US_d = &\gamma_0 \left(AGOA_k \times Post_t \right) + \gamma_1 \left(AGOA_k \times Post_t \times US_d \right) + \\ &\delta_1 MFA_{kt} + \delta_2 \left(MFA_{kt} \times US_d \right) + \lambda_{fjk} + \mu_{jt} + u_{fjkt}, \end{aligned} \tag{3.3}$$

with US_d being a dummy variable that equals one if the export goes to the United States. $AGOA_k$ equals one if the product became eligible for nonreciprocal preferences under AGOA and zero otherwise. All controls from the second stage are also included in the first stage.

3.4 The Effects of Nonreciprocal Preferences on Firm Exports

In this section, I use the methodology described above, to analyze how exporting firms react to receiving nonreciprocal trade preferences through ATPDEA. The results describe the effects on the intensive as well as the extensive margin. The intensive margin, denoted as $ln(x_{ijkt})$, corresponds to firm exports in USD of a given product to a given destination that are positive in both the pre- and post-period. The extensive margin, $P(X_{ijkt})$, corresponds to the probability that an exporting firm enters or exits a product-destination market assuming that firms potentially could export all products that they have ever exported in the period of observation to all markets that they have at least once exported to.[9]

3.4.1 Baseline Results

For the IV-approach to work, the instrument needs to be relevant and fulfill the exclusion restriction. The results of the first stage, which is defined in Equations 3.2 and 3.3, shows that the AGOA product list is a valid instrument for the ATPDEA product list (cf. Table C2 in the Appendix). As expected, the AGOA-interaction terms have a positive effect on $T_k \times Post_t$ and $T_k \times Post_t \times US_d$.

Table 3.2 reports the estimation results of Equation 3.1. Columns (1) and (3) are the most parsimonious specifications accounting for firm-destination-product and year-destination fixed effects, but not for changes in the MFA, which are included in columns (2) and (4). As column (1) shows, when not accounting for the MFA, nonreciprocal preferences increase firms exports to the United States by 30.6% relatively to third countries. However, at the same time the trade diversion effect measured by β_{RoW}, the coefficient of the interaction term $T_k \times Post_t$,

[9] For example if firm 1 has exported product k_1 to the United States (d_1) and Germany (d_2), k_2 to China (d_3) and k_3 to the United States d_1 and China d_2, I would assume that it could export all three products $k_i, i = 1, 2, 3$ to all three destinations d.

is highly significant and negative, indicating a net effect of the nonreciprocal preferences of 9.4%.

The nonreciprocal preferences also have an effect on the extensive margin of trade: the probability of a firm to start exporting product k to the U.S. relatively to the rest of the world increases due to the ATPDEA preferences by 2.7% (column (4)). The average probability of exporting equals 1.6% for the whole sample. Therefore, this effect can be interpreted as relatively large. Exports to the rest of the world remain virtually unchanged with a precisely measured zero coefficient. Advocates of nonreciprocal trade arrangements often put the learning-by-exporting hypothesis forward. By granting firms in developing countries preferential market access those firms acquire new knowledge about how to export and then start to also serve other markets. In the Peruvian context, the results do not support this argument as no positive spillover effects can be found.

Next, I discuss if changes in the MFA drive the results. Columns (2) and (5) only account for changes in MFA, columns (3) and (6) interact the MFA variables with the dummy variable for ATPDEA eligibility. For both the intensive and the extensive margin, β_{RoW} is very robust to accounting for the MFA. β_{US} decreases slightly, but the standard errors are wide across the different specifications, suggesting that the coefficients of interests are not statistically significant from each other. Hence, the positive net effect of the nonreciprocal preferences on the export performance is not driven by the MFA effect. Table C1 in the Appendix shows that almost all of the change in export values is driven by changes in quantity and not in prices, which are measured as unit values.

The remainder of the table reports the coefficients when using the OLS-estimator instead of 2SLS. Interestingly, the coefficients are very similar: while β_{US} is slightly downward-biased when not accounting for potential endogeneity in the treatment variable, β_{RoW} does not vary. For the extensive margin (column (4) and (8)) both coefficients are somewhat smaller when using the OLS-estimator. The small downward bias indicates that the United States deliberately chose products Peru is particularly good at. This result goes in line with the "trade-for-aid" character of nonreciprocal arrangements. If the main objective is to help Peruvian firms to increase exports, it makes sense to choose products where Peru has a comparative advantage. The downward bias could also be due to lobbying of Peruvian firms in the U.S. or the presence of multinational enterprises in Peru—an argument put forward by Blanchard and Matschke (2015).

Table 3.2: Baseline Results

	IV						OLS					
	(1) ln(x)	(2) ln(x)	(3) ln(x)	(4) P(X)	(5) P(X)	(6) P(X)	(7) ln(x)	(8) ln(x)	(9) ln(x)	(10) P(X)	(11) P(X)	(12) P(X)
T × Post	-0.212***	-0.198***	-0.215***	0.007***	0.003***	0.003***	-0.199***	-0.191***	-0.163***	0.005***	0.002***	0.002***
	(0.078)	(0.074)	(0.070)	(0.001)	(0.001)	(0.001)	(0.055)	(0.051)	(0.054)	(0.001)	(0.001)	(0.001)
T × Post × US	0.306**	0.248*	0.260*	0.027***	0.020***	0.020***	0.267**	0.228**	0.214**	0.018***	0.011***	0.012***
	(0.139)	(0.137)	(0.133)	(0.004)	(0.004)	(0.004)	(0.104)	(0.100)	(0.102)	(0.003)	(0.003)	(0.003)
MFA		-0.022	0.120*		0.005***	0.004***		-0.023	0.126*		0.005***	0.004***
		(0.046)	(0.068)		(0.001)	(0.001)		(0.046)	(0.067)		(0.001)	(0.001)
MFA × US		0.102	0.091		0.009***	0.015***		0.108	0.086		0.013***	0.014***
		(0.079)	(0.154)		(0.003)	(0.003)		(0.079)	(0.152)		(0.003)	(0.003)
T × MFA × Post			-0.174**			0.001			-0.197***			0.002*
			(0.079)			(0.001)			(0.076)			(0.001)
T × MFA × Post × US			0.026			-0.008**			0.047			-0.001
			(0.169)			(0.004)			(0.163)			(0.003)
N	201,043	201,043	201,043	20,609,798	20,609,798	20,609,798	201,043	201,043	201,043	20,609,798	20,609,798	20,609,798
F-Statistic	403.6	369.7	449.3	8,352.2	5,510.1	5,957.5	.	.	.	.	.	.

Note: The table shows the the results of estimating equation 3.1. Columns (1) to (4) report the IV results, the remainder of the table shows the results for OLS. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). The Kleibergen-Paap F-statistic is shown in the table. All regressions include firm-product-destination and destination-year fixed effects. Errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

The very similar results suggest that the bias due to an endogenous choice of the eligible products is small. Thus, as argued above, receiving the ATPDEA preferences is indeed an exogenous event, at least from the perspective of the Peruvian firm, resulting in exogenous variation that can be used for the empirical analyses. Due to the slight differences between OLS and 2SLS, I will use the OLS approach for the remainder of this analysis and include the two MFA variables, hence, column (2) and (5) are the baseline specification. The 2SLS results can be found in the Appendix. The IV-analysis leads to another interesting observation: AGOA is a valid instrument for ATPDEA. This insight could be helpful in other contexts where OLS results yield biased results.

3.4.2 Sensitivity Analysis

In this subsection I will perform a sensitivity analysis to check whether the positive effects of nonreciprocal trade effects are robust, Table 3.3 reports the results.

Placebo Test First, I run a placebo test to make sure the baseline results are not driven by some pre-trends. I make use of the long panel data and change the period of observation to 1994 to 1997, i.e. one year after the original version of the ATPA came into force and four years before it was amended. In this period the treatment variable should not have any effect. If the results are not driven by pre-trends the coefficients should be insignificant. I treat 1996 and 1997 as the placebo-post period and run the same regression as in the baseline specification. Indeed, columns (3) and (4) report insignificant coefficients, diminishing concerns about pre-trends biasing the baseline results.

Demand Shock The positive effect of nonreciprocal preferences on Peruvian exporters could be driven by a US-specific change in demand for ATPDEA eligible products. To check for this, I use firm-level data from Uruguay, which is available through the World Bank's Exporter Dynamics Database (Fernandes et al. 2016).[10] Unfortunately the time coverage is not ideal, as the World Bank data for Uruguay only starts in 2001. Nevertheless, it is a useful check: if results were driven by a change in U.S. demand, then this should also be visible for the shorter time period. As columns (5) and (6) of Table 3.3 show, also Uruguayan exporters reduce exports of treated products in the post-period. However, Uruguayan firms cannot alleviate this effect by increasing exports to the United States. Hence, the positive effect of the nonreciprocal preferences is not driven by a sudden increase of American demand for the ATPDEA products.

[10] The data can be downloaded here https://www.worldbank.org/en/research/brief/exporter-dynamics-database.

Exclusion of the Year 2002 Third, I exclude the year 2002, which was characterized by turmoil: the original ATPA was not in effect until August, and the ATPDEA preferences were only introduced in November 2002, so relatively late in the year. Therefore, it is not surprising that excluding 2002 leads to a higher net effect of nonreciprocal preferences on exports: for much of 2002 firms exported relatively more to third countries than to the U.S. (see columns (7) and (8)).

Firm-Trends Next, I control for firm-trends by including a firm fixed effect that can vary in the pre- and post-period. While the coefficient for the U.S. exports, β_{US}, remains relatively stable, the coefficient measuring exports to third countries almost halves. The effects for the extensive margin almost vanish. However, one has to keep in mind that the model is highly saturated and therefore only very little variation is left that can be used to identify any effect. By including firm-trends the model might become too demanding.

Eastern Enlargement of the European Union Lastly, I want to check if the eastern enlargement of the European Union in 2004, when ten new member states (NMS) joined, might bias the baseline results. Why should this matter? With the accession to the European Union the ten NMS immediately inherited all regional trade agreements that the European Union had in place, including inter alia the GSP program, through which Peru had preferential access to the European market. Thus, when the NMS joined the European Union, Peru suddenly gained preferential access to their markets, too, potentially biasing the baseline results. In columns (11) and (12) I include the triple interaction term $T_k \times Post_t \times NMS_d$ to net out a potentially diverging effect for the exports to the NMS in the post-period. The coefficient β_{NMS} enters the results significantly and is highly negative. This indicates that Peruvian exports for treated products to the NMS plummeted relatively to the rest of the world (minus the United States) in the post-period. This could be due to the increased competition in the NMS-markets from the remaining members of the European Union that now had duty free access to these markets. However, the coefficients measuring the effects of the ATPDEA preferences on Peruvian exports to the United States are robust to this additional control.

Table 3.3: Robustness Checks—OLS

	Baseline		Placebo		URY Firms		no 2002		Firm-Trends		New EU-Members	
	(1) ln(x)	(2) P(X)	(3) ln(x)	(4) P(X)	(5) ln(x)	(6) P(X)	(7) ln(x)	(8) P(X)	(9) ln(x)	(10) P(X)	(11) ln(x)	(12) P(X)
T $\times$ Post	-0.191***	0.002***	0.094	-0.000	-0.269**	-0.009	-0.217***	0.003***	-0.122*	0.000	-0.190***	0.003***
	(0.051)	(0.001)	(0.061)	(0.000)	(0.124)	(0.007)	(0.063)	(0.001)	(0.069)	(0.001)	(0.051)	(0.001)
T $\times$ Post $\times$ US	0.228**	0.011***	-0.035	-0.001	-0.140	0.001	0.317***	0.014***	0.227**	0.008***	0.226**	0.011***
	(0.100)	(0.003)	(0.134)	(0.002)	(0.206)	(0.010)	(0.115)	(0.003)	(0.115)	(0.003)	(0.100)	(0.003)
MFA	-0.023	0.005***	-0.495***	-0.008***	0.047	0.001	-0.008	0.005***	-0.007	0.005***	-0.024	0.005***
	(0.046)	(0.001)	(0.093)	(0.002)	(0.068)	(0.004)	(0.046)	(0.001)	(0.045)	(0.001)	(0.046)	(0.001)
MFA $\times$ US	0.108	0.013***	0.322	-0.009	0.014	-0.032***	0.020	0.012***	0.100	0.012***	0.108	0.013***
	(0.079)	(0.003)	(0.344)	(0.005)	(0.159)	(0.010)	(0.077)	(0.003)	(0.078)	(0.003)	(0.079)	(0.003)
T $\times$ Post $\times$ NMS											-1.022***	-0.007***
											(0.330)	(0.001)
N	201,043	20,609,798	28,795	7,494,472	40,775	1,550,948	178,838	18,736,180	200,290	20,609,798	201,043	20,609,798

Note: The table shows various robustness test. See main text for details. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). All regressions include firm-product-destination and destination-year fixed effects. Errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Changes in GSP Eligibility The control group consists of products that are eligible for ATPA preferences and/or GSP preferences. Similar to the ATPA also the GSP is regularly up for renewal potentially inducing trade policy uncertainty or even the suspension of the program. If this were the case, the baseline results could be driven by a dip in the control group, which would be driven entirely by those products that are only eligible for GSP preferences. None of the exporters in the sample export products that are only eligible for GSP preferences. Therefore, this potential source of bias is not an issue.

Overall, the results are robust to the various sensitivity checks indicating that the reported effects are not due to spurious correlation. All of the checks also hold when using 2SLS (see Table C3 in the Appendix).

3.4.3 Heterogeneity

Next, I report results of a heterogeneity analysis. First, I try to shed some light on the importance of RoOs and pre-existing sourcing patterns. Second, I check if the effects are different for firms that were exposed to a sudden increase of competition in a third market, namely the European Union.

Sourcing and Rules of Origin RoOs matter for nonreciprocal trade preferences: only exporters that comply with them are granted preferential access. Existing evidence on RoOs shows that they reduce trade within a free trade agreement and reduce imports from third countries (Andersson 2015; Augier et al. 2005; Bombarda and Gamberoni 2013; Conconi et al. 2018). Costs of RoOs arise through two channels. First, firms have to bare direct costs for example because they have to pay for the certificate of origin and need to accumulate legal knowledge to comply with the rules. Second, firms might alter global value chains by reducing inputs from suppliers that are outside of the trade agreement in order to comply with the rules. So far, there is no evidence that helps us to understand which one of the two channels matters more in a firm's choice to export.

The Peruvian context makes it possible to distinguish between the two mechanisms through which costs of RoOs arise: if global value chains matter firms with a sourcing structure compliant to the rules prior the nonreciprocal preferences became available should react stronger to the preferential market access than those with a different sourcing structure. Furthermore, one can formally test if the claim of the 9th U.S. report of the ATPA is true that more lenient RoOs with respect to sourcing requirements were actually the reason why Peruvian firms preferred to use ATPA preferences instead of GSP (Okun et al. 2004).

To identify such heterogeneities across firms, ideally, I would have information on the production function of each firm and its global value chains for each product separately. Such detailed information is unfortunately not available. However, I have access to firm-level import data that can be matched to the exports. As described in Section 3.2, in the ATPDEA (and in its predecessor ATPA, too) the RoOs require that only inputs from the Andean countries, the U.S. or 24 Caribbean countries (RoOs-eligible countries) are used for production. Using the information on imports I calculate for every firm in the pre-period the share of imports that has been imported from RoOs-eligible countries relative to total imports (the share is denoted as $(CBERA + ANDEAN + US)M - Exposure_f$). Then, I interact the share with the $T_k \times Post_t$ and $T_k \times Post_t \times US_d$ and instrument it with the AGOA product-list.

Columns (5) to (8) of Table 3.4 show that the baseline results do not substantially change when accounting for firms' import patterns. For the intensive margin the import exposure measures enter the regression insignificantly with very large standard errors indicating that importing mostly from RoOs-eligible countries before the ATPDEA did not have a positive effect on exports.[11]

The results suggest that firms with RoOs compliant sourcing did not profit more from the nonreciprocal preferences than those with a different sourcing structure indicating that the global value chain channel did not play a major role for the ATPDEA preferences. This is merely an observation and I do not try to give an answer on why the global value chain channel does not respond. It might be driven by the fact that the ATPDEA products were products that mostly use domestic inputs, which are not picked up by the import exposure measure. Furthermore, the import exposure measure might pick up some other firm characteristic that drives the results and is more important than the RoOs channel. Lastly, the measure is relatively crude and serves only as a rough approximation of the firm's global value chains. Nevertheless, it is interesting to see that in the context of Peru and for this specific nonreciprocal trade arrangement costs of RoOs induced by non-compliant sourcing patterns do not seem to matter.

Increased Competition in a Third Market The eastern enlargement of the European Union in 2004 changed the landscape of trade policy quite a bit: in 2004 ten eastern European countries joined the European Union resulting in free trade between the former EU15-states and the new member states (NMS). Furthermore, the NMS adopted all existing trade agreements. For third countries, like Peru, the eastern enlargement leads to trade diversion, i.e. exports to the European Union decrease. I look at trade flows within firm-product-destination and compare combinations with an ATPDEA product to those without. Thus, as long as the eastern enlargement shock does not affect ATPDEA products differently from non-ATPDEA products, the DiD accounts for this type of omitted variables.

[11] The results do not change substantially when I alter the definition of RoOs-eligible countries. In Table C5 the RoOs-eligible countries are first defined as only the United States, second the United States and the Andean countries other than Peru (Bolivia, Ecuador, and Colombia), and lastly when also the Caribbean countries are added (cf. Appendix).

Let me quickly review for which types of products the eastern enlargement reduced trade costs between the NMS and the former EU15-states: in the early 1990's the European Union signed free trade agreements with all the NMS eliminating tariffs on all industrial products. Thus, in 1997, the first year included in the analysis described above, these tariff cuts were already in place and therefore, accounted for by the DiD. In 2004, tariffs were only cut on agricultural products, not a sector for which Andean countries were granted nonreciprocal preferences to the U.S. market under ATPDEA making an omitted variable bias unlikely. In addition to tariff cuts also reforms that took place in the NMS prior accession reduced trade costs between the NMS and the former EU15-states yielding—again—lower exports from Peru to the European Union. As these reforms are not product-specific the destination-time fixed effects control for them.

Although the empirical strategy should account for the eastern enlargement effect, firms that are more strongly affected by the shock might react differently to receiving nonreciprocal preferences as they are exposed to increased competition in a third market. I check for heterogeneity along these lines by interacting the two variables of interest $T_k \times Post_t$ and $T_k \times Post_t \times US_d$ with firm-specific exposure to the European market. $EU15-X-Exposure_f$ equals the share of all exports in the pre-period that a firm sold to the EU15-states and can range between 0 and 1. The results are displayed in columns (1)-(4) of Table 3.4.[12]

The baseline results for the intensive margin are entirely driven by those firms with high exposure to the European market. Firms that experience high competition due to high exposure to the European Union reorganize their portfolio towards ATPDEA products and the U.S. market taking advantage of the nonreciprocal preferences. For the remaining firms the nonreciprocal trade preferences did not have any effect on exports. Instead, the probability of exporting is not affected by these competition effects indicating that some firms start exporting the ATPDEA products to the United States due to the nonreciprocal preferences.

This insight puts the baseline results into perspective. Only the interplay of increased competition in a third market and nonreciprocal preferences in the U.S. led to the large and positive effects on the intensive margin. Hence, it is questionable if nonreciprocal preferences alone would have had the same trade promoting effect for firms that exported already in the past. However, the stable effects on the extensive margin suggest that the cost reduction induced by the nonreciprocal preferences was enough to make it profitable for firms to start exporting the eligible products to the U.S.

[12] For the IV analysis, I instrument these interaction terms with the AGOA product-list. Results are in the Appendix Table C3.

Table 3.4: Heterogeneity—OLS

	Export Exposure to EU15 Market				Share of Imports from the U.S.			
	(1) ln(x)	(2) ln(x)	(3) P(X)	(4) P(X)	(5) ln(x)	(6) ln(x)	(7) P(X)	(8) P(X)
T × Post	-0.187***	-0.073	0.000	0.004***	-0.217***	-0.170**	0.001	-0.000
	(0.051)	(0.071)	(0.001)	(0.001)	(0.063)	(0.086)	(0.001)	(0.002)
T × Post × US	0.227**	0.077	0.021***	0.019***	0.327***	0.407**	0.020***	0.033***
	(0.100)	(0.124)	(0.005)	(0.006)	(0.126)	(0.188)	(0.006)	(0.009)
MFA	-0.037	-0.036	0.001	0.002	-0.004	-0.006	0.002*	0.002*
	(0.053)	(0.052)	(0.001)	(0.001)	(0.065)	(0.066)	(0.001)	(0.001)
MFA × US	0.114	0.113	0.014***	0.014***	-0.005	-0.011	0.009*	0.009*
	(0.087)	(0.087)	(0.004)	(0.004)	(0.111)	(0.110)	(0.005)	(0.005)
EU15 X-Exposure × T × Post		-0.331**		-0.012***				
		(0.151)		(0.004)				
EU15 X-Exposure × T × Post × US		0.498*		0.010				
		(0.296)		(0.013)				
EU15 X-Exposure × Post		0.010		-0.004**				
		(0.121)		(0.002)				
CBERA + Andean + US M-Exposure × T × Post						-0.176		0.002
						(0.247)		(0.004)
CBERA + Andean + US M-Exposure × T × Post × US						-0.159		-0.035
						(0.382)		(0.024)
CBERA + Andean + US M-Exposure × Post						0.024		-0.005**
						(0.109)		(0.002)
N	166,100	166,100	14,572,712	14,572,712	131,268	131,268	13,131,184	13,131,184

Note: The table shows the results of estimating equation 3.1. Columns (1) to (4) differentiates by exposure to the European Union, the remainder of the table shows how differences in sourcing affects the results. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). All regressions include firm-product-destination and destination-year fixed effects. Errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

3.5 Conclusion

This paper examines how nonreciprocal trade preferences affect Peruvian firm-level exports in the context of the expansion of the Andean Trade Preference Act in 2002. It is the first paper that addresses endogeneity of extending nonreciprocal preferences with an instrumental variable approach and at the same time controls for omitted variables using a triple difference-in-differences. I find that firms increase exports of eligible products to the United States relative to ineligible products on average by 25%. However, this increase goes in line with a strong trade diversion effect, i.e. a shift of exports away from third countries towards the United States resulting in a net increase of 5%. The effect is solely driven by firms experiencing a negative competition shock in a third market. It seems like the combination of the two is necessary to find a positive effect of nonreciprocal preferences on the intensive margin. Also the extensive margin is affected by the nonreciprocal arrangement: the probability to export increases by 2%. The average probability of exporting equals 1.6% for the whole sample. Therefore, this effect can be interpreted as relatively large.

I cannot find any positive spillover effects. Furthermore, I show that firms with a sourcing structure that is compliant with the RoOs of ATPA did not benefit more from the nonreciprocal preferences. Therefore, the costs arising due to global value chains are negligible in the Peruvian context, probably because most of the inputs are produced domestically. This finding is relevant because it helps us to better understand the nature of the costs of RoOs.

To what extent can the results be transferred to other setups? First, in the Peruvian context the extent of the reduction in tariffs was relatively small compared to other nonreciprocal arrangements. Tariff changes that can be used for identification are only applicable for approximately 200 HS6-products. When tariff reductions are applicable for more products, the effects might turn out to be larger. Second, uncertainty about how long the preferences were in fact granted might have actually risen due to the temporary suspension of the program in 2001/02. This might have caused firms to not use the preferences in the first place. Both of these effects most likely attenuate the results, so it might be possible that in other settings with larger tariff cuts and less uncertainty the effects of nonreciprocal trade arrangements would be more pronounced.

It would be interesting to see if the interaction between increased competition in markets of third countries and nonreciprocal preferences also drives results in other set-ups. For example, the positive and large effects reported by Frazer and Van Biesebroeck (2010) could also be driven by this channel as in their study the timing lines up with the eastern enlargement of the European Union, too. They do not account for firm-level exposure to the European market. Lastly, further research should analyze if the ATPA led to job growth, higher wages and ultimately reduced drug trafficking as these were the original objectives for extending the trade preferences.

Appendix A

Appendix to Chapter 1

A.1 Data Cleaning

Table A1 summarizes the steps taken to solve all the issues described in the main text, i.e. missing data, mistakes and oddities in the original Data, multiple preferential tariffs, aggregation bias, different product nomenclatures, non-WTO members, and non-ad valorem tariffs.

Download Data and Minor Steps First I download the raw data from WITS and perform minor cleaning steps as adding country codes and converting the 6-digit products into the first HS nomenclature, HS88/92. By doing so, I make sure that the tariffs can be compared over time and across countries. These steps are done separately for the different types of tariffs (bounds, MFN and preferential). I only keep the relevant information i.e. importer, for the preferential tariffs exporter, year, product, tariff (only the ad valorem component and including the ad valorem equivalent). CTS is the only source for the bound tariffs, for the MFN tariffs I use information from TRAINS and IDB, and for the preferential tariffs I only use TRAINS. Because of the immense amount of measurement error in the IDB data for the preferential tariffs (compare main text), I have decided against using them as they would do more harm than good. Whenever more than one preferential scheme applies (i.e. FTA and nonreciprocal preferences through SDT), I always assume the lowest preferential tariff to be effectively in place.

To solve the problem of non-ad valorem tariffs and their conversion into AVEs ideally I would have the original terms of the tariffs (for example 1.22 USD/kg) and unit values to convert the non-ad valorem tariffs by myself. Unfortunately WITS does not provide this type of information, therefore I cannot do much other than using the available AVEs on WITS trusting in the UNCTAD method. However, the database contains a variable that equals one whenever WITS tells that the tariff is an AVE. Thus, researchers can decide themselves whether to include the AVEs in the analysis.

Table A1: Overview Data Cleaning Procedure

	Bounds	MFN Tariffs	Preferential Tariff
(1)	download (CTS) and clean data (add iso codes, concord to HS88/92); data format: importer, product (HS88/92), tariff (only ad valorem)	download (TRAINS and IDB) and clean data (add iso codes, concord to HS88/92); data format: importer, product (HS88/92), tariff (only ad valorem), tariff (including AVEs)	download (TRAINS) and clean data (add iso codes, concord to HS88/92, only keep lowest tariff); data format: importer, exporter, product (HS88/92), tariff (only ad valorem), tariff (including AVEs)
(2)	Only CTS	Combine TRAINS and IDB	Only TRAINS
(3)	n/a	add national sources (EU and US)	add national sources (EU and US), add information of phasing-in schedules for 149 FTAs
(4)	n/a	n/a	cross-check with RTA database
(5)	interpolate missing years	interpolate missing years	interpolate missing years
(6)	combine Bounds, MFN and Preferential tariffs; data format: importer, exporter, product (HS88/92), effectively applied tariff (only ad valorem), effectively applied tariff (including AVEs)		
(7)	add information about WTO membership and indicator whether there are multiple tariff lines within 6-digit product		

Note: The table sums up the different steps that were taken to clean up the WITS tariff data.

Additional Information Next, I add as much additional information as possible. For both, MFN and preferential tariffs, I add data from national sources for the European Union and the United States provided by the World Bank (Forero-Rojas et al. 2018), for preferential tariffs I further have the phasing-in schedules of 149 FTAs. This information is from the WTO's RTA database.[1]

Cross-Validation of Preferential Tariffs To cross-validate the preferential tariffs I need panel data on all RTAs —FTAs, CUs and nonreciprocal preferences granted under the SDT—

[1] rtais.wto.org/.

in place, for all countries and years in the sample. For reciprocal trade agreements (i.e. FTAs and CUs) I use Dür et al. (2014), who have the most comprehensive database comprising over 600 agreements and the corresponding accessions and withdrawals. For the nonreciprocal arrangements I use the Database on Economic Integration Agreements, put together by Scott Baier and Jeffrey Bergstrand.[2] Furthermore, I add information from the WTO's list of preferential trade agreements[3] and researched myself the schemes provided by the European Union and the United States. I keep preferential tariffs only if my list of agreements indicates that preferential market access is granted. Otherwise I will assume that the MFN tariff is applicable.

Interpolation of Missing Data Next I interpolate the missing data. I do so in the following way: rather than replacing missing tariffs by linearly interpolating observations, I set them equal to the nearest preceding observation. This procedure accounts for the fact that countries are more likely to update schedules after a significant tariff change. If there is no preceding observation, missing tariffs are set equal to the nearest succeeding observation. For preferential tariffs interpolating is significantly harder because FTAs are often phased in. Thus, adding the exact phasing-in schedules provided by the WTO's RTA database is crucial, as it improves the data quality significantly. Nevertheless, there are still cases where I have to deal with missing data. For a precise interpolation, I use detailed information for more than 500 FTAs.[4] I know whether phasing-in is allowed and the final year when all changes have to be implemented. Whenever phasing-in is allowed and the final year of implementation has not been reached yet, I allow for linear interpolation, otherwise I use the procedure described above.

Table A2 illustrates how the algorithm works when interpolating the missing tariffs. It shows a fictional pattern of missing observations and the resulting imputed tariff. In Example 1 the algorithm uses the preceding observations for the interpolation of all the missing observations, so for 1997 the tariff of the year 1996 is used, for 2000 to 2002 the tariff corresponds to the tariff that was reported in 1999 and in 2004/2005 the tariff from 2003 is used. In Example 2 the same is true for the years 2001, 2002, 2004, and 2005. However, for the years 1996-1999 no preceding observation can be found in the original data. In this case the tariff from the year 2000, i.e. the nearest succeeding observation, is used for the previous years.

When an RTA has no phasing-in, the procedure just described for the MFN tariff is also applicable for the preferential tariff with a slight complication: the interpolation algorithm

[2] Available at https://kellogg.nd.edu/nsf-kellogg-institute-data-base-economic-integration-agreements and first used in Baier et al. (2014).

[3] Available at http://ptadb.wto.org/ptaList.aspx

[4] The data is provided by DESTA (Dür et al. 2014). I use the version of March 2018.

has to account for the entry into force date of the RTA. Before the RTA enters into force, the MFN tariff is used for the interpolation and afterwards the preferential tariff. Table A2, Example 3 illustrates this. The preferential tariff is only used until 2001, the year when the RTA enters into force. Before I use the MFN tariff for the interpolation.

When phasing-in is possible there are two ways to go. The WTO-RTA database provides information about the particular phasing-in schedule for 149 RTAs. In these cases no further interpolation is necessary, I just use the additional information, since in the WTO-RTA database no observations are missing (see Example 4 in Table A2). Unfortunately the WTO-RTA database does not have the tariff schedules for all RTAs that allow for phasing-in.

DESTA (Dür et al. 2014) has information on the final year when all the tariff cuts have to be implemented. For example, NAFTA entered into force in 1994 and all tariff cuts had to be implemented by 2008. In this case, DESTA tells that the final year of implementation is 2008. So, we know for which RTAs phasing-in is possible and when the last tariff cuts have to be implemented. Typically phasing-in means that for certain products the tariffs are gradually reduced, for example every five years a tariff cut of 2%-points. I approximate this by linearly interpolating the missing tariffs for the years after the RTA has entered into force but before the phasing-in has been fully implemented.

Now two possibilities emerge. Either the final year of implementation is within the period of observation or in the future. In Table A2, Example 5 I show a case where the phasing-in has already been fully implemented, in this fictional case in the year 2004. Therefore, I linearly interpolate the preferential tariffs for the years 2001 to 2004 and use the tariff 2006 for the year 2005. When the full implementation has not yet been reached (compare Example 6 where the implementation date is set to 2020), the linear interpolation is done for the whole period of observation.

Last Steps Lastly, I combine all different tariff types, and add indicator variables to identify non-WTO members and whether there are any sublines within the 6-digit product. I end up with a database of the following structure: importer–exporter–product–year–effectively applied tariff.

A.2 Forms of Tariffs

Different forms of non-ad valorem tariffs: *Specific tariffs* are computed on the physical quantity of the good being imported, for example 1.22 EUR/kg. A combination of ad valorem and specific tariffs are called *compound tariffs* (i.e. 1.22 EUR/kg + 8%). *Mixed tariffs* are expressed as either a specific or an ad valorem rate, depending on which generates the most (or sometimes the least) revenue. For example, duties may be either 1.22 EUR/kg or 8%, which ever

Table A2: Examples for Interpolation

MFN Tariffs:

Example 1			Example 2		
Year	Original t	Imputed t	Year	Original t	Imputed t
1996	10	10	1996	.	5
1997	.	10	1997	.	5
1998	5	5	1998	.	5
1999	5	5	1999	.	5
2000	.	5	2000	5	5
2001	.	5	2001	.	5
2002	.	5	2002	.	5
2003	2	2	2003	2	2
2004	.	2	2004	.	2
2005	.	2	2005	.	2

Preferential Tariffs:

Example 3: no Phasing-In					Example 4: Phasing-In, WTO info				
Year	Original t	Entry	Phasing-In	Imputed t	Year	Original t	Entry	WTO-Info	Imputed t
1996	10	2001	0	10	1996	10	2001	.	10
1997	.	2001	0	10	1997	.	2001	.	10
1998	5	2001	0	5	1998	5	2001	.	5
1999	5	2001	0	5	1999	5	2001	.	5
2000	.	2001	0	mfn-2000	2000	.	2001	.	5
2001	.	2001	0	0	2001	.	2001	2	2
2002	.	2001	0	0	2002	.	2001	2	2
2003	0	2001	0	0	2003	.	2001	2	2
2004	.	2001	0	0	2004	.	2001	1	1
2005	0	2001	0	0	2005	.	2001	1	1
2006	.	2001	0	0	2006	.	2001	0	0

Example 5: Phasing-In, DESTA info					Example 6: Phasing-In, DESTA info				
Year	Original t	Entry	Phasing-In	Imputed t	Year	Original t	Entry	Phasing-In	Imputed t
1996	15	2000	2004	15	1996	15	2001	2020	10
1997	.	2000	2004	15	1997	.	2001	2020	10
1998	15	2000	2004	15	1998	15	2001	2020	5
1999	15	2000	2004	15	1999	15	2001	2020	5
2000	.	2000	2004	12.5	2000	.	2001	2020	12.5
2001	10	2000	2004	10	2001	10	2001	2020	10
2002		2000	2004	7.5	2002		2001	2020	7.5
2003	5	2000	2004	5	2003	5	2001	2020	5
2004		2000	2004	0	2004		2001	2020	5
2005		2000	2004	0	2005		2001	2020	5
2006	0	2000	2004	0	2006	5	2001	2020	5

Note: The table illustrates the interpolation algorithm. The black font describes how the original looks like, the red font tells the tariff supposed by the algorithm. The examples illustrate different cases in the pattern of missing observations that have to be dealt with.

is higher. Then there are *technical tariffs* that depend on certain product characteristics for example duties might be 8% for butter with fat content between 9-40%. *Tariff rate quotas* are made up of a low tariff rate on the initial imports (the within-quota quantity) and a very high tariff rate on imports entering above the initial amount (outside-quota quantity). Figure A1 summarizes the different forms.

The first three forms of non-ad valorem tariffs can be converted into ad valorem equivalents (AVEs) by dividing the specific element of the tariff by the value of the product per unit. To obtain a percentage value, the result needs to be multiplied by 100.[5] It is rather difficult or even impossible to calculate AVEs for the remaining non-ad valorem tariffs (compare Bouët et al. (2008) for a detailed discussion).

Figure A1: Overview of Forms of Tariffs

Ad-Valorem	Ad-Valorem	8%
Non-Ad Valorem	Specific	1.22 USD/kg
	Compound	1.22 USD/kg + 8%
	Mixed	either 1.22 USD/kg or 8%
	Technical	8% on butter with fat content between 9-40%
	Quota	within/outside quota quantity

Note: The figure shows the different forms of tariffs.

Converting Non-Ad Valorem tariffs into Ad Valorem Equivalents Regardless of the type of tariff—bound, MFN or preferential—it can take two forms. *Ad valorem tariffs* are the most common ones. Here the customs duty is calculated as a percentage of the value of the product (for example 8%). The *non-ad valorem tariffs* can take on five different forms (specific tariffs, compound tariffs, mixed tariffs, technical tariffs and tariff rate quotas, see Section A.2 of the Appendix for more details). 1.22 USD/kg or 1.22 USD/kg + 8% are examples for these types of tariffs.

It is possible to convert non-ad valorem tariffs into ad valorem equivalents (AVEs) by dividing the non-ad valorem element of the tariff by the value of the product per unit.[6] While the

[5] There are several problems when choosing the unit value. See Bouët et al. (2008) for a discussion and ways of solving the issues.

[6] For technical tariffs and tariff rate quotas it is rather difficult to do the conversion, see Bouët et al. (2008) for a more detailed discussion.

WTO does not report AVEs, TRAINS estimates AVEs.[7] Since AVEs are a function of unit values, they are much more volatile than ad valorem tariffs; they change whenever the price of a good changes, which does not have to be necessarily related to trade policy changes but could be for example because of in-/deflation or shifts in demand. In my database a dummy variable is included indicating AVEs, therefore, users can decide themselves whether to include them or if sensitivity analyses are necessary. Countries might report AVEs instead of the non-ad valorem tariffs to the institutions collecting data, for example the European Union does so. In these cases it is unfortunately impossible to tell the type a tariff, i.e. non-ad valorem or ad valorem and therefore elimination of these cases of AVEs is impossible. To deal with this issue, I assume that all tariffs higher than 100% are "non-ad valorem tariffs in disguise" and there is a dummy variable in the database flagging these cases.

Although the transformation of non-ad valorem tariffs is challenging, it does not matter for many countries: in 2017 the WTO reports only 14 countries with non-ad valorem tariffs for at least 5% of their tariff lines (WTO 2018).[8] Switzerland is an exception, with almost all tariffs being non-ad valorem. I proxy Swiss tariffs with the average tariffs of all other EFTA members.[9]

A.3 The Effectively Applied Tariff in IDB

Countries do not only report tariffs sporadically but even when they report, it does not necessarily mean that they report both, MFN and preferential tariffs. To confuse the trade economist even more, some countries do not report all, but only some preferential tariffs i.e. only the unilateral schemes or only certain FTAs. Such irregularities are present in TRAINS and in IDB. One would think that these types of missing observations were simply that in the data: missing. This is true for TRAINS. However, one tariff type available through IDB, which is called *"the effectively applied tariff or AHS"*, has a rather odd feature: whenever a preferential scheme is missing, instead of a missing observation the corresponding MFN tariff is stored in the database.

Figure A2 makes the consequences of this fact clear. The solid line shows the simple mean of the effectively applied tariff Mexico has against the US (Panel (a)) and Germany (Panel (b))

7 TRAINS estimates the unit values using HS 6-digit import statistics of all OECD countries. This produces unique unit values for each product common to all importing countries and all types of rates. This procedure is called the "UNCTAD method".

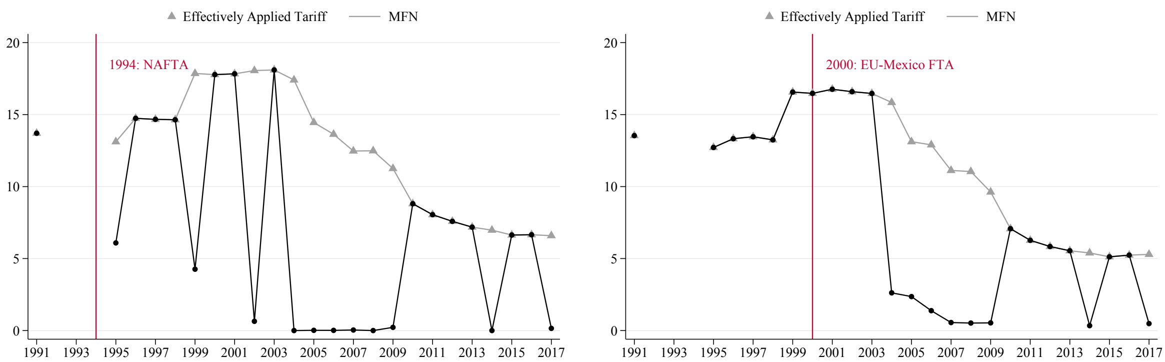
8 The 14 countries (ordered by their shares) with non-ad valorem tariffs for at least 5% of their tariff lines are Switzerland (75%) , Thailand (10%), Belarus (9%), Kyrgyz Republic (9%), Russia (9%), Armenia (9%), United States of America (8%), Zimbabwe (8%), Kazakhstan(8%), Colombia (7%), Lebanese Republic (6%), Norway (6%), Ecuador (6%), and European Union (5%).

9 I also account for the changes in EFTA i.e. Austria, Denmark, Finland, Portugal, Sweden, and the United Kingdom left EFTA to join the European Union.

over time when using the original data that WITS provides.[10] The light gray line is Mexico's MFN tariff. Mexico reported tariffs for the first time in 1991 and from 1995 onwards each year. Mexico has an FTA with both countries in place: NAFTA entered into force in 1994 and the EU-Mexico FTA in 2000, respectively. Both FTAs eliminate almost all tariffs on goods. Therefore, one would expect the effectively applied tariff to be equal to the MFN tariff in the years before the FTAs enter into force and to zero afterwards. This is not the case.

Figure A2: Example of Measurement Error in WITS

(a) Effectively Applied Tariff Mexico-United States (b) Effectively Applied Tariff Mexico-Germany



Note: The graph shows the simple average of the effectively applied tariff (in WITS this tariff type is called "AHS") that Mexico imposes on imports from the United States (Panel (a)) and Germany (Panel(b)) using the original data from WITS. NAFTA, the FTA between Mexico, Canada and the United States, entered into force in 1994. The FTA between the EU and Mexico entered into force in 2000.

As the solid line in Panel (a) indicates, WITS correctly reports the effectively applied tariff Mexico imposes against the United States to be equal to the MFN tariff in 1991. In 1995, the next year Mexico reports tariffs, the effectively applied tariff is significantly lower than the MFN tariff but not zero yet. As phasing-in was still going on it makes perfectly sense that the effectively applied tariff is not all the way down to zero. However, in 1996 instead of decreasing further or at least staying at the same level, the tariff jumps up again to the level of the MFN tariff. It stays at the high level for two years, only to jump down again in 1999. This jumping-pattern persists for the whole period of observation. In Panel (b) the same pattern can be observed for the tariff Mexico has on German exports.

Additionally, the issue on missing data described above can be observed in the plot: even though the EU-Mexico FTA has entered into force in 2000, the first time Mexico reports prefer-

[10] The data for the US can be downloaded here https://wits.worldbank.org/CountryProfile/en/Country/MEX/StartYear/1990/EndYear/2017/TradeFlow/Import/Partner/USA/Indicator/AHS-SMPL-AVRG and for Germany here https://wits.worldbank.org/CountryProfile/en/Country/MEX/StartYear/1990/EndYear/2017/TradeFlow/Import/Partner/DEU/Indicator/AHS-SMPL-AVRG. See Figure A5 in the Appendix for the original plots from the website.

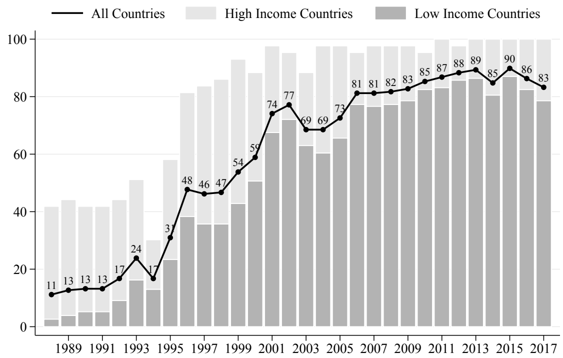
ential tariffs for Germany (or more correctly the EU as Germany does not have its own trade policy) was only in 2003. When comparing the two plots it becomes apparent that Mexico has not simply missed to report all preferential tariffs but instead in 2002 it reported in fact preferential tariffs for the United States but not for Germany, making it almost impossible to correctly interpret the effectively applied tariff reported by WITS. These "oddities" are not only true for Mexico but for a broad set of countries.

Using data on the effectively applied tariff provided by IDB through WITS would lead to an entirely wrong assumption: instead of preferential tariffs one would mistakenly suppose the MFN level to be the correct one. Therefore, I will refrain from using this data altogether for the preferential tariffs and instead entirely rely on TRAINS. To be clear, for MFN tariffs IDB will be used to supplement TRAINS, but for the preferential tariffs only the latter can be used as the effectively applied tariff by IDB exhibits too much measurement error.

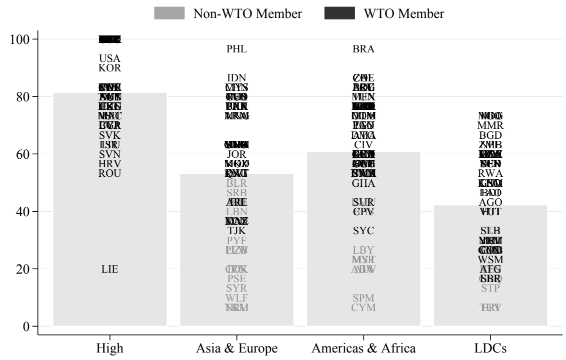
A.4 Additional Material

Figure A3: Pattern of Reporting

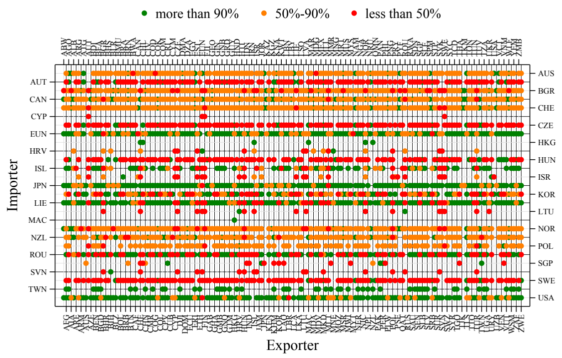
(a) Share of Reporting Countries by Year (in %)



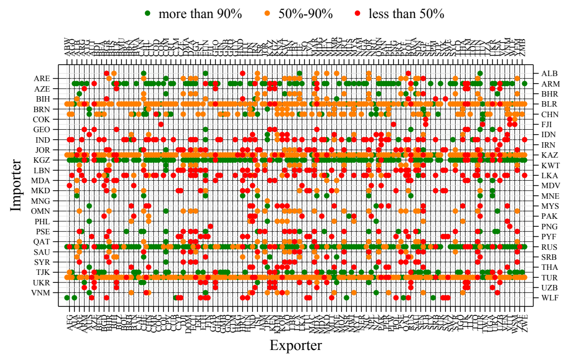
(b) Share of Reported Years by Country (in %)



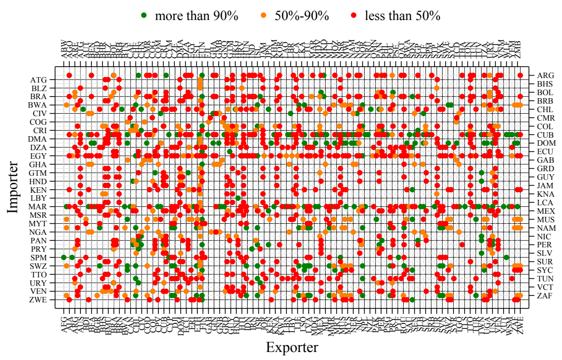
(c) Pref. Tariff — High Income



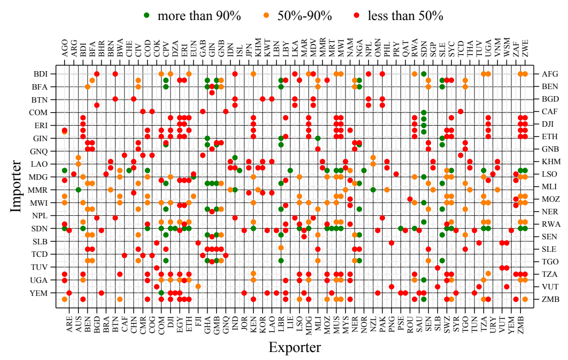
(d) Pref. Tariff — Low/Middle Income: Asia & Europe



(e) Pref. Tariffs — Low/Middle Income: Africa & Americas



(f) Pref. Tariff — Least Developed Countries



Note: In Panel (a) the total number of reporting countries is 197, the total number of high income Countries 43 and of low income countries it equals 143. In Panel (b) the total number of available years equals 30. Panels (c)-(f) show the share of reported preferential tariffs. This number equals the number of reported bilateral preferential tariffs divided by the number of years the pair should have a preferential tariff because the RTA or SDT is in force. The importing or reporting country is displayed on the two y-axes, the exporters are on the two x-axes.

Table A3: Summary Statistics

ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
A) Least Developed Countries					
AFG	2016	28,406,345	81%	4,855	2004
AGO	1994	28,889,121	58%	4,945	2002
BDI	1965	28,971,405	57%	4,967	2002
BEN	1963	28,925,427	47%	4,953	2001
BFA	1963	29,163,733	44%	5,018	1993
BGD	1972	29,163,733	37%	5,018	1989
BTN	–	28,889,121	81%	4,945	1996
CAF	1963	29,163,733	43%	5,018	1995
COD	1997	28,593,101	75%	4,887	2003
COM	–	28,593,101	74%	4,887	2008
DJI	1994	29,163,733	72%	5,018	1998
ERI	–	28,805,211	94%	4,930	2002
ETH	–	29,160,001	69%	5,017	1995
GIN	1994	29,163,733	75%	5,018	1998
GMB	1965	29,163,733	74%	5,018	2003
GNB	1994	28,925,427	54%	4,953	2001
GNQ	–	29,163,733	84%	5,018	1998
HTI	1950	28,889,121	62%	4,945	2001
KHM	2004	28,889,121	62%	4,945	2001
LAO	2013	29,152,100	65%	5,016	2000
LBR	2016	27,048,050	86%	4,603	2010
LSO	1988	28,925,427	53%	4,953	2001
MDG	1963	29,163,733	33%	5,018	1995
MLI	1993	29,163,733	31%	5,018	1995
MMR	1948	28,889,121	43%	4,945	1996
MOZ	1992	29,163,733	48%	5,018	1994
MRT	1963	28,889,121	70%	4,945	2001
MWI	1964	29,163,733	48%	5,018	1994
NER	1963	28,925,427	47%	4,953	2001
NPL	2004	29,163,733	40%	5,018	1993
RWA	1966	29,163,733	51%	5,018	1993
SDN	–	29,163,733	72%	5,018	1996

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
SEN	1963	28,925,427	47%	4,953	2001
SLB	1994	29,163,733	69%	5,018	1995
SLE	1961	28,553,263	84%	4,880	2004
STP	—	27,237,225	87%	4,636	2013
TCD	1963	29,163,733	48%	5,018	1995
TGO	1964	29,163,733	33%	5,018	1996
TLS	—	27,301,065	80%	4,647	2011
TUV	—	27,322,064	93%	4,653	2010
TZA	1961	29,163,733	48%	5,018	1993
UGA	1962	29,160,001	45%	5,017	1994
VUT	2012	28,915,017	62%	4,951	2002
WSM	2012	27,301,065	77%	4,647	2011
YEM	2014	28,925,427	72%	4,953	2000
ZMB	1982	29,163,733	46%	5,018	1993
B) LoM Africa					
BWA	1987	28,925,427	50%	4,953	2001
CIV	1963	29,163,733	44%	5,018	1993
CMR	1963	29,163,733	49%	5,018	1994
COG	1963	29,159,911	47%	5,017	1994
CPV	2008	28,889,121	64%	4,945	2004
DZA	—	29,163,733	54%	5,018	1993
EGY	1970	29,163,733	40%	5,018	1995
GAB	1963	29,163,733	46%	5,018	1995
GHA	1957	29,163,733	53%	5,018	1993
KEN	1964	29,163,733	45%	5,018	1994
LBY	—	29,160,031	90%	5,017	1996
MAR	1987	29,163,733	34%	5,018	1993
MUS	1970	29,163,733	32%	5,018	1995
MYT	—	27,301,065	77%	4,647	2007
NAM	1992	28,925,427	50%	4,953	2001
NGA	1960	29,163,733	26%	5,018	1988
SWZ	1993	28,925,427	50%	4,953	2001
SYC	2015	29,163,733	74%	5,018	2000
TUN	1990	29,163,733	39%	5,018	1990

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
ZAF	1948	29,163,733	20%	5,018	1988
ZWE	1948	29,163,733	56%	5,018	1996
C) LoM Americas					
ABW	—	27,242,963	80%	4,637	2011
AIA	—	27,139,194	81%	4,619	2012
ARG	1967	29,163,733	21%	5,018	1992
ATG	1987	28,994,676	40%	4,972	1996
BHS	—	28,889,121	70%	4,945	1999
BLZ	1983	28,978,986	49%	4,972	1996
BMU	—	28,915,287	59%	4,951	2001
BOL	1990	29,163,733	21%	5,018	1993
BRA	1948	29,163,733	9%	5,018	1989
BRB	1967	29,037,823	60%	4,983	1996
CHL	1949	29,163,733	26%	5,018	1992
COL	1981	29,163,733	21%	5,018	1991
CRI	1990	29,163,733	33%	5,018	1995
CUB	1948	29,163,733	29%	5,018	1993
CYM	—	27,785,543	93%	4,748	2016
DMA	1993	28,994,676	46%	4,972	1996
DOM	1950	29,156,209	35%	5,016	1996
ECU	1996	29,163,733	23%	5,018	1993
GRD	1994	29,030,389	55%	4,981	1996
GTM	1991	29,163,733	37%	5,018	1995
GUY	1966	28,994,676	50%	4,972	1996
HND	1994	29,163,733	35%	5,018	1995
JAM	1963	29,060,185	51%	4,989	1996
KNA	1994	29,033,226	47%	4,982	1996
LCA	1993	29,035,051	53%	4,982	1996
MEX	1986	29,163,733	32%	5,018	1991
MSR	—	27,895,894	81%	4,766	1996
NIC	1950	29,163,733	28%	5,018	1995
PAN	1997	29,163,733	41%	5,018	1997
PER	1951	29,152,387	35%	5,015	1993
PRY	1994	29,163,733	21%	5,018	1991

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
SLV	1991	29,163,733	31%	5,018	1995
SPM	—	26,923,107	90%	4,581	2015
SUR	1978	28,960,012	75%	4,968	1996
TTO	1962	29,163,733	49%	5,018	1991
URY	1953	29,163,733	28%	5,018	1992
VCT	1993	29,033,256	55%	4,982	1996
VEN	1990	29,163,733	28%	5,018	1992
D) LoM Asia					
ARE	1994	28,650,467	60%	4,899	2003
ARM	2003	28,925,427	50%	4,953	1996
AZE	—	28,889,121	69%	4,945	2002
BHR	1993	29,163,733	42%	5,018	1999
BRN	1993	29,160,031	30%	5,017	1992
CHN	2001	29,163,733	23%	5,018	1992
COK	—	27,301,065	80%	4,647	2010
FJI	1993	28,597,965	60%	4,890	2003
GEO	2000	28,889,121	44%	4,945	1994
IDN	1950	29,163,733	19%	5,018	1989
IND	1948	29,163,733	38%	5,018	1990
IRN	—	28,883,744	81%	4,944	2000
JOR	2000	28,925,427	47%	4,953	2000
KAZ	2015	29,163,733	67%	5,018	1996
KGZ	1998	29,160,031	48%	5,017	1995
KWT	1963	29,100,326	51%	5,002	2002
LBN	—	28,919,697	63%	4,952	1999
LKA	1948	29,163,733	37%	5,018	1990
MDV	1983	28,925,427	47%	4,953	2000
MNG	1997	29,020,082	36%	4,979	1996
MYS	1957	29,163,733	28%	5,018	1988
NRU	—	26,666,296	93%	4,537	2016
OMN	2000	29,163,733	47%	5,018	1992
PAK	1948	29,163,733	32%	5,018	1995
PHL	1979	29,163,733	8%	5,018	1988
PLW	—	28,593,101	74%	4,887	2005

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
PNG	1994	28,889,121	49%	4,945	1997
PSE	—	27,094,399	84%	4,613	2013
PYF	—	28,593,101	72%	4,887	2008
QAT	1994	29,163,733	51%	5,018	2002
SAU	2005	29,160,031	42%	5,017	1994
SYR	—	28,860,358	88%	4,940	2002
THA	1982	29,163,733	38%	5,018	1989
TJK	2013	28,883,744	70%	4,944	2002
TKM	—	28,883,744	93%	4,944	1998
TON	2007	27,301,065	68%	4,647	2007
TUR	1951	29,163,733	38%	5,018	1993
UZB	—	28,889,121	75%	4,945	2001
VNM	2007	29,163,733	44%	5,018	1994
WLF	—	26,882,524	90%	4,574	2015
E) LoM Europe					
ALB	2000	28,925,427	39%	4,953	1997
BIH	—	28,925,427	60%	4,953	2001
BLR	—	29,163,733	55%	5,018	1996
MDA	2001	29,163,733	43%	5,018	1996
MKD	2003	28,925,427	52%	4,953	2001
MNE	2012	27,391,431	64%	4,665	2007
RUS	2012	29,163,733	49%	5,018	1993
SRB	—	28,925,427	63%	4,953	2001
UKR	2008	29,163,733	54%	5,018	1995
F) High Income Countries					
AUT	1951	28,712,191	35%	4,940	1990
BEL	1948	29,163,733	21%	5,018	1988
BGR	1996	28,981,537	49%	4,970	1997
CYP	1963	29,017,251	42%	4,979	1996
CZE	1993	29,163,733	51%	5,018	1992
DEU	1951	29,163,733	21%	5,018	1988
DNK	1950	29,163,733	21%	5,018	1988
ESP	1963	29,163,733	21%	5,018	1988

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
EST	1999	29,163,733	36%	5,018	1995
FIN	1950	29,147,430	33%	5,015	1988
FRA	1948	29,163,733	21%	5,018	1988
GBR	1948	29,163,733	21%	5,018	1988
GRC	1950	29,163,733	21%	5,018	1988
HRV	2000	28,936,206	50%	4,957	2001
HUN	1973	29,163,733	44%	5,018	1991
IRL	1967	29,163,733	21%	5,018	1988
ITA	1950	29,163,733	21%	5,018	1988
LTU	2001	29,163,733	50%	5,018	1995
LUX	1948	29,163,733	21%	5,018	1988
LVA	1999	29,163,733	44%	5,018	1996
MLT	1964	29,014,138	41%	4,978	1996
NLD	1948	29,163,733	21%	5,018	1988
POL	1967	29,163,733	35%	5,018	1991
PRT	1962	29,163,733	21%	5,018	1988
ROU	1971	29,163,733	57%	5,018	1991
SVK	1993	28,994,922	46%	4,974	1998
SVN	1994	29,017,251	53%	4,979	1999
SWE	1950	29,098,808	34%	5,007	1988
AUS	1948	29,163,733	34%	5,018	1991
CAN	1948	29,163,733	40%	5,018	1989
CHE	1966	29,163,733	31%	5,018	1990
HKG	1986	29,163,733	27%	5,018	1988
ISL	1968	29,163,733	32%	5,018	1993
ISR	1962	29,158,003	43%	5,017	1993
JPN	1955	29,158,003	31%	5,017	1988
KOR	1967	29,163,733	36%	5,018	1988
LIE	1995	27,157,339	84%	4,624	2011
MAC	1991	28,925,427	29%	4,953	1996
NOR	1948	29,163,733	67%	5,018	1988
NZL	1948	29,158,003	42%	5,017	1992
SGP	1973	29,163,733	26%	5,018	1989
TWN	2002	29,163,733	23%	5,018	1989

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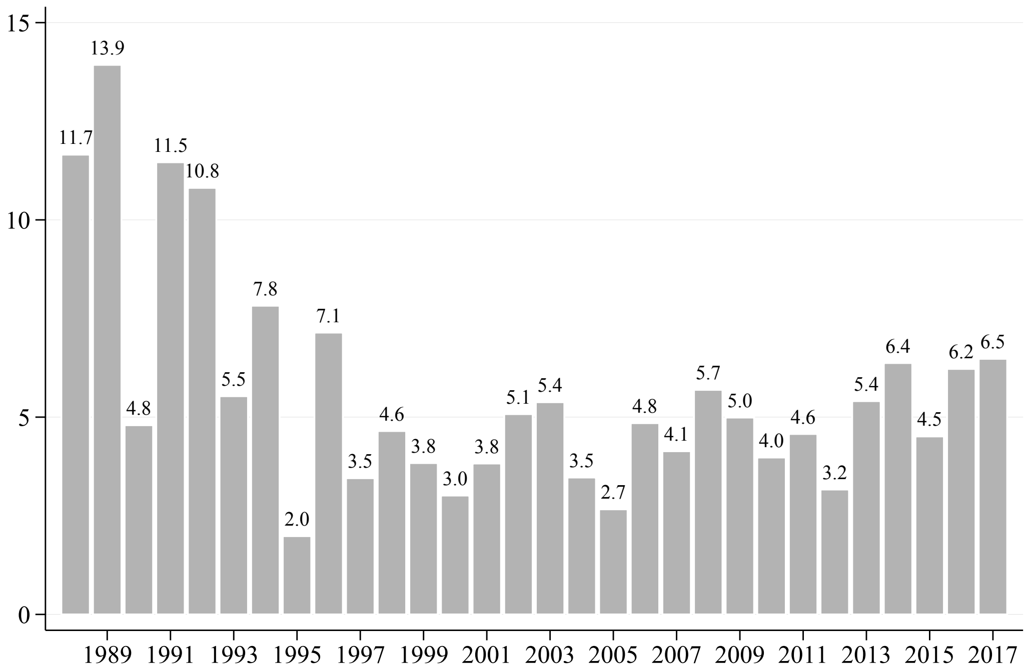
ISO3	**GATT/WTO**	**Nr. of Obs.**	**Share of Imputed**	**Nr. of Products**	1^{st} **av. Year**
USA	1948	29,163,733	21%	5,018	1989

Note: The table shows the year of accession to the GATT or the WTO, respectively, the total number of observations in the new data, the share of imputed data, the number of products and the first available year for each country included in the sample. The summary statistics sum over all available years, i.e. 1988 to 2017. The total number of all observations equals 5,692,605,390 out of which 2,805,297,527 are imputed (49%).

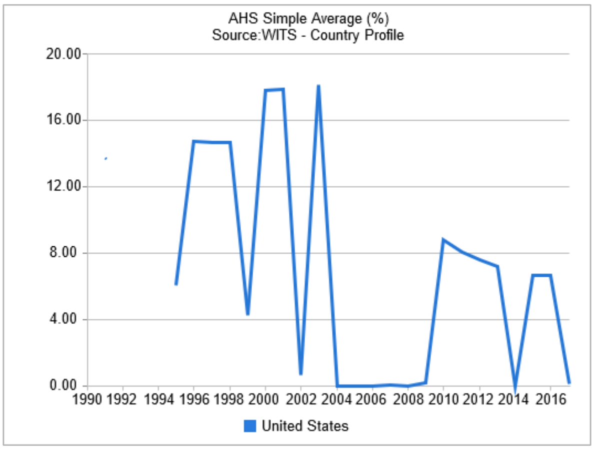
Figure A4: Share of Misreported Tariffs (in %)



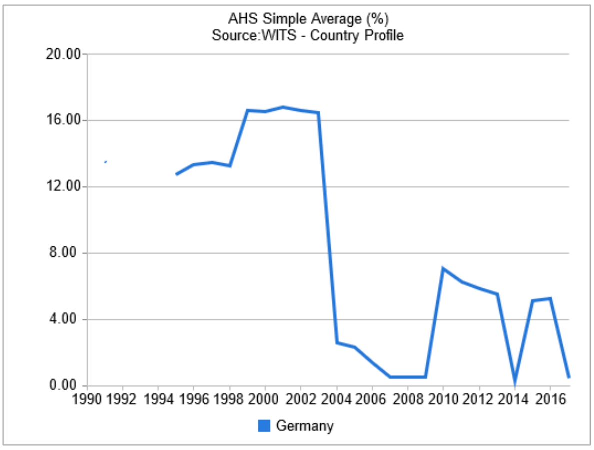
Note: The figure reports the share of misreported preferential tariffs, i.e. the number of preferential tariffs that got falsely reported despite no RTA is in force.

Figure A5: AHS Simple Average Mexico-United States

(a) Effectively Applied Tariff Mexico-United States

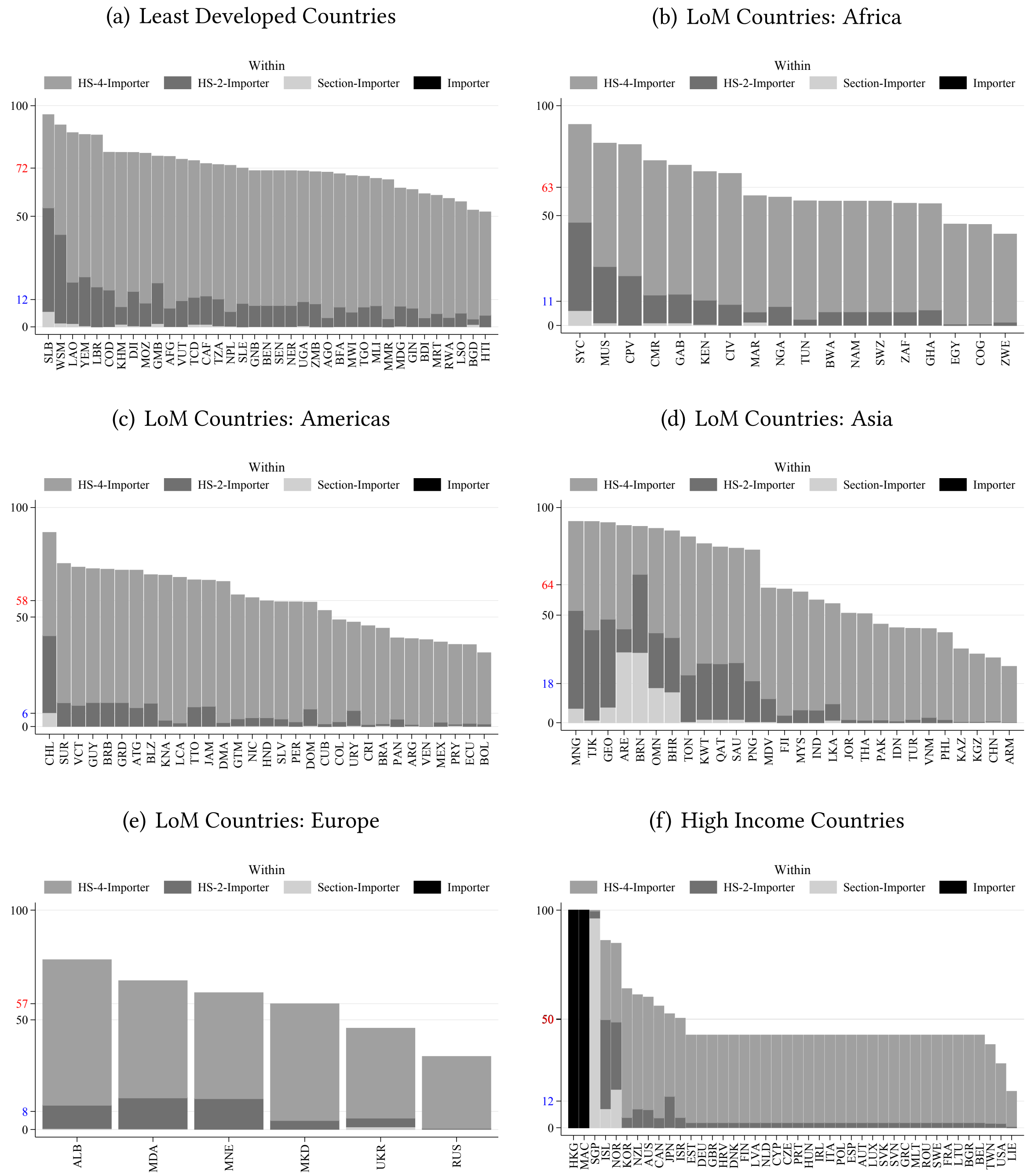


(b) Effectively Applied Tariff Mexico-Germany



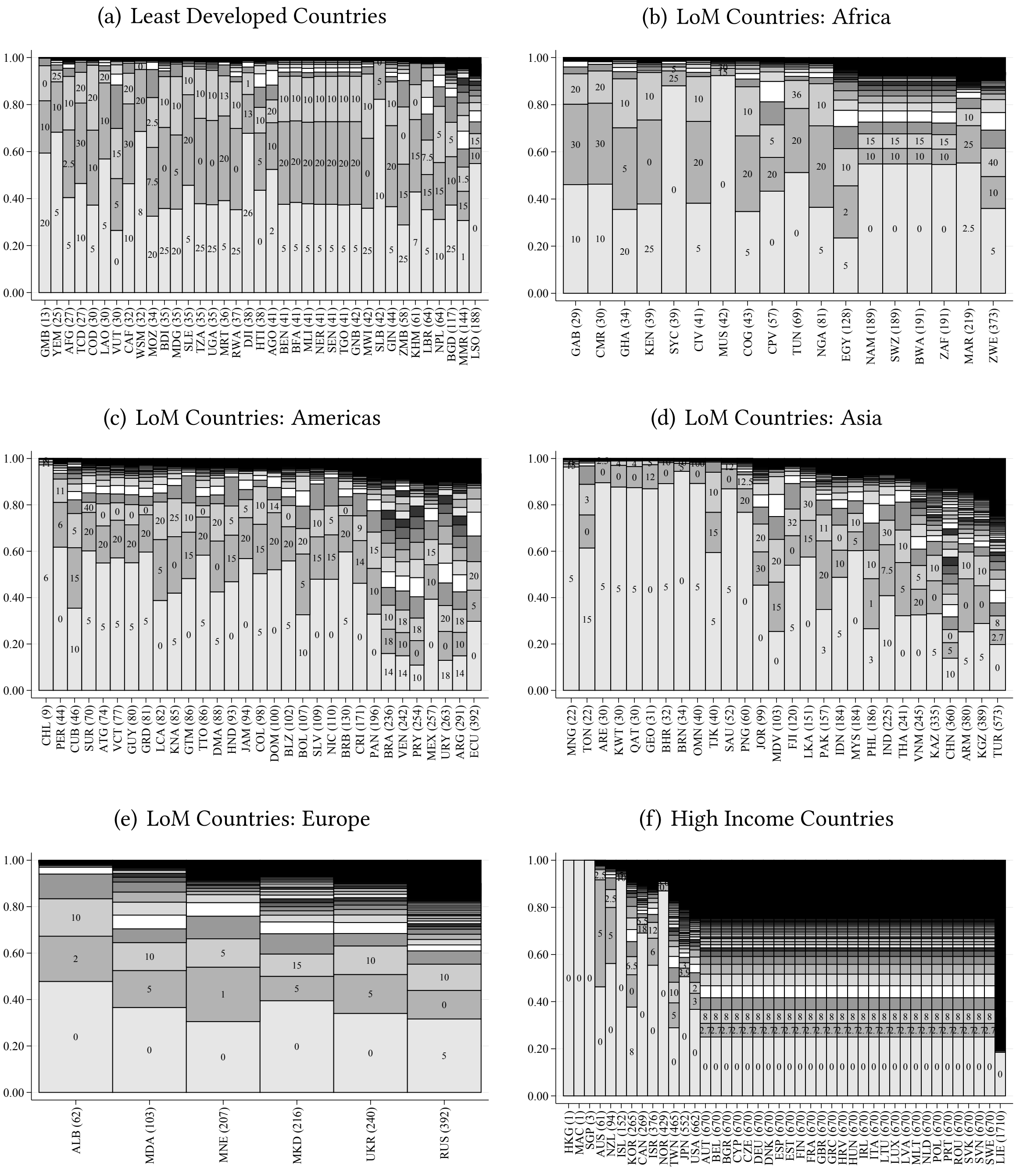
Note: The graph shows the simple average of the effectively applied tariff (in WITS this tariff type is called AHS) that Mexico imposes on imports from the United States (Panel (a)) and Germany (Panel(b)) using the original data that can be downloaded from WITS. NAFTA, the FTA between Mexico, Canada and the United States, entered into force in 1994. The FTA between the EU and Mexico entered into force in 2000. Mexico did not report tariffs for the years 1990 and 1992 to 1994.

Figure A6: Heterogeneity in the Share of Same Tariffs



Note: The graph shows the share of same tariffs across countries and within different levels of aggregation. I distinguish between different levels of aggregation (HS-4, HS-2, section, and all products, i.e. the importing country). The red label on the y-axis equals the average share of same tariffs within HS4-importer for the respective country group and the blue label equals the average share of same tariffs within HS2-importer.

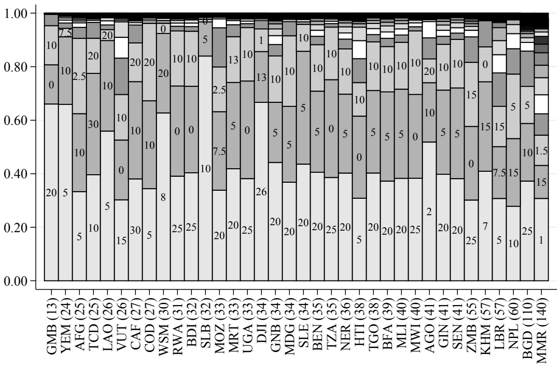
Figure A7: Distribution of Unique Tariffs and Most Frequently used Tariff across Countries



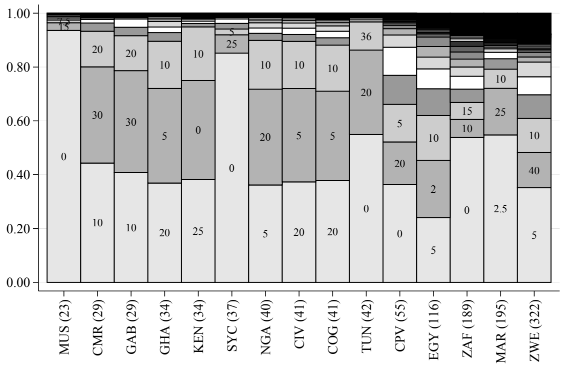
Note: The graph shows the number of unique tariffs a countries has in place. The countries on the x-axis are ordered by the number of total unique tariffs, i.e. the further on the right the more unique tariffs. Whenever two countries have the same total number of unique tariffs the countries are ordered alphabetically. Furthermore, the graph shows the three most frequently used tariffs by country. The total number of unique MFN tariffs is in parentheses behind the country-code on x-axis.

Figure A8: Distribution of Unique Tariffs and Most Frequently used Tariff across Countries (Positive Imports)

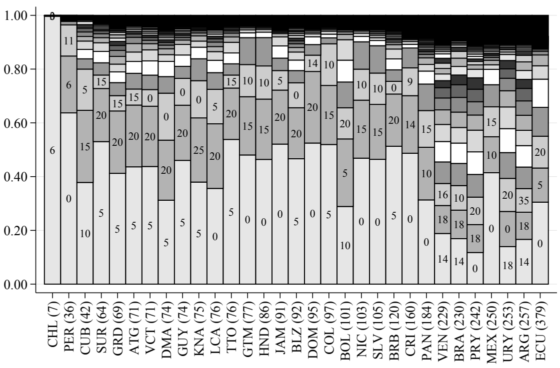
(a) Least Developed Countries



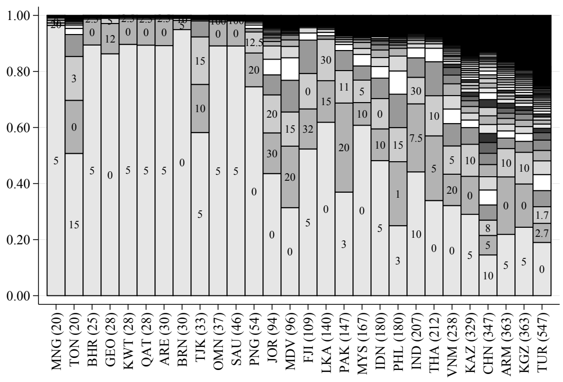
(b) LoM Countries: Africa



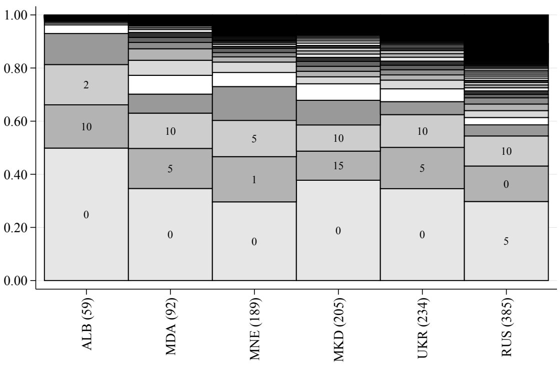
(c) LoM Countries: Americas



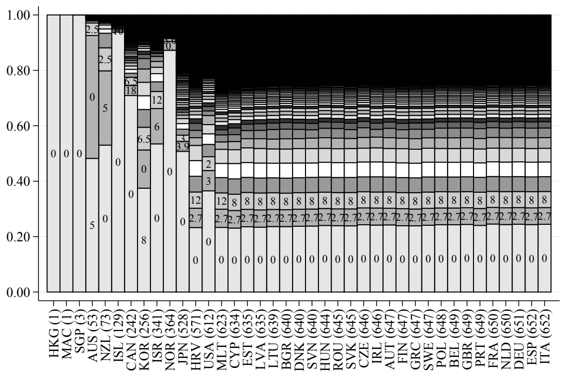
(d) LoM Countries: Asia



(e) LoM Countries: Europe



(f) High Income Countries



Note: The graph shows the number of unique tariffs a countries has in place excluding HS6-products that are not imported.The countries on the x-axis are ordered by the number of total unique tariffs, i.e. the further on the right the more unique tariffs. Whenever two countries have the same total number of unique tariffs the countries are ordered alphabetically. Furthermore, the graph shows the three most frequently used tariffs by country. The total number of unique MFN tariffs is in parentheses behind the country-code on x-axis.

Table A4: Description of Sections

Numeric	Abbreviation	Description
1	ANIM	Live Animals
2	VEGE	Vegetable Products
3	FATS	Fats & Oils
4	FOOD	Food, Bev. & Tobacco
5	MINE	Mineral Products
6	CHEM	Chemicals
7	PLAS	Plastics
8	LEATH	Leather
9	WOOD	Wood Products
10	PAPER	Pulp & Paper
11	TEXT	Textile & App.
12	FOOT	Footwear
13	STON	Stone & Glass
14	JEW	Jewelery
15	META	Base Metals
16	MACH	Mach. & Elec. Equipment
17	TRAN	Transportation Rq.
18	OPT	Optics
19	ARMS	Arms & Ammun.
20	MISC	Miscall. Manufactured Articles
21	ART	Works of Art

Note: The table lists all sections, their abbreviations and full descriptions.

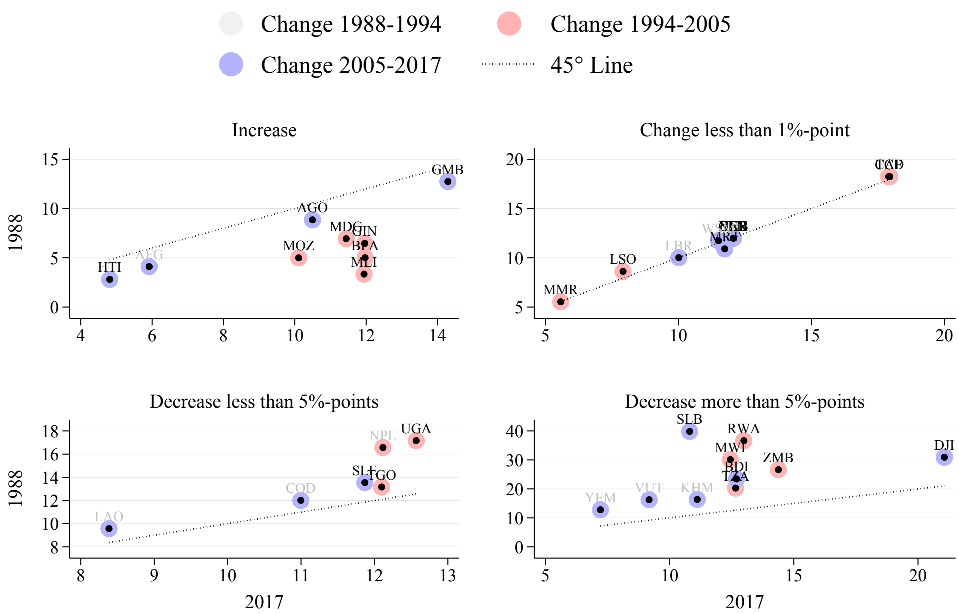
Table A5: Change in MFN Tariffs across Income Groups (Agricultural Products)

	$\Delta T_0^1 = t_1 - t_0$				$B = 1$ if $\tilde{t}_{ik} < t_{ik}^{before}$		
	ΔT_{88}^{17}	ΔT_{05}^{17}	ΔT_{94}^{05}	ΔT_{88}^{94}	P(B)	P(B)	$\Delta T_{88}^{17} \| B = 0$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LDCs	-2.45***	3.12***	-6.26***	0.68**	-0.54***	-0.48***	-7.69***
	(0.54)	(0.34)	(0.44)	(0.33)	(0.00)	(0.01)	(0.90)
LoM Africa	-8.16***	-1.33***	-8.18***	1.35***	-0.40***	-0.29***	-11.22***
	(0.59)	(0.48)	(0.56)	(0.32)	(0.00)	(0.01)	(0.95)
LoM Americas	-0.12	3.89***	-4.26***	0.25	-0.55***	-0.28***	-6.31***
	(0.51)	(0.30)	(0.43)	(0.33)	(0.00)	(0.01)	(0.88)
LoM Asia	-5.90***	3.63***	-8.73***	-0.80**	-0.47***	-0.11***	-9.96***
	(0.62)	(0.45)	(0.59)	(0.37)	(0.00)	(0.01)	(0.97)
LoM Europe	-0.88*	3.05***	-6.13***	2.20***	0.00	0.15***	-4.79***
	(0.51)	(0.34)	(0.50)	(0.35)	(.)	(0.01)	(0.96)
HICs (Ref. Group)	-2.22***	-4.42***	3.36***	-1.17***	0.59***	0.55***	4.44***
	(0.47)	(0.25)	(0.42)	(0.32)	(0.00)	(0.01)	(0.87)
Observations	112,092	112,092	112,092	112,092	86,615	25,477	82,825
joined WTO					< 1995	> 1995	all

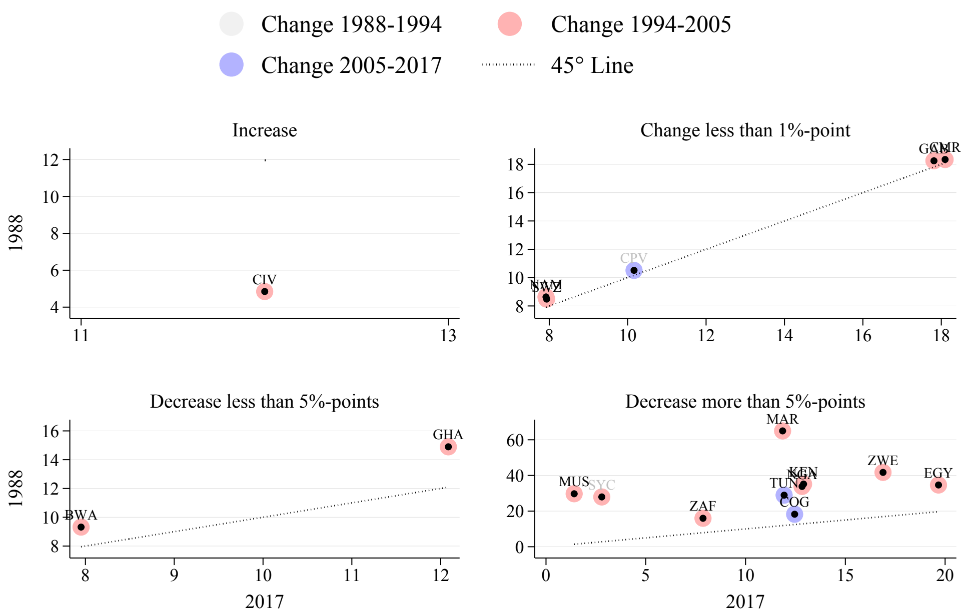
Note: The table shows the regression output of $y_{ik} = \sum_{G=1}^{6} \beta_G I^G + u_{ik}$. In columns (1) to (4) the dependent variable y_{ik} equals the absolute change in the MFN tariff ΔT_0^1 for different time intervals. In column (5) and (6) the dependent variable is the probability of having a binding bound tariff P(B), in column (7) it is the change in MFN tariffs between 1988 and 2017 for products with a binding bound tariff. See the main text for the definition of B. Robust standard errors in parentheses. ***/**/* indicate significance at the 1%/5%/10% level.

Figure A9: Changes in the Average Applied MFN Tariff (1988 – 2017, in %-points)

(a) Least Developed Countries



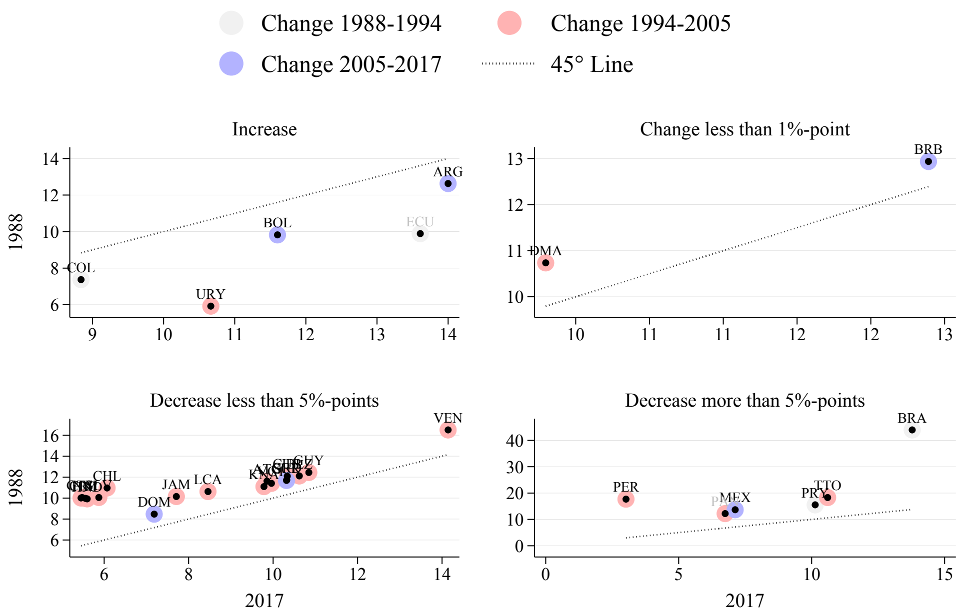
(b) Low and Middle Income Countries: Africa



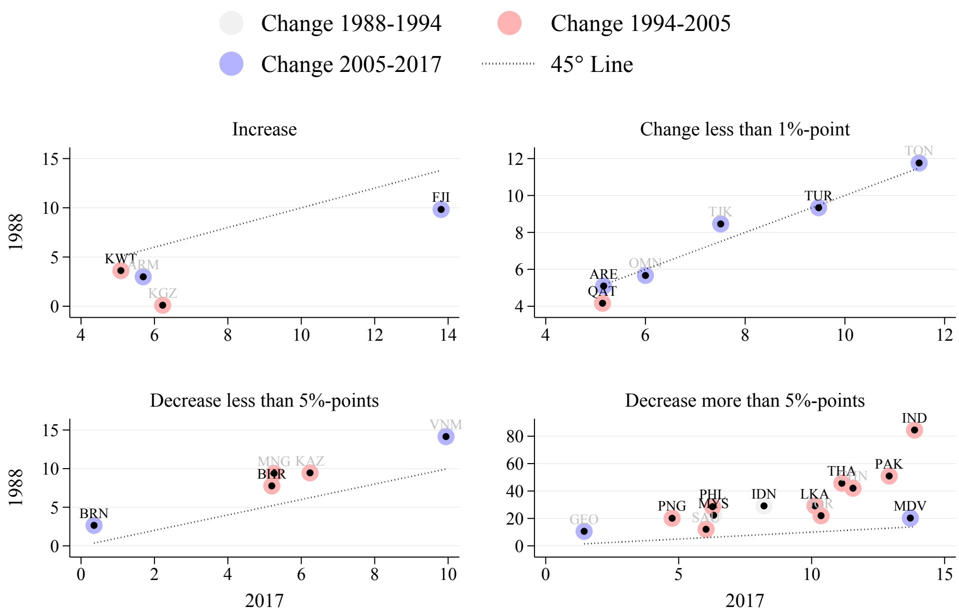
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took place. The country-codes of countries that joined the WTO after 1995 are in gray.

Figure A9: Changes in the Average Applied MFN Tariff (1988 – 2017, in %-points) *-continued*

(c) Low and Middle Income Countries: Americas



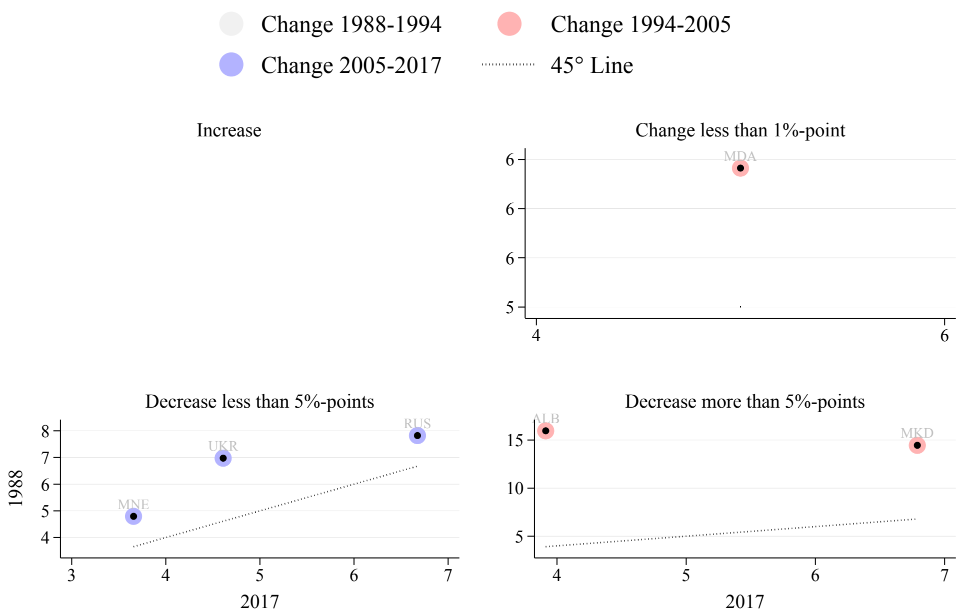
(d) Low and Middle Income Countries: Asia



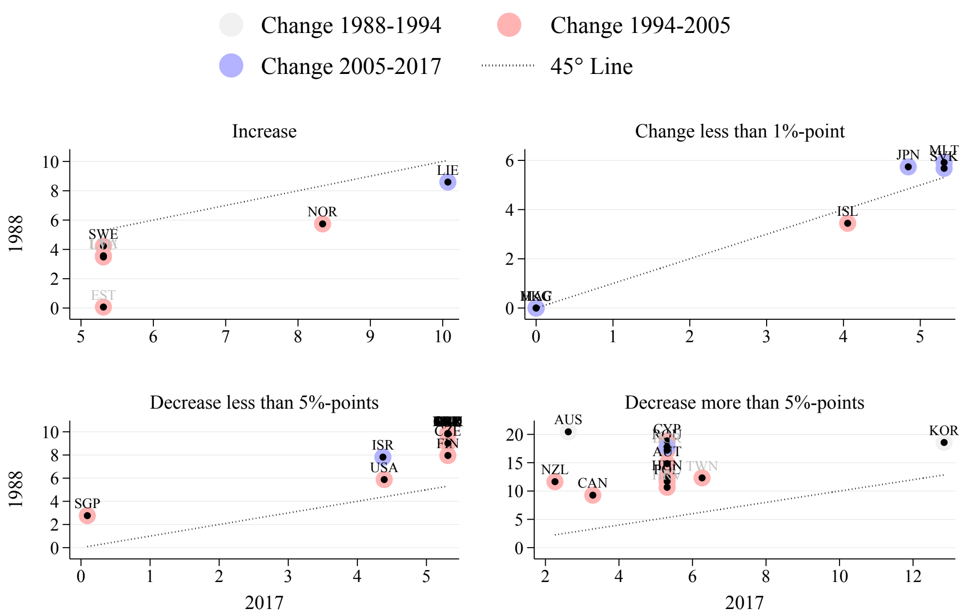
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took place. The country-codes of countries that joined the WTO after 1995 are in gray.

Figure A9: Changes in the Average Applied MFN Tariff (1988 – 2017, in %-points) *-continued*

(e) Low and Middle Income Countries: Europe

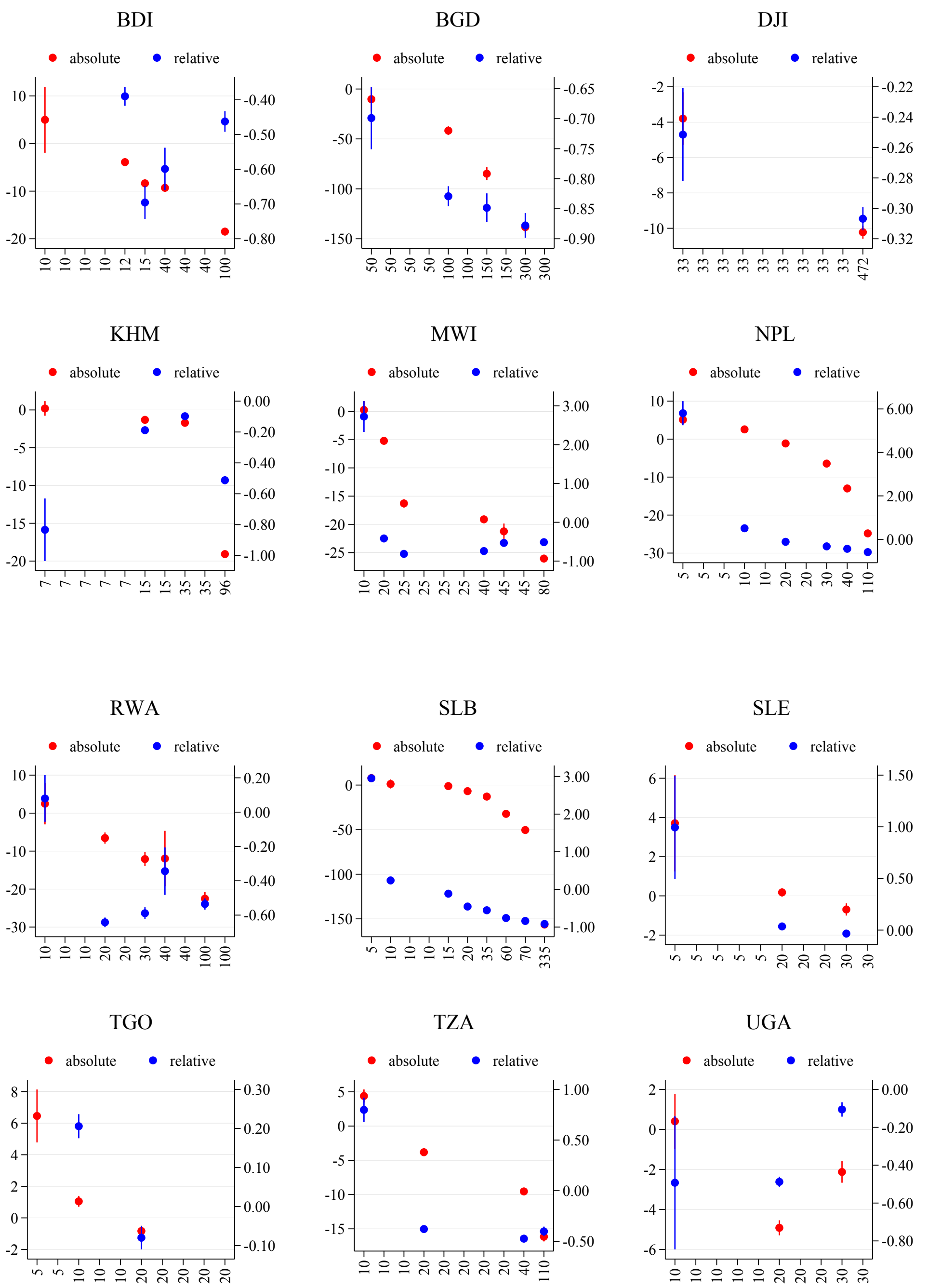


(f) High Income Countries



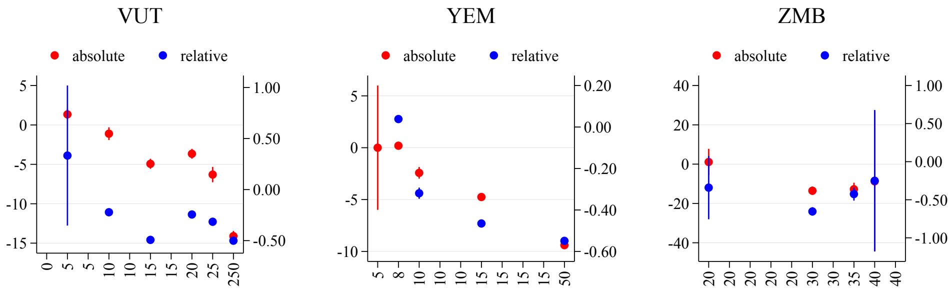
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took place. The country-codes of countries that joined the WTO after 1995 are in gray.

Figure A10: Pattern in Tariff Reductions (2017 − 1988) for LDCs



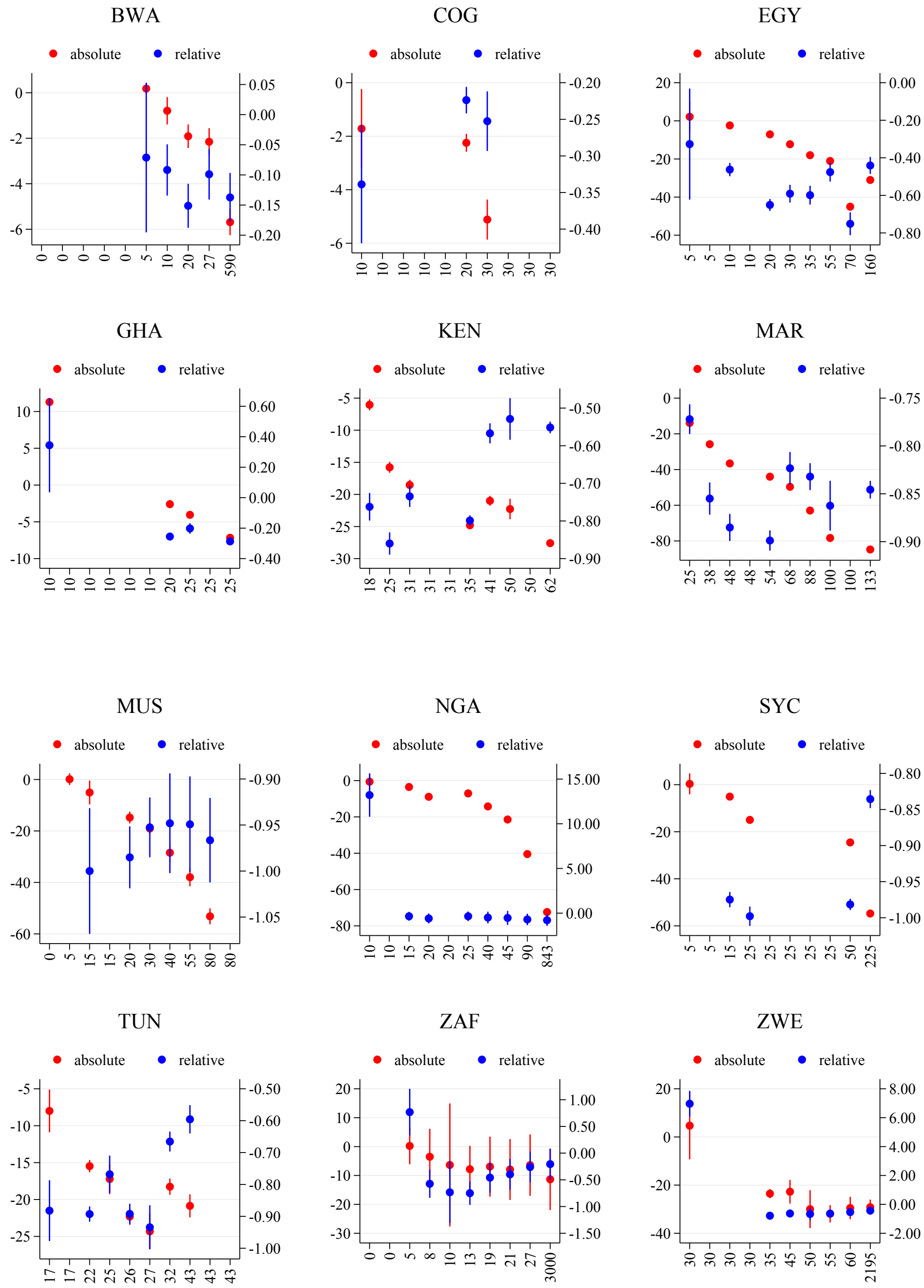
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A10: Pattern in Tariff Reductions (2017 – 1988) for LDCs — *continued*



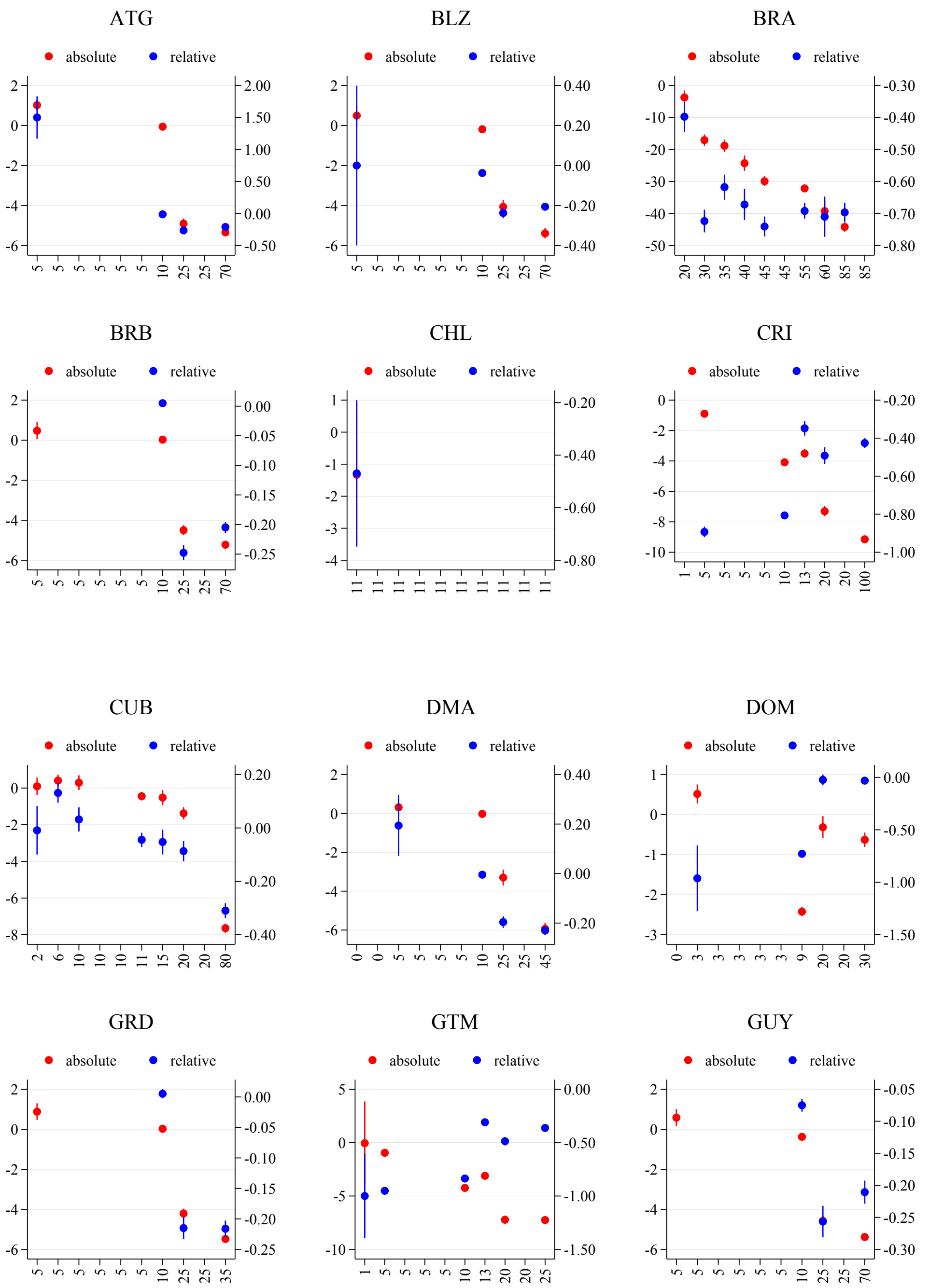
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A11: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in Africa



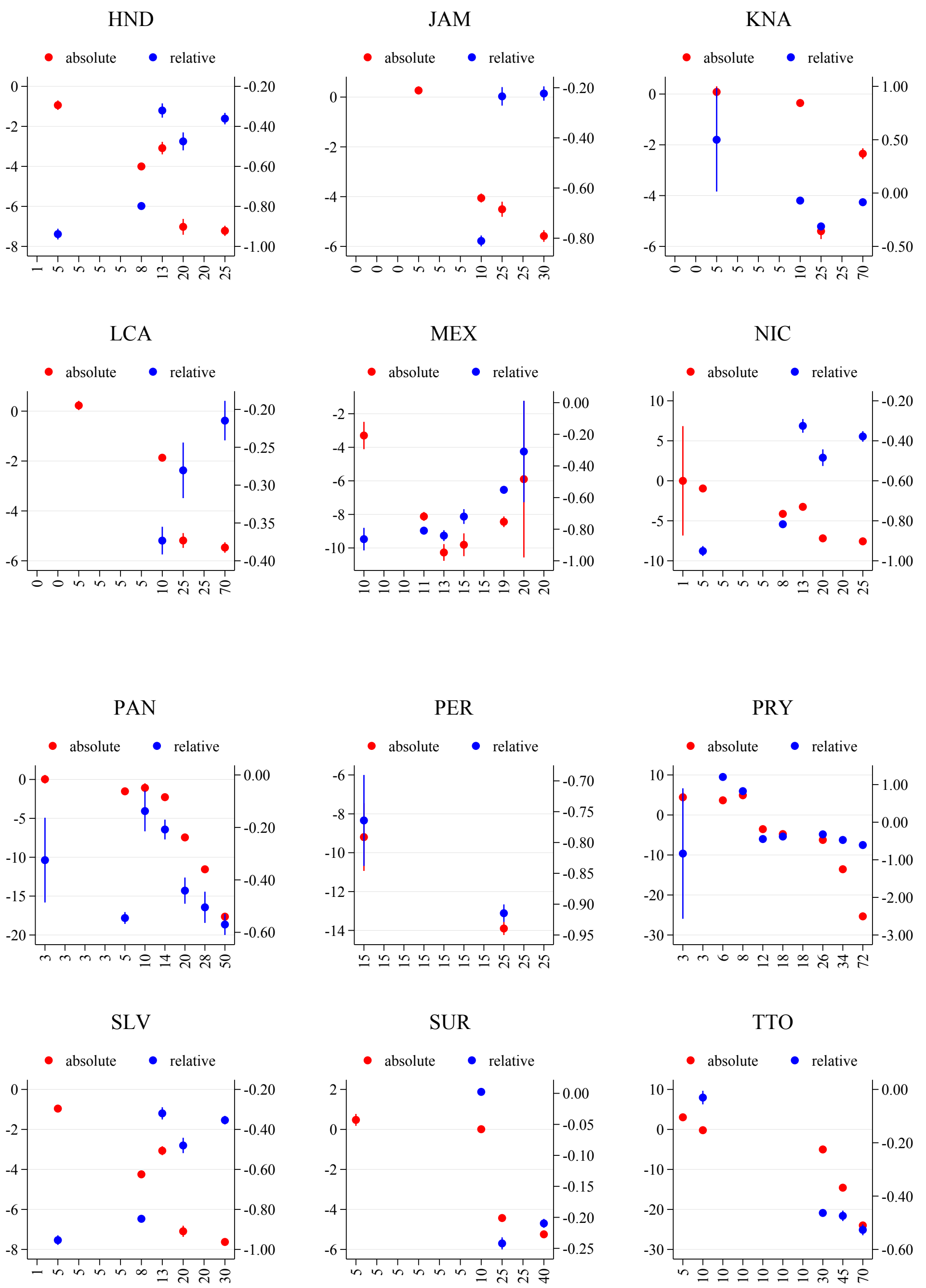
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A12: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in the Americas



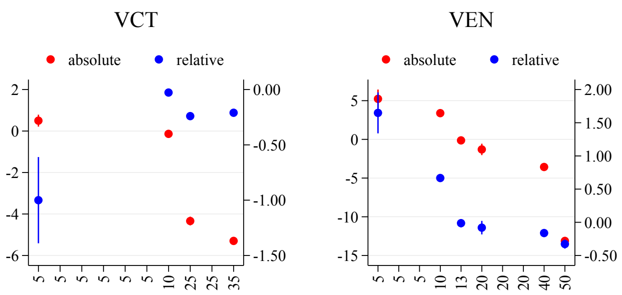
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A12: Pattern in Tariff Reductions (2017 – 1988) for LoM Countries in the Americas — *continued*



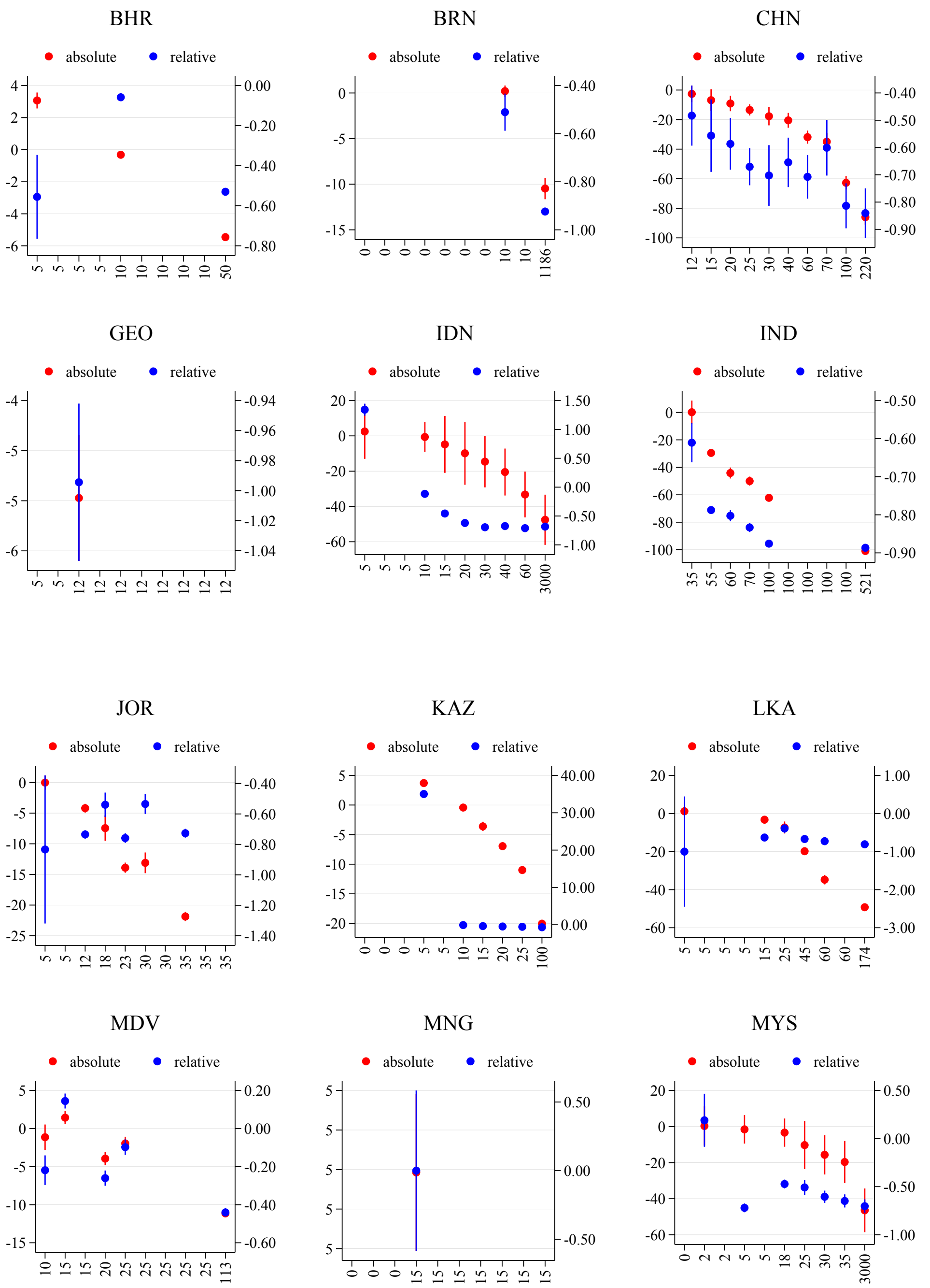
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A12: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in the Americas — *continued*



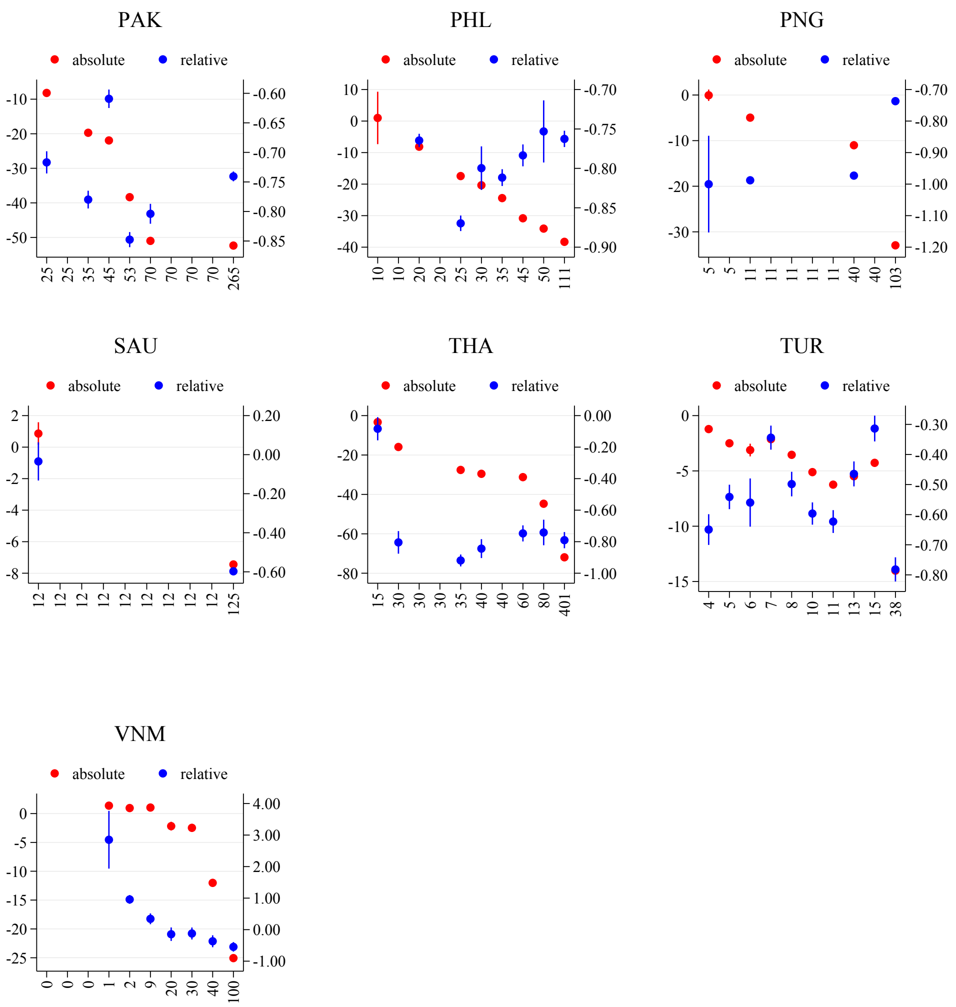
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A13: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in Asia



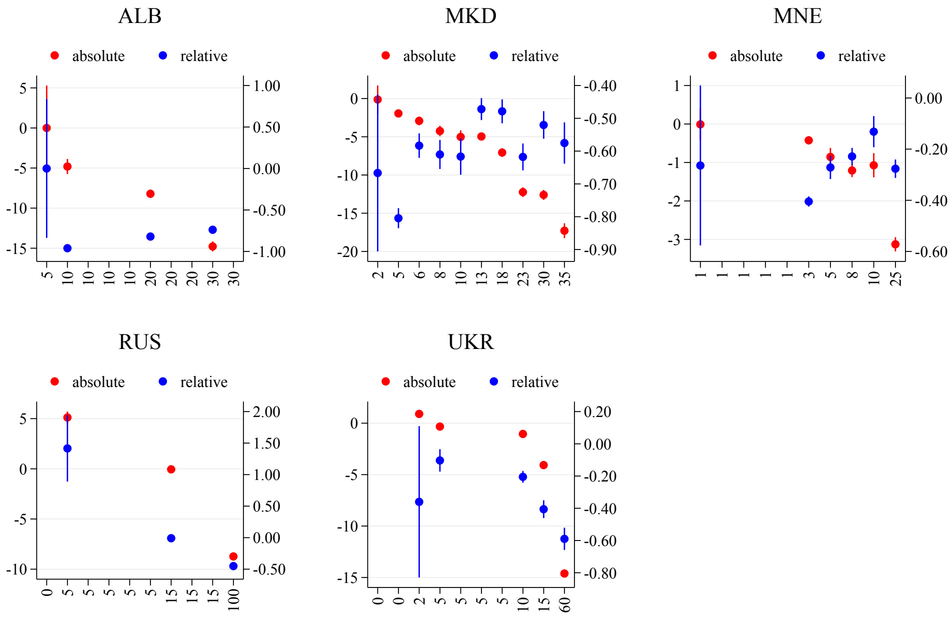
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A13: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in Asia *—continued*



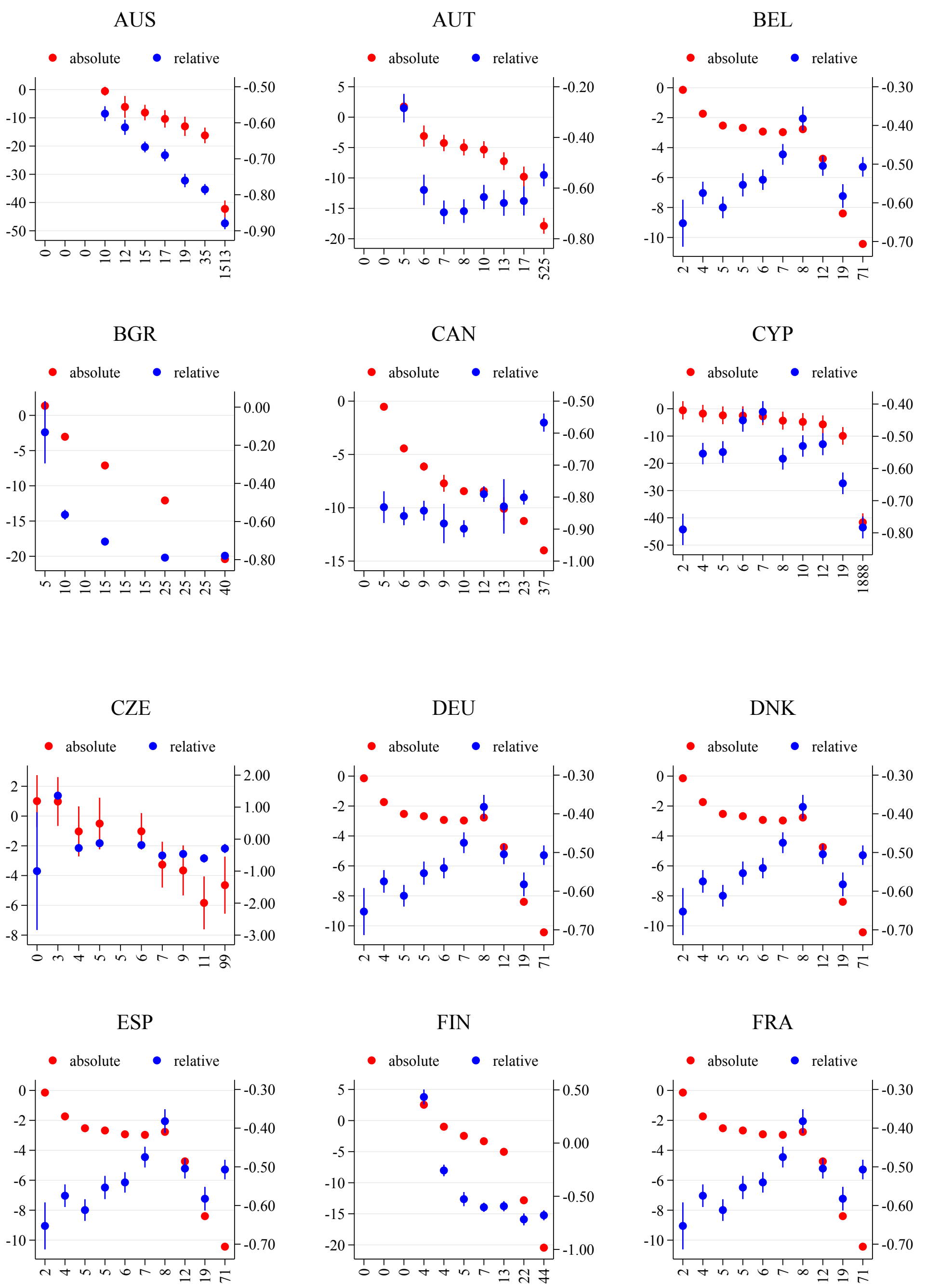
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A14: Pattern in Tariff Reductions (2017 − 1988) for LoM Countries in Europe



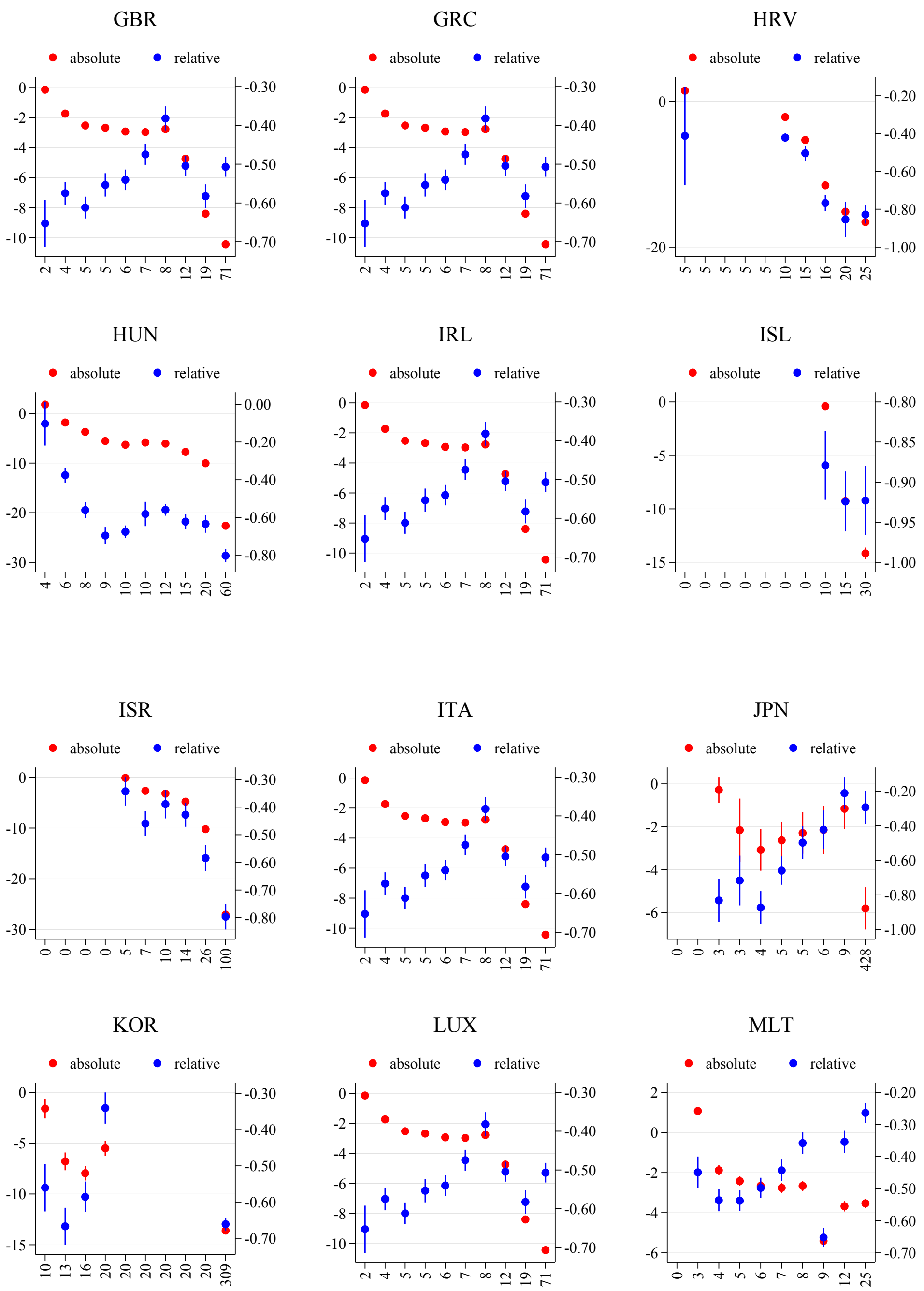
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A15: Pattern in Tariff Reductions (2017 – 1988) for High Income Countries



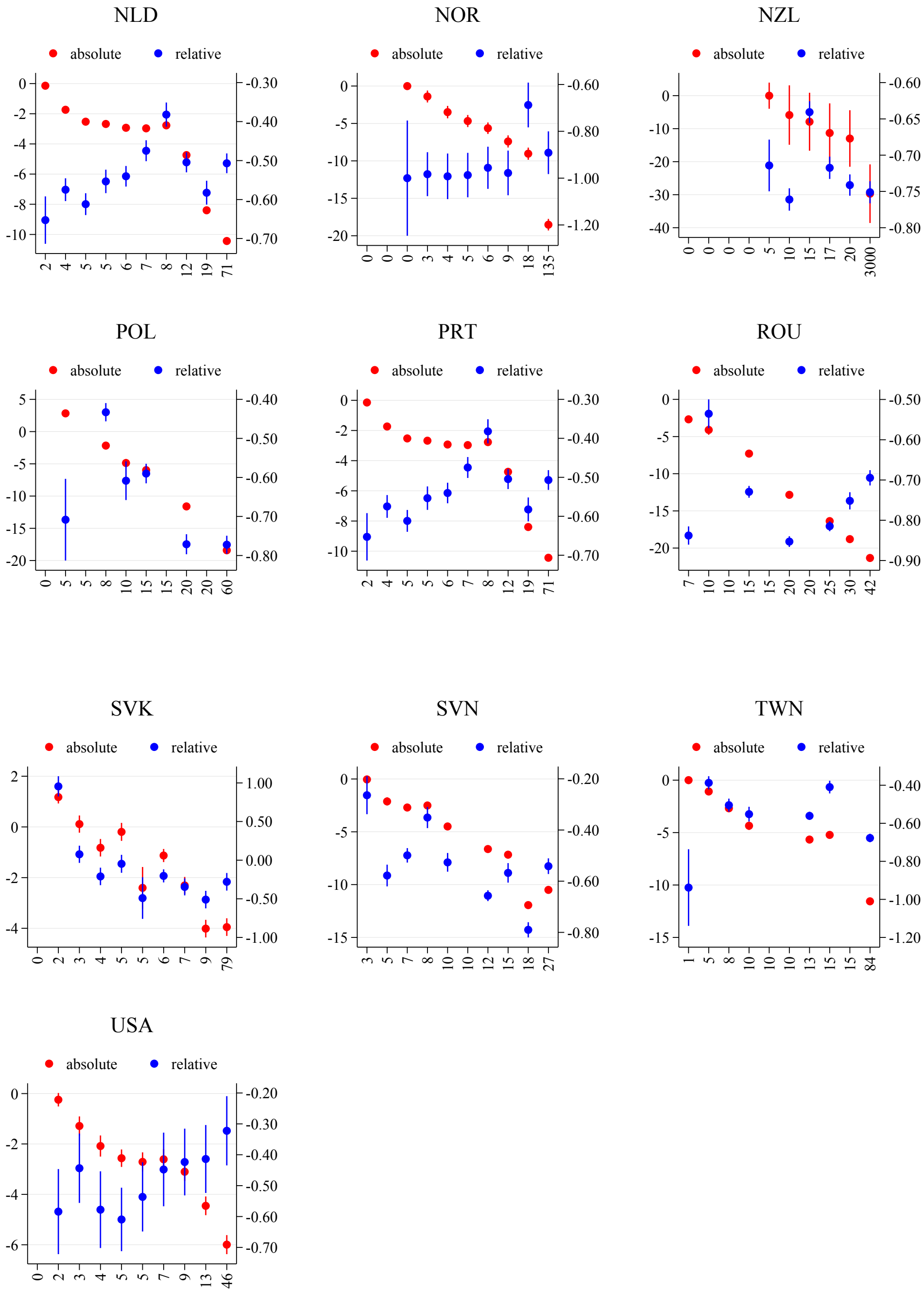
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A15: Pattern in Tariff Reductions (2017 – 1988) for High Income Countries *—continued*



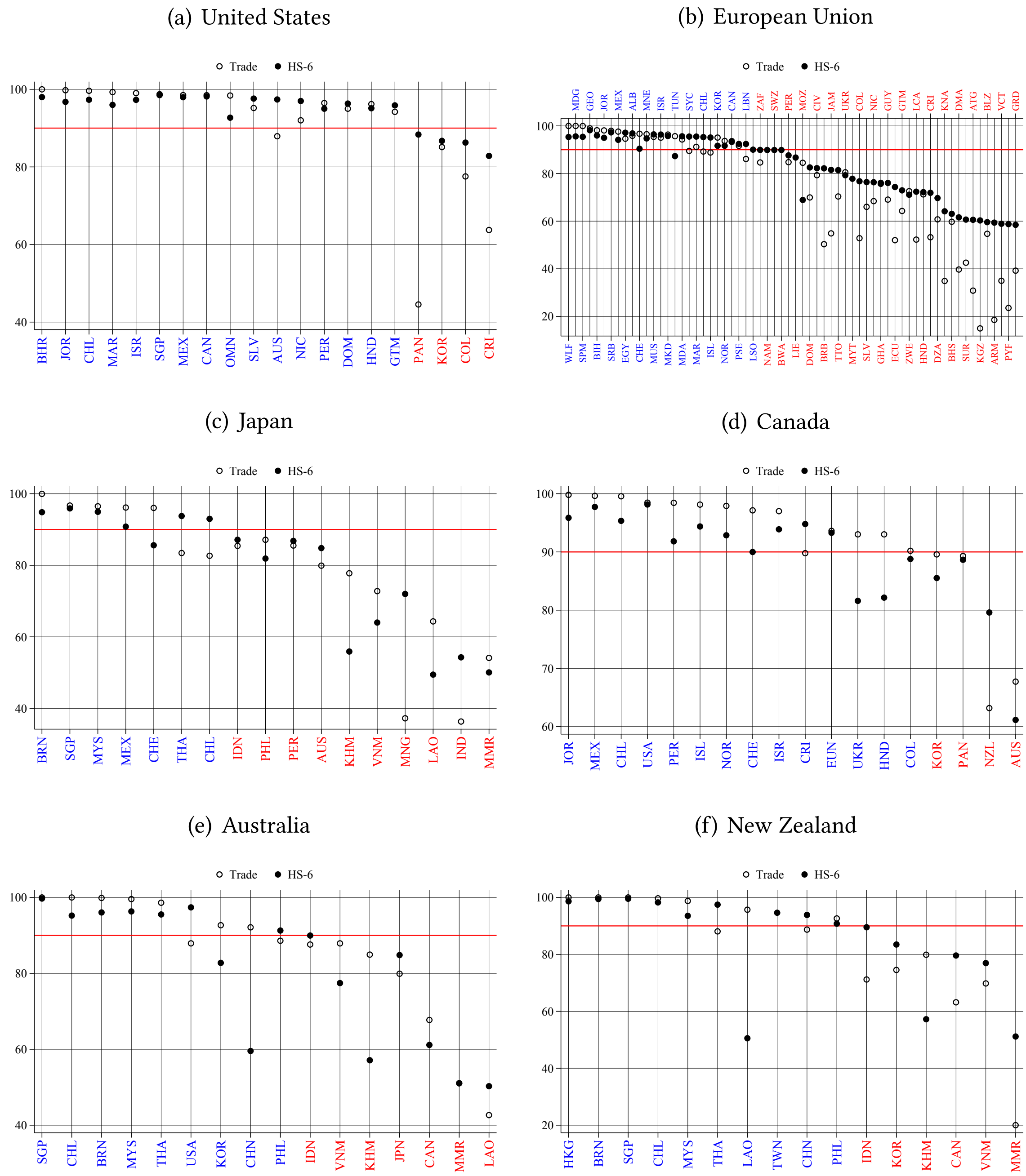
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

Figure A15: Pattern in Tariff Reductions (2017 – 1988) for High Income Countries *—continued*



Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition of the two dependent variables).

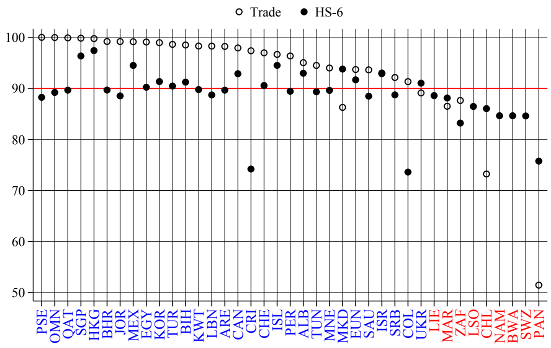
Figure A16: Pairwise Share of Zero Trade and Tariff Lines with Zero Tariffs (in %)



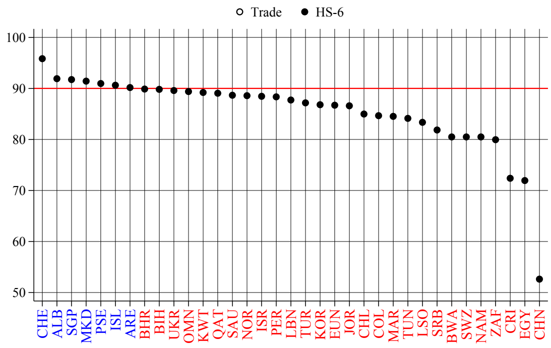
Note: The graph shows the two interpretations of the substantially-all-trade criterion, namely the pairwise share of zero trade and tariff lines with zero tariffs for all North-South country pairs.

Figure A16: Pairwise Share of Zero Trade and Tariff Lines with Zero Tariffs (in %) — *continued*

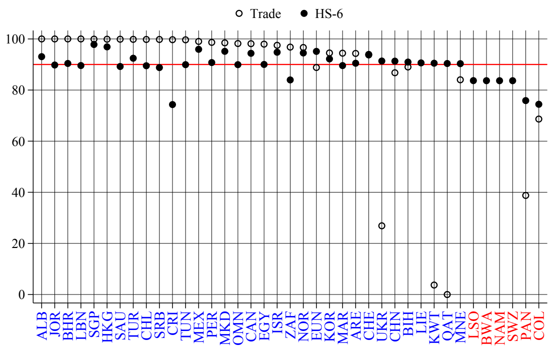
(g) Norway



(h) Liechtenstein

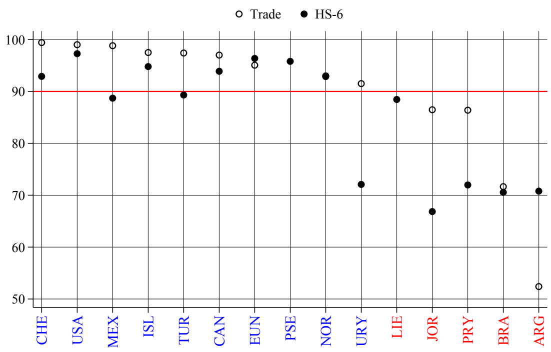


(i) Iceland

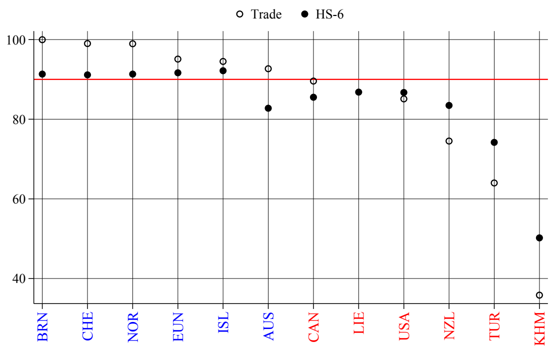


(j) Singapore

(k) Israel



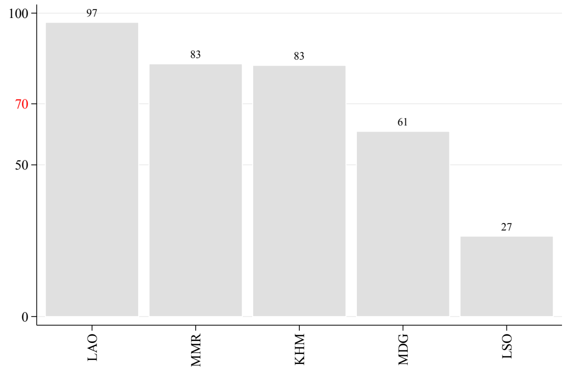
(l) South Korea



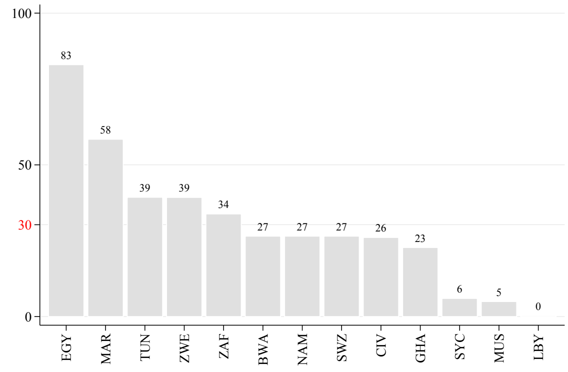
Note: The graph shows the two interpretations of the substantially-all-trade criterion, namely the pairwise share of zero trade and tariff lines with zero tariffs for all North-South country pairs.

Figure A17: Phasing-In across Countries

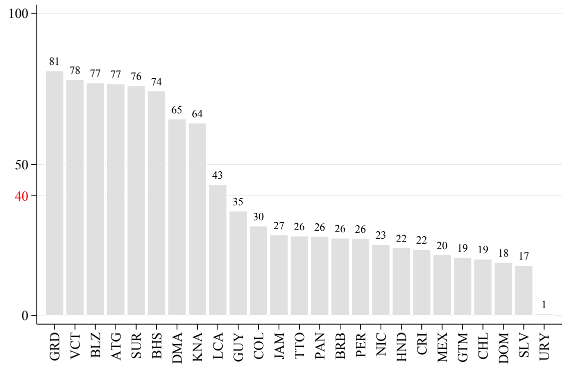
(a) Least Developed Countries



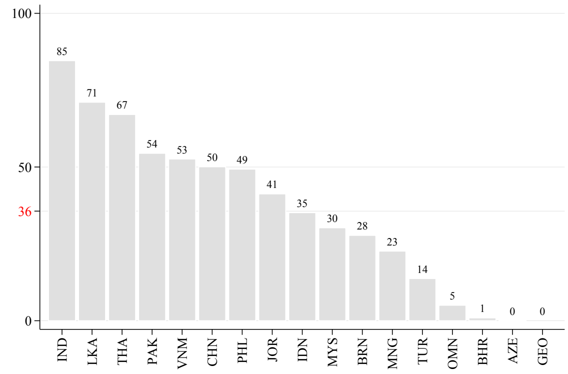
(b) LoM Countries: Africa



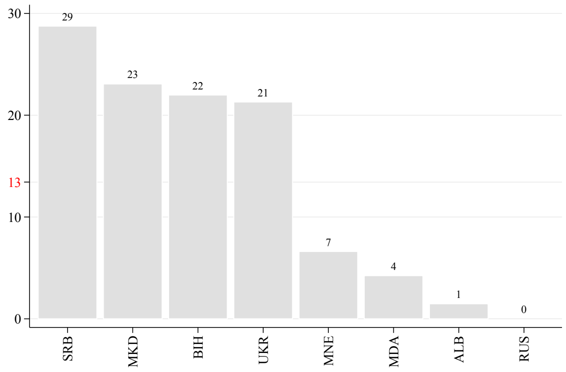
(c) LoM Countries: Americas



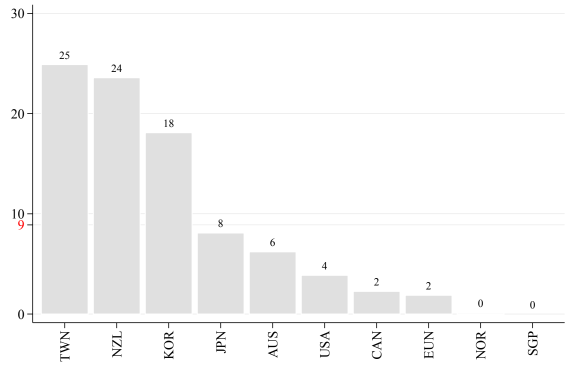
(d) LoM Countries: Asia



(e) LoM Countries: Europe



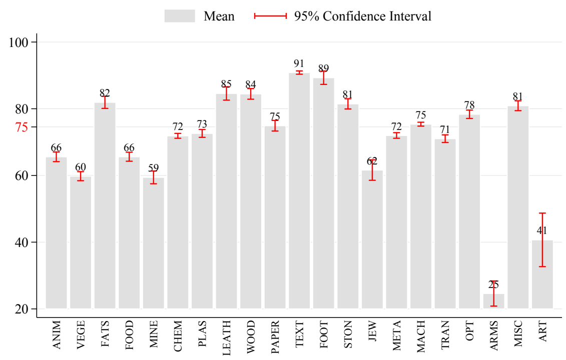
(f) High Income Countries



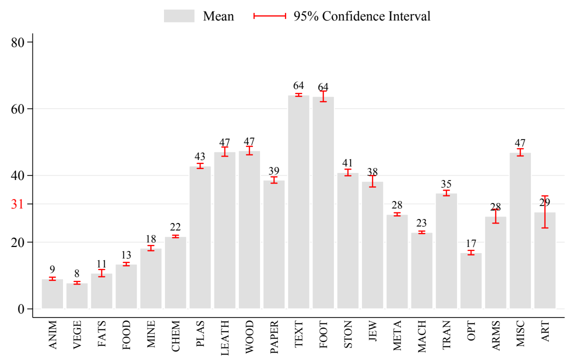
Note: The graph shows the probability of Phasing-In across all countries. The sample is different from the one used in the main analysis because this information is not available for all FTAs but instead only 149. The countries on the x-axis are sorted by descending order.

Figure A18: Probability of Phasing-In across Sectors by Income Groups

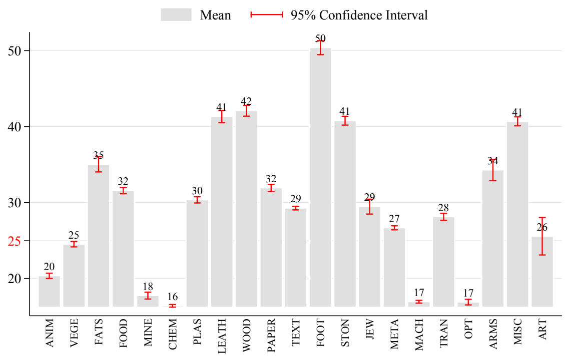
(a) Least Developed Countries



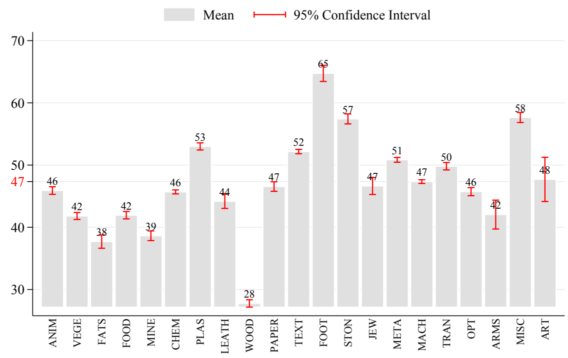
(b) LoM Countries: Africa



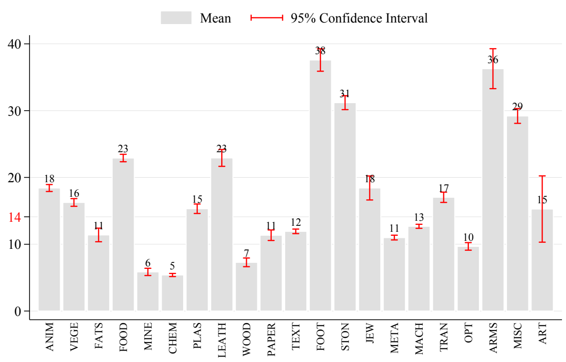
(c) LoM Countries: Americas



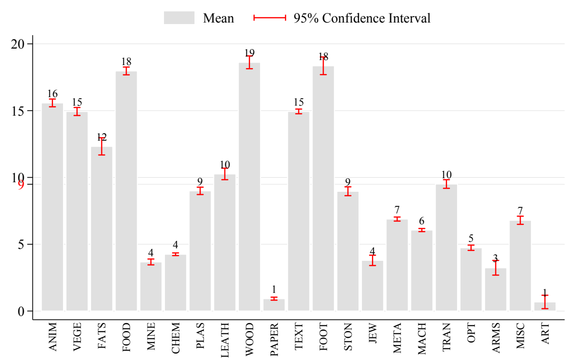
(d) LoM Countries: Asia



(e) LoM Countries: Europe



(f) High Income Countries



Note: The graph shows the probability of Phasing-In across all countries. The sample is different from the one used in the main analysis because this information is not available for all FTAs but instead only 149. The countries on the x-axis are sorted by descending order.

Table A6: Unilateral Trade Liberalizations used in the Literature

Country	Description of Trade Liberalization	Included in Tariff Database?	Example
Argentina	Argentina started to reduce its MFN tariff in October 1988, by October 1991 most of the cuts were in place	*no* — 1992 is the first time tariffs have been reported	Bustos (2011)
Brazil	Brazil implemented large tariff cuts from 1990 to 1995	*yes* — tariffs are annually reported from 1989 onwards	Bustos (2011), Kovak (2013), Menezes-Filho and Muendler (2011), and Dix-Carneiro and Kovak (2017)
Chile	from 1974-1979 tariffs were reduced to 10%, during crisis years in 1982 to 1984 the tariff was increased again to 35%, only to be reduced from 1985 (20%) onwards. It equaled 15% in 1988 and in 1991 11%	*no* — most of the trade liberalization happened before 1988 and because Chile starts to report MFN tariffs only in 1992 even the last cut from 1988 to 1991 is not observable in the data	Corbo (1997), Pavcnik (2002), L. Liu (1993), and Tybout et al. (1991)
Costa Rica	starting in 1986, Costa Rica reduced tariffs until mid 1990's	*no* — tariffs are not reported for the years 1988-1994. By the first reported year, most of the liberalization has already took place	Arkolakis et al. (2008)
Cote d'Ivoire	trade reform with tariff cuts by on average 30% was implemented in 1985 and extended in 1986 and early 1987	*no* — tariff reductions have been already implemented before tariff database starts in 1988	Harrison (1994)
India	tariffs decreased drastically from 1991 (80%) to 1997 (37%)	*partially* — tariffs are reported in 1990, 1992 and from 1996-2017. Therefore, the large cuts can only be observed partially	Topalova (2010), Topalova and Khandelwal (2011), and De Loecker et al. (2016)
Indonesia	Indonesia committed to reduce all bound tariffs to 40% or less over a ten-year period starting 1995, also applied tariffs were decreased	*yes* — tariffs are reported annually from 1995 onwards, even some observations for the years before the WTO accession (1989, 1990 and 1993)	Amiti and Konings (2007)
Turkey	The 1984 import program significantly reduced both tariff and non-tariff barriers (immediate cuts)	*no* — 1992 is the first time tariffs have been reported, i.e. after implementation of trade liberalization	Levinsohn (1993)

Note: The table gives an overview of the unilateral trade liberalizations in developing countries used in the literature. Neither the list of trade liberalizations is exhaustive nor of the references.

Appendix B

Appendix to Chapter 2

B.1 Tariff Data

Using the World Bank's World Integrated System (WITS) software, which pools data from the United Nations and the World Trade Organization, we combine all publicly available information on MFN tariffs and preferential tariffs.[1] The data have information for more than 150 countries on the 6-digit product level of the common HS system with some of the data dating back to 1988.[2] Whenever more than one preferential scheme applies (i.e. a bilateral FTA or GSP), we always assume the lowest preferential tariff to be effectively in place. We complement this data with tariffs from the USITC and the European Commission (TARIC), which have been cleaned by Forero-Rojas et al. (2018).

Unfortunately, the WITS data need substantial cleaning and completing. Anderson and Van Wincoop (2004) state *"the grossly incomplete and inaccurate information on policy barriers available to researchers is a scandal and a puzzle" (p. 693).* Almost 15 years after writing these words, the situation is still not much better. Most countries do not report tariffs every year: for example in 1996 out of 126 WTO-members only 49% reported tariffs. Even more troublesome, the set of countries that report only sporadically is not random but rather consists mostly of developing countries. As tariffs tend to be systematically different between developing and developed countries, the non-random pattern of missing data could bias results.

So far, there is no consensus in the literature how to tackle the problem. We deal with the missing data in the following way: rather than replacing missing MFN tariffs by linearly interpolating observations, we set them equal to the nearest preceding observation. This pro-

[1] In case of specific tariffs, the sources report ad valorem equivalents.

[2] Tariffs are typically defined at the 8-digit level. We use 6-digits because this is the most disaggregated level where product classifications are harmonized across countries; beyond 6-digits every country has its own product classification. Moreover, tariffs at such disaggregated levels are not available for a broad range of countries. We will provide sensitivity analysis related to the level of aggregation.

cedure accounts for the WTO logic of notification, when countries report only policy changes. If there is no preceding observation, missing MFN tariffs are set equal to the nearest succeeding observation. As the MFN tariff only applies when a country is a member of the WTO, inferring tariffs without inducing large margins of error is only possible for countries that are WTO members. Thus, whenever the exporting or importing country is not a WTO-member we do not interpolate any data. For preferential tariffs interpolating is significantly harder because FTAs are often phased-in. For a precise interpolation, we use detailed information for more than 500 FTAs.[3]

Due to revisions of the Harmonized System in 1996, 2002, 2007 and 2012 the product-identifiers are not uniform across countries and over time in the original data. Thus, to impute the data it is necessary to convert all products into one revision. Furthermore, not all countries report in the same revision, especially developing countries often keep using the older revision, developed countries typically switch once the newer one is available. For any cross-country analysis the product codes need to be transformed into consistent ones across all reporting countries. We use the methodology developed by Pierce and Schott (2012) to create consistent six digit product classification changes over time. We end up with 4,455 product codes.

B.2 Estimation of Transportation Costs

In this section, we give some background information on the estimation of transportation costs. We assume transportation costs to be a function of distance D_{ij} such that $\tau_{ij}^k = \alpha^k (D_{ij})^{\delta^k}$ with $\delta^k \in (0,1)$. Thus, it is possible to estimate the parameters α^k and δ^k for every product k for the US using $\tau_{US,c}^k$ and the bilateral distances between the US and its trading partners i, $D_{US,i}$. Information on bilateral distances comes from CEPII. Taking logs makes OLS a feasible estimator. The regression equation equals $ln(\tau_{US,i}^k) = ln(\alpha^k) + \delta^k ln(D_{US,i}) + u^k$. We regress the cif/fob ratios on the bilateral distance for every product separately to allow for product-specific constants. One can interpret the estimated coefficients as follows: $\hat{\alpha}^k$ is the product-specific component that does not vary across pairs, $\hat{\delta}^k$ represents the component that is pair-specific. For example, perishable freight like vegetables will be more sensitive to the pair-specific bilateral distance than other goods.

Figure B1 Panel (a) shows the distribution of $\hat{\alpha}^k$, while Panel (b) focuses on the distribution of $\hat{\delta}^k$, with $k = 1, ..., 3853$. We group the coefficients by sections. The figures show the range of the values (excluding the top and bottom 10%) and the mean for 2014. There is large

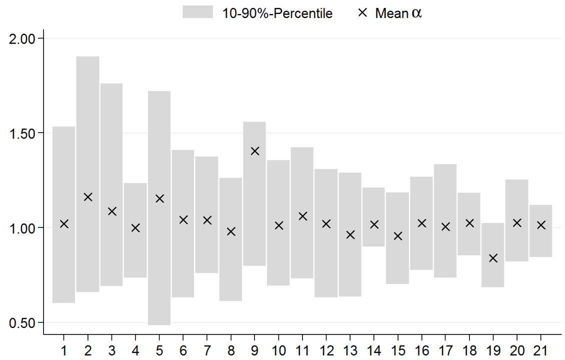
[3] The data is provided by DESTA (Dür et al. 2014). Note that the WITS data sometimes reports MFN tariffs when preferential tariffs should be reported and vice-versa. Our data imputation algorithm accounts for these peculiarities.

variation within as well as across sections. For example, while $\hat{\alpha}^k$ and $\hat{\delta}^k$ are relatively wide spread in sections 1, 2, 3, 5, and 12 , the opposite is true for sections 4, 14, 18, 19, and 21. $\hat{\alpha}^k$ equals on average 1.05 and has a standard deviation of 0.86. The mean of $\hat{\delta}^k$ is 0.01 and the standard deviation equals 0.04.

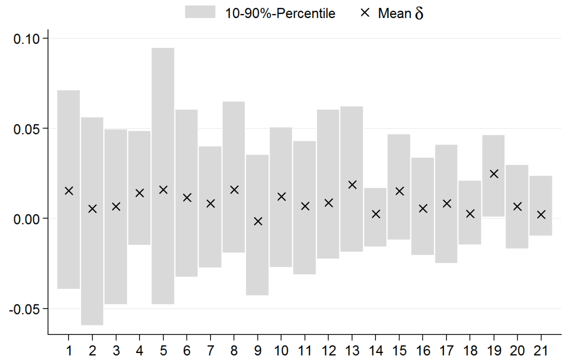
For $\hat{\tau}_{ijkd}$ to be sensible, i.e. $\hat{\tau}_{ijkd} \geq 1$, it must hold that $\hat{\alpha}^k < 1 \iff \hat{\delta}^k > 0$ and $\hat{\alpha}^k > 1 \iff \hat{\delta}^k < 0$. The economic interpretation is straightforward: whenever the product-specific (bilateral) component of transportation costs essentially does not matter, the transportation costs are entirely determined by bilateral (product-specific) characteristics. Therefore, if we had many $\hat{\alpha}^k - \hat{\delta}^k$ combinations where these conditions are violated, we would end up with many unreasonable $\hat{\tau}_{ijkd}$'s. Panel (c) shows the relationship between $\hat{\alpha}^k$ and $\hat{\delta}^k$ for 2014. A clear negative correlation between the two coefficients is apparent ($\rho = -0.96$). Further, there is not a single case where the pair of coefficients lies in the "critical" quadrant, i.e. with $\hat{\delta}^k < 0$ and $\hat{\alpha}^k < 1$. Panel (d) shows the distribution of the estimated transportation costs for 2014. The values concentrate around 1.06, with most of the values laying below 1.25.

Figure B1: Descriptive Facts about the Estimated Transportation Costs (2014)

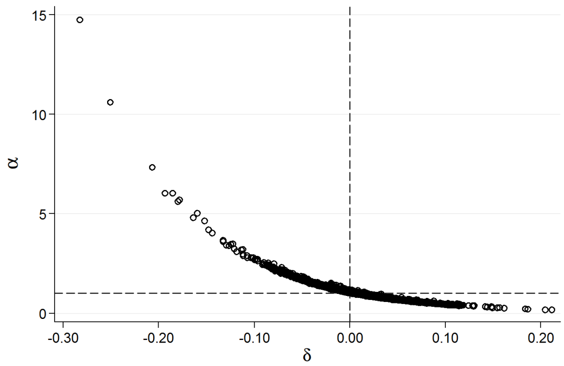
(a) Distribution of $\hat{\alpha}^k$



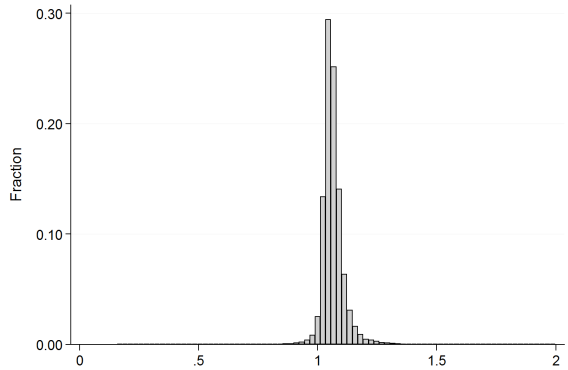
(b) Distribution of $\hat{\delta}^k$



(c) Relationship between $\hat{\alpha}^k$ and $\hat{\delta}^k$ - 2014



(d) Distribution of estimated Transportation Costs $\hat{\tau}$ (2014)



Note: Panel (a) and (b) show the distribution of the $\hat{\alpha}^k$ and $\hat{\delta}^k$. The two coefficients result from estimating the following equation $ln(\tau^k_{US,i}) = ln(\alpha^k) + \delta^k ln(D_{US,i}) + u^k, \forall k$. Panel (c) shows the relationship between the two coefficients of interest. Panel (d) shows the estimated transportation costs for every product-pair combination. All data is for 2014.

B.3 List of Countries in the Sample

The following 129 countries i are in the sample Albania, Argentina, Armenia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Belize, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burundi, Cambodia, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cuba, Cyprus, Czechia, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji, Finland, France, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guyana, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea (the Republic of), Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lesotho, Lithuania, Luxembourg, Macedonia (the former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Malta, Mauritius, Mexico, Moldova, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saudi Arabia, Senegal, Sierra Leone, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Suriname, Swaziland, Sweden, Switzerland, Taiwan (Province of China), Tajikistan, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia, and Zimbabwe.

The following 156 countries j are in the sample Albania, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belgium, Belize, Benin, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Congo (the Democratic Republic of the), Congo, Costa Rica, Croatia, Cuba, Cyprus, Czechia, Côte d'Ivoire, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea (the Republic of), Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lesotho, Lithuania, Luxembourg, Macedonia (the former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova (the Republic of), Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Suriname, Swaziland, Sweden, Switzerland, Taiwan (Province of China), Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia, and Zimbabwe.

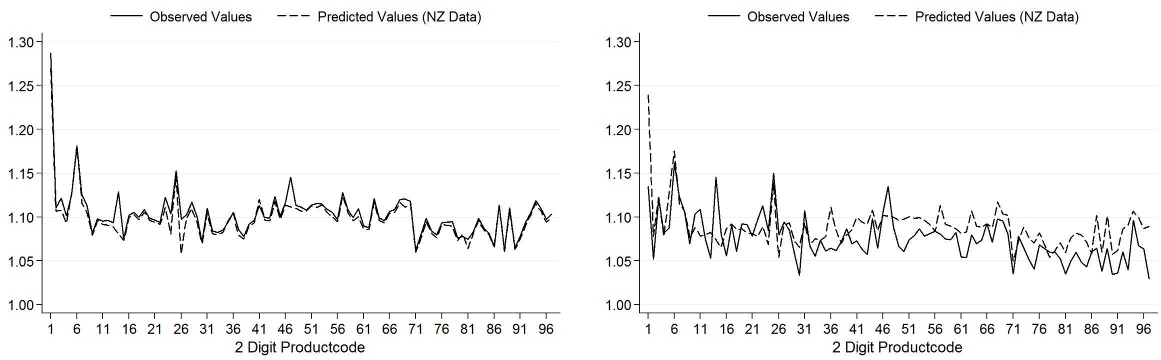
The following 171 countries c are in the sample Albania, Algeria, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bermuda, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo (the Democratic Republic of the), Congo, Costa Rica, Croatia, Cuba, Cyprus, Czechia, Côte d'Ivoire, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Fiji, Finland, France, French Polynesia, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea (the Republic of), Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Luxembourg, Macedonia (the former Yugoslav Republic of), Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, Suriname, Swaziland, Sweden, Switzerland, Taiwan (Province of China), Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Uzbekistan, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Yemen, Zambia, Zimbabwe

B.4 Additional Material

Figure B2: Predicting Transportation Costs using Import Data from New Zealand

(a) In-Sample Prediction: New Zealand

(b) Out-of-Sample Prediction: USA

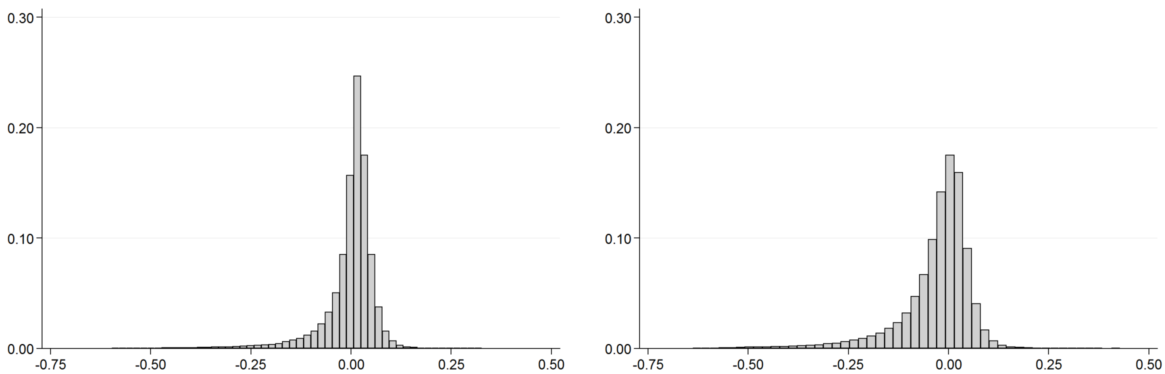


Note: The graphs shows the observed cif/fob ratios and the predicted values for New Zealand (a) $\hat{\tau}_{NZ,j} = exp(ln(\hat{\alpha}) + \hat{\delta}ln(D_{NZ,j}))$ and the United States (b) $\hat{\tau}_{US,j} = exp(ln(\hat{\alpha}) + \hat{\delta}ln(D_{US,j}))$. We aggregate by taking the arithmetic average over the two-digit products. The data stem from the US Census, Statistics New Zealand and CEPII.

Figure B3: Difference between Predicted and Observed Transportation Costs using Import Data from the United States

(a) In-Sample Prediction: USA

(b) Out-of-Sample Prediction: New Zealand



Note: The graphs show the difference between the predicted and observed transportation costs for the United States (a) $D_{US} = \hat{\tau}_{US,j} - \tau_{US_j}$ and New Zealand (b) $D_{NZ} = \hat{\tau}_{NZ,j} - \tau_{NZ_j}$. The data are from the US Census, Statistics New Zealand and CEPII.

Table B1: Correlation between Prices and Tariffs

	Price Exports	Price Imports	Tariff (simple)	Tariff (weighted)	MFN (simple)	Pref. (simple)	MFN (weighted)	Pref. (weighted)
Price Exports	1							
Price Imports	0.0235	1						
Tariff (simple)	-0.233^{**}	-0.108	1					
Tariff (weighted)	-0.235^{**}	-0.148	0.833^{***}	1				
MFN (simple)	-0.176^{*}	-0.1000	0.983^{***}	0.794^{***}	1			
Pref. (simple)	-0.0493	0.00296	0.217^{*}	0.186^{*}	0.186^{*}	1		
MFN (weighted)	-0.226^{**}	-0.218^{**}	0.846^{***}	0.924^{***}	0.837^{***}	0.199^{*}	1	
Pref. (weighted)	-0.0433	0.120	0.182^{*}	0.0976	0.186^{*}	0.709^{***}	0.164	1

Note: The table shows correlations between tariff levels and relative prices of exports and imports, respectively. The data for the prices stem from Feenstra et al. (2015). For the tariffs we use simple and trade-weighted means. *Tariff* is the effectively applied tariff, *MFN* the MFN-tariff and *Pref* the average over all preferential tariffs. ***/**/* Indicate significance at the 1%/5%/10% level.

Appendix C

Appendix to Chapter 3

Table C1: Baseline Results—Quantity and Unit Values

	IV				OLS			
	(1) ln(q)	(2) ln(q)	(3) ln(p)	(4) ln(p)	(5) ln(q)	(6) ln(q)	(7) ln(p)	(8) ln(p)
T × Post	-0.221***	-0.213***	0.009	0.015	-0.203***	-0.198***	0.004	0.007
	(0.075)	(0.075)	(0.035)	(0.033)	(0.053)	(0.052)	(0.024)	(0.023)
T × Post × US	0.236*	0.208	0.071	0.041	0.237**	0.220**	0.030	0.007
	(0.136)	(0.136)	(0.055)	(0.054)	(0.104)	(0.101)	(0.039)	(0.038)
MFA		-0.012		-0.009		-0.016		-0.007
		(0.044)		(0.020)		(0.044)		(0.021)
MFA × US		0.049		0.053*		0.045		0.063**
		(0.078)		(0.028)		(0.077)		(0.028)
N	201,042	201,042	201,042	201,042	201,042	201,042	201,042	201,042
F-Statistic	403.7	369.7	403.7	369.7	.	.	.	.

Note: The table shows the results of estimating equation 3.1. Columns (1) to (4) report the OLS results, the remainder of the table shows the results for the IV-approach. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log quantity in kg ($ln(q)$) or the log price, which equals $ln(p) = ln\left(\frac{x}{q}\right)$. The Kleibergen-Paap F-statistic is shown in the table. All regressions include firm-product-destination and destination-year fixed effects. Standard errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Table C2: First Stage

	(1) T × Post	(2) T × Post × US
AGOA × Post	0.645***	0.000
	(0.024)	(0.000)
AGOA × Post × US	0.095***	0.739***
	(0.021)	(0.014)
MFA × Post	0.008	-0.000
	(0.010)	(0.000)
MFA × Post × US	0.019**	0.027***
	(0.009)	(0.006)
N	201,043	201,043

Note: This table reports the estimation of the first stage as defined in Equation 3.2. $AGOA$ is a dummy variable indicating if the product becomes eligible for preferential treatment through the nonreciprocal program AGOA through which the United States offer preferential market access to least developed African countries. All regressions include firm-product-destination and destination-year fixed effects. Standard errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Table C3: Robustness Checks—2SLS

	Baseline		Placebo		URY Firms		no 2002		Firm-Trends		New EU-Members	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	ln(x)	P(X)	ln(x)	P(X)	ln(x)	P(X)	ln(x)	P(X)	ln(x)	P(X)	ln(x)	P(X)
T × Post	-0.198***	0.003***	0.086	-0.001*	-0.321	-0.006	-0.271***	0.004***	0.179	0.000	-0.197***	0.004***
	(0.074)	(0.001)	(0.093)	(0.001)	(0.210)	(0.011)	(0.091)	(0.001)	(0.169)	(0.001)	(0.074)	(0.001)
T × Post × US	0.248*	0.020***	0.103	-0.003	0.115	-0.005	0.363**	0.027***	0.292*	0.015***	0.247*	0.020***
	(0.137)	(0.004)	(0.176)	(0.003)	(0.430)	(0.016)	(0.166)	(0.005)	(0.163)	(0.004)	(0.137)	(0.004)
MFA	-0.022	0.005***	-0.496***	-0.008***	0.052	0.001	0.008	0.005***	-0.024	0.005***	-0.022	0.005***
	(0.046)	(0.001)	(0.095)	(0.002)	(0.069)	(0.004)	(0.046)	(0.001)	(0.045)	(0.001)	(0.046)	(0.001)
MFA × US	0.102	0.009***	0.347	-0.009*	-0.018	-0.031***	0.007	0.004	0.092	0.009***	0.103	0.009***
	(0.079)	(0.003)	(0.347)	(0.005)	(0.164)	(0.010)	(0.079)	(0.003)	(0.078)	(0.003)	(0.079)	(0.003)
T × Post × NMS											-1.015***	-0.007***
											(0.337)	(0.001)
N	201,043	20,609,798	28,795	7,494,472	40,775	1,550,948	178,838	18,736,180	200,290	20,609,798	201,043	20,609,798
F-Statistic	369.7	5,510.1	268.0	8,636.3	25.6	132.4	276.7	4,604.0	79.0	1,522.2	369.2	5,378.9

Note: The table shows various robustness test. See main text for details. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). The Kleibergen-Paap F-statistic is shown in the table. All regressions include firm-product-destination and destination-year fixed effects. Errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Table C4: Heterogeneity—2SLS

	Export Exposure to EU15 Market				Share of Imports from the U.S.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln(x)	ln(x)	P(X)	P(X)	ln(x)	ln(x)	P(X)	P(X)
T × Post	-0.189**	-0.054	0.002	0.005***	-0.246***	-0.177	0.002	0.001
	(0.074)	(0.100)	(0.001)	(0.002)	(0.091)	(0.122)	(0.001)	(0.002)
T × Post × US	0.245*	0.055	0.039***	0.036***	0.411**	0.425*	0.038***	0.056***
	(0.138)	(0.165)	(0.007)	(0.009)	(0.172)	(0.217)	(0.009)	(0.012)
MFA	-0.037	-0.037	0.001	0.001	0.004	0.003	0.002	0.002
	(0.054)	(0.053)	(0.001)	(0.001)	(0.067)	(0.067)	(0.001)	(0.001)
MFA × US	0.109	0.109	0.005	0.005	-0.031	-0.032	0.001	0.001
	(0.087)	(0.087)	(0.004)	(0.004)	(0.111)	(0.111)	(0.005)	(0.005)
EU15 X-Exposure × T × Post		-0.378*		-0.013**				
		(0.201)		(0.005)				
EU15 X-Exposure × T × Post × US		0.633*		0.012				
		(0.362)		(0.016)				
EU15 X-Exposure × Post		0.014		-0.004**				
		(0.133)		(0.002)				
CBERA + Andean + US M-Exposure × T × Post						-0.277		0.001
						(0.330)		(0.006)
CBERA + Andean + US M-Exposure × T × Post × US						0.038		-0.050*
						(0.473)		(0.030)
CBERA + Andean + US M-Exposure × Post						0.031		-0.004**
						(0.121)		(0.002)
N	166,100	166,100	14,572,712	14,572,712	131,268	131,268	13,131,184	13,131,184
F-Statistic	359.4	102.2	2,020.5	1,010.0	173.1	61.7	1,138.4	555.0

Note: The table shows the results of estimating equation 3.1. Columns (1) to (4) differentiates by exposure to the European Union, the remainder of the table shows how differences in sourcing affects the results. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). The Kleibergen-Paap F-statistic is shown in the table. All regressions include firm-product-destination and destination-year fixed effects. Errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Table C5: Heterogeneity across the Sourcing Structure—OLS

	ln(x)				P(X)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
T × Post	-0.217***	-0.261***	-0.172**	-0.170**	0.001	0.000	0.000	-0.000
	(0.063)	(0.076)	(0.085)	(0.086)	(0.001)	(0.002)	(0.002)	(0.002)
T × Post × US	0.327***	0.469***	0.413**	0.407**	0.020***	0.034***	0.033***	0.033***
	(0.126)	(0.169)	(0.184)	(0.188)	(0.006)	(0.008)	(0.009)	(0.009)
MFA	-0.004	-0.004	-0.006	-0.006	0.002*	0.002*	0.002*	0.002*
	(0.065)	(0.065)	(0.066)	(0.066)	(0.001)	(0.001)	(0.001)	(0.001)
MFA × US	-0.005	-0.009	-0.012	-0.011	0.009*	0.009*	0.009*	0.009*
	(0.111)	(0.110)	(0.110)	(0.110)	(0.005)	(0.005)	(0.005)	(0.005)
US M-Exposure × T × Post		0.219				0.002		
		(0.239)				(0.004)		
US M-Exposure × T × Post × US		-0.542				-0.047*		
		(0.377)				(0.027)		
US M-Exposure × Post		-0.028				-0.004*		
		(0.114)				(0.002)		
Andean + US M-Exposure × T × Post			-0.174				0.001	
			(0.247)				(0.004)	
Andean + US M-Exposure × T× Post × US			-0.178				-0.036	
			(0.379)				(0.024)	
Andean + US M-Exposure × Post			0.019				-0.005**	
			(0.109)				(0.002)	
CBERA + Andean + US M-Exposure × T × Post				-0.176				0.002
				(0.247)				(0.004)
CBERA + Andean + US M-Exposure × T × Post × US				-0.159				-0.035
				(0.382)				(0.024)
CBERA + Andean + US M-Exposure × Post				0.024				-0.005**
				(0.109)				(0.002)
N	131,268	131,268	131,268	131,268	13,131,184	13,131,184	13,131,184	13,131,184

Note: The table shows the results of estimating equation 3.1 and includes different measures for import exposure by firms. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). All regressions include firm-product-destination and destination-year fixed effects. Standard errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

Table C6: Heterogeneity across the Sourcing Structure—2SLS

	ln(x)				P(X)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
T × Post	-0.246***	-0.280**	-0.180	-0.177	0.002	0.002	0.001	0.001
	(0.091)	(0.113)	(0.120)	(0.122)	(0.001)	(0.002)	(0.002)	(0.002)
T × Post × US	0.411**	0.479**	0.423**	0.425*	0.038***	0.057***	0.056***	0.056***
	(0.172)	(0.209)	(0.213)	(0.217)	(0.009)	(0.011)	(0.012)	(0.012)
MFA	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002
	(0.067)	(0.067)	(0.067)	(0.067)	(0.001)	(0.001)	(0.001)	(0.001)
MFA × US	-0.031	-0.033	-0.032	-0.032	0.001	0.001	0.001	0.001
	(0.111)	(0.111)	(0.111)	(0.111)	(0.005)	(0.005)	(0.005)	(0.005)
US M-Exposure × T × Post		0.160				-0.000		
		(0.302)				(0.006)		
US M-Exposure × T × Post × US		-0.288				-0.066*		
		(0.457)				(0.034)		
US M-Exposure × Post		-0.040				-0.003		
		(0.129)				(0.002)		
Andean + US M-Exposure × T × Post			-0.275				0.000	
			(0.330)				(0.006)	
Andean + US M-Exposure × T× Post × US			0.044				-0.051*	
			(0.471)				(0.030)	
Andean + US M-Exposure × Post			0.023				-0.004**	
			(0.122)				(0.002)	
CBERA + Andean + US M-Exposure × T × Post				-0.277				0.001
				(0.330)				(0.006)
CBERA + Andean + US M-Exposure × T × Post × US				0.038				-0.050*
				(0.473)				(0.030)
CBERA + Andean + US M-Exposure × Post				0.031				-0.004**
				(0.121)				(0.002)
N	131,268	131,268	131,268	131,268	13,131,184	13,131,184	13,131,184	13,131,184
F-Statistic	173.1	84.1	57.5	61.7	1,138.4	556.4	550.9	555.0

Note: The table shows the results of estimating equation 3.1 and includes different measures for import exposure by firms. I use the list of products eligible for AGOA preferences as an instrument. The dependent variable equals either the log value in USD ($ln(x)$) or the probability of exporting $P(X)$). The Kleibergen-Paap F-statistic is shown in the table. All regressions include firm-product-destination and destination-year fixed effects. Standard errors are clustered by firms. ***/**/* indicate significance at the 1%/5%/10% level.

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