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334
2020

July 2020

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ifo INSTITUTE

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at the University of Munich

Imprint:

ifo Working Papers
Publisher and distributor: ifo Institute – Leibniz Institute for Economic Research at the University of Munich
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ifo Working Paper No. 334

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Abstract

This paper 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 deal simultaneously 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 in the data is particularly relevant for developing countries. With this new dataset at hand I document numerous new facts about tariffs around the world improving our understanding of how countries set tariffs substantially.

JEL Code: F13, F14
Keywords: Tariffs, MFN, preferences

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* I am very thankful to my advisors, Gabriel Felbermayr, Andrew Bernard, and Monika Schnitzer for their invaluable guidance and support. I would also like to thank Andrea Ariu, Martin Braml, Volker Nitsch, and participants of the EGIT 2020 for their valuable comments and suggestions. I gratefully acknowledge financial support received from Senatsausschuss Wettbewerb (SAW) under grant no. SAW-2016-ifo-4 and the scholarship from the Bernt Rohrer Foundation. All errors are my own.

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 Caliendo et al. (2018), Pavcnik (2002), 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 and Bergstrand 2007; Baier et al. 2014; 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; Baldwin 1984; Bown and Irwin 2017; Bureau et al. 2019; Caliendo et al. 2015; Irwin 2020). 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 mem-

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

bers 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 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 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 5 concludes.

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,

[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.

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 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).

[3] See the website of the WTO, https://www.wto.org/english/thewto{_}e/whatis{_}e/tif{_}e/fact5{_}e.htm.

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

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 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 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 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

[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."*

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.

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-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.

[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.

[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.

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]

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 anal-

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

ysis 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 respective RTA. This information can be found in the WTO's RTA Database.[13] Second, I have detailed

[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.

[13] rtais.wto.org/

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 B 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 B 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-

[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 C.

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 agricul-

[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.

tural products among high income countries. Therefore, it is unfeasible to compare bound 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*

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

Table 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.

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 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 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

[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.

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.

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.

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 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

[23] In a series of papers, Anderson and Neary (1992, 1994, 2003, 2007) 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.

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

Table 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).

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

[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 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 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 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 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 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

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 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.

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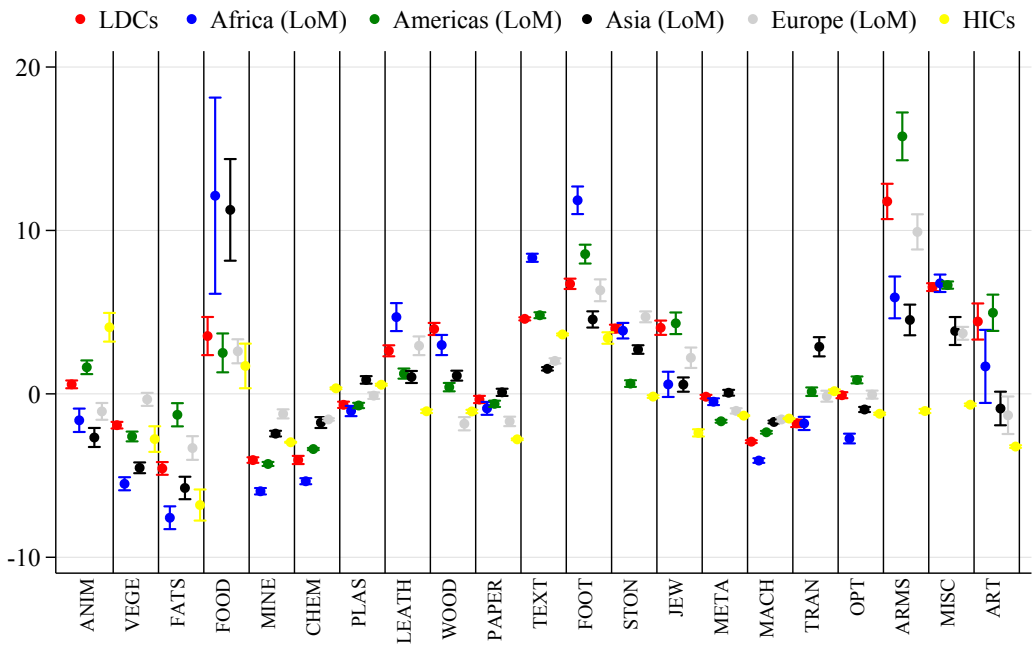
results for trade between Germany and ten Eastern European transition countries. The differences in the share of same tariffs within HS4-digit industries might be the reason for the discrepancies. In fact, for the year 2003, one year before Poland joined the European Union and two years after China acceded 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: 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.

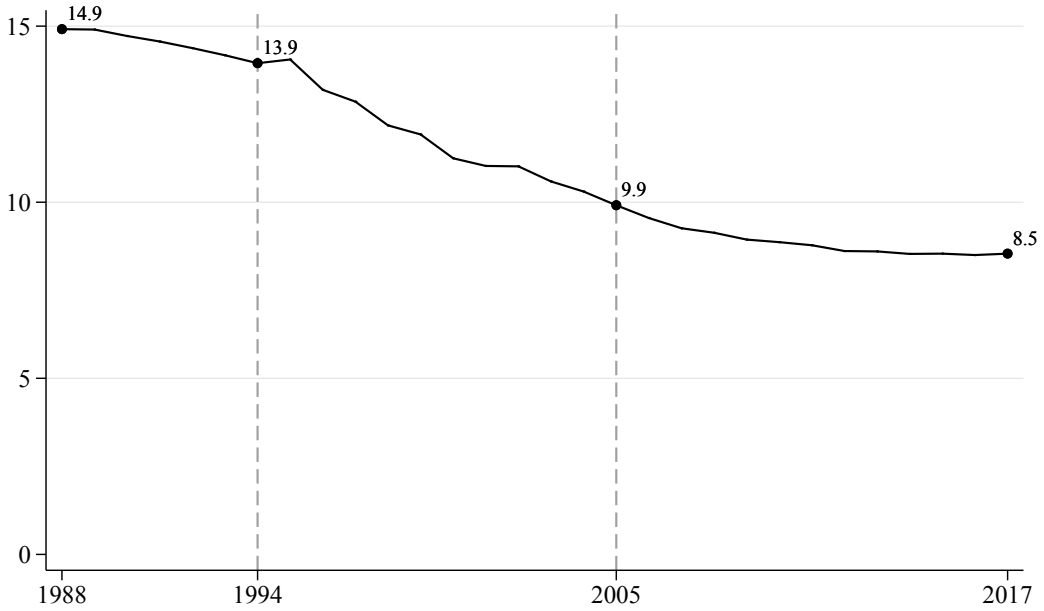
Summing up, on the one hand applied MFN tariffs are distinct across countries with tariff levels and water in the tariffs correlating negatively with income. On the other hand I report two customary practices that apply to all countries: tariffs are often multiples of five or zero and countries tend 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.

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 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 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 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 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

[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).

[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.

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.

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

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

Table 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.

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 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, especially 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

[32] For agricultural products the results are qualitatively the same. Due to large measurement error in the bound tariffs (see Section 3 for details) of agricultural products it is hard to correctly quantify the coefficients.

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 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

[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.

(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.

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.

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 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.

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-North), tariffs on industrial products have been eliminated for almost all HS6-products. Whereas

[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.

Table 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".

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.

Table 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.

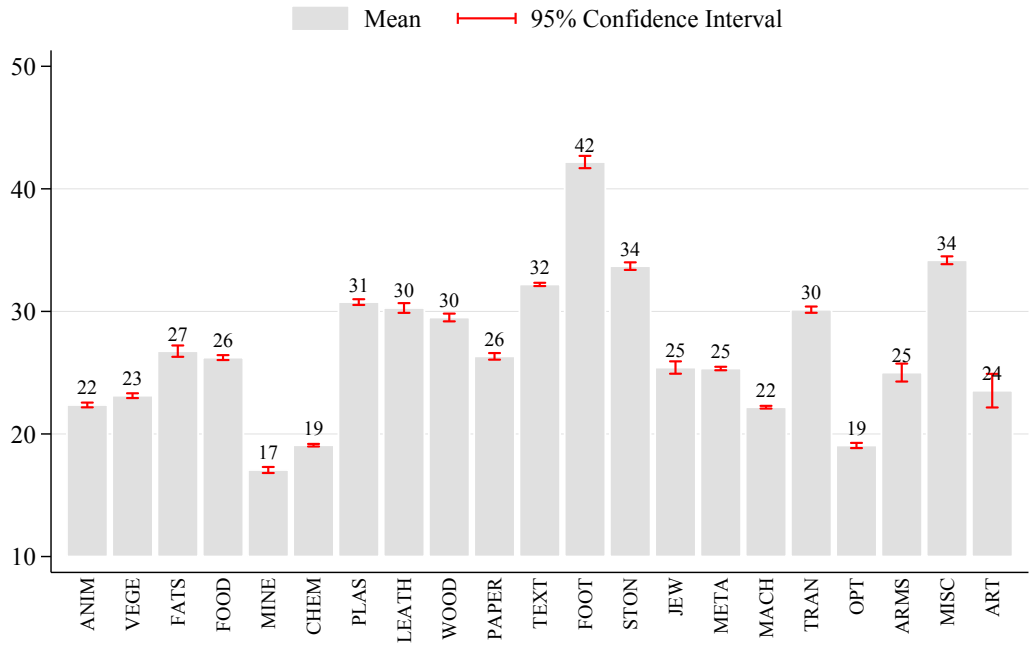
In the new tariff database I include detailed phasing-in schedules from the WTO's RTA database.[35] Unfortunately, they are not available for all RTAs but only for 149 FTAs. The subset includes mostly recent FTAs. Next, I analyze how frequently countries use phasing-in and check for cross-country and sectoral heterogeneity.

Table 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

[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 tariff 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.

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.

Figure 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.

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 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 Figure 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.

Table 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.

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

Table 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".

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.

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A Appendix

B 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.

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.

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.

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.[37]

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— 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

[37] rtais.wto.org/.

Baier and Jeffrey Bergstrand.[38] Furthermore, I add information from the WTO's list of preferential trade agreements[39] 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.[40] 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 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,

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

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

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

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.

C 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 is higher. Then there are *technical tariffs* that depend on certain product characteristics for

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

Year	Original t	Entry	Phasing-In	Imputed t
1996	10	2001	0	10
1997	.	2001	0	10
1998	5	2001	0	5
1999	5	2001	0	5
2000	.	2001	0	mfn-2000
2001	.	2001	0	0
2002	.	2001	0	0
2003	0	2001	0	0
2004	.	2001	0	0
2005	0	2001	0	0
2006	.	2001	0	0

Example 4: Phasing-In, WTO info

Year	Original t	Entry	WTO-Info	Imputed t
1996	10	2001	.	10
1997	.	2001	.	10
1998	5	2001	.	5
1999	5	2001	.	5
2000	.	2001	.	5
2001	.	2001	2	2
2002	.	2001	2	2
2003	.	2001	2	2
2004	.	2001	1	1
2005	.	2001	1	1
2006	.	2001	0	0

Example 5: Phasing-In, DESTA info

Year	Original t	Entry	Phasing-In	Imputed t
1996	15	2000	2004	15
1997	.	2000	2004	15
1998	15	2000	2004	15
1999	15	2000	2004	15
2000	.	2000	2004	12.5
2001	10	2000	2004	10
2002		2000	2004	7.5
2003	5	2000	2004	5
2004		2000	2004	0
2005		2000	2004	0
2006	0	2000	2004	0

Example 6: Phasing-In, DESTA info

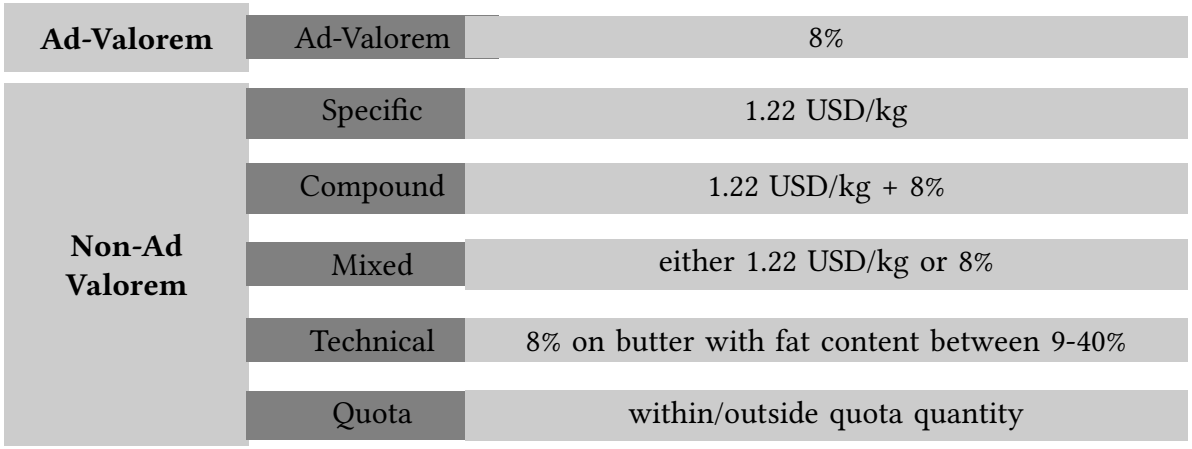
Year	Original t	Entry	Phasing-In	Imputed t
1996	15	2001	2020	10
1997	.	2001	2020	10
1998	15	2001	2020	5
1999	15	2001	2020	5
2000	.	2001	2020	12.5
2001	10	2001	2020	10
2002		2001	2020	7.5
2003	5	2001	2020	5
2004		2001	2020	5
2005		2001	2020	5
2006	5	2001	2020	5

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.

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.[41] 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



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 C of the Appendix for more details). 1.22 USD/kg or 1.22 USD/kg + 8% are examples for these types of tariffs.

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

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.[42] While the WTO does not report AVEs, TRAINS estimates AVEs.[43] 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).[44] 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.[45]

D 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

[42] 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.

[43] 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".

[44] 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%).

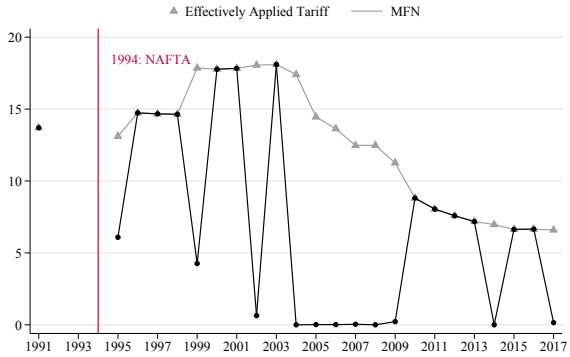
[45] I also account for the changes in EFTA i.e. Austria, Denmark, Finland, Portugal, Sweden, and the United Kingdom left EFTA to join the European Union.

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.

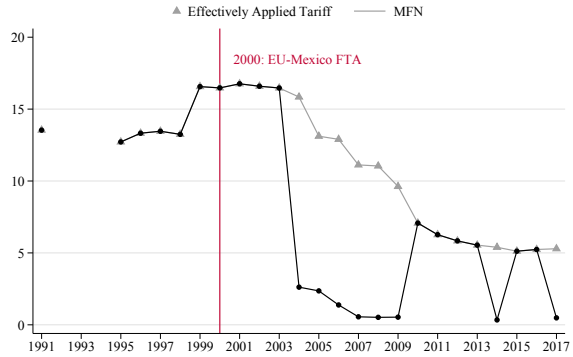
Figure A2 makes the consequences of this fact clear. The solid line shows the simple mean of the effectively applied tariff Mexico has against the US (Panel (a)) and Germany (Panel (b)) over time when using the original data that WITS provides.[46] The light gray line is Mexico's MFN tariff. Mexico reported 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

[46] 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.

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.

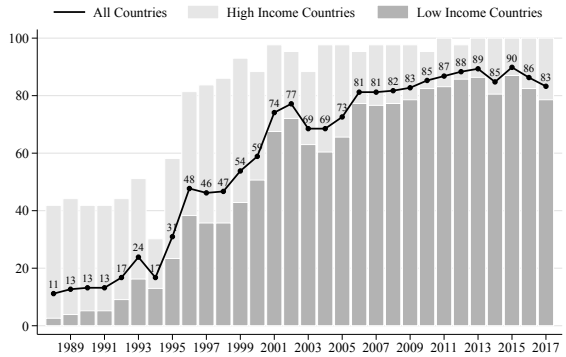
Additionally, the issue on missing data described above can be observed in the plot: even though the EU-Mexico FTA has entered into force in 2000, the first time Mexico reports preferential tariffs for Germany (or more correctly the EU as Germany does not have its own trade policy) was only in 2003. 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.

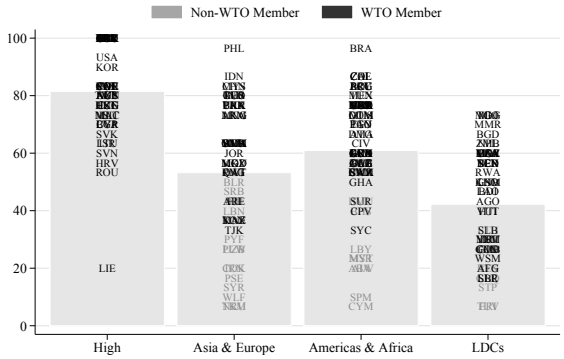
E Additional Material

Figure A3: Pattern of Reporting

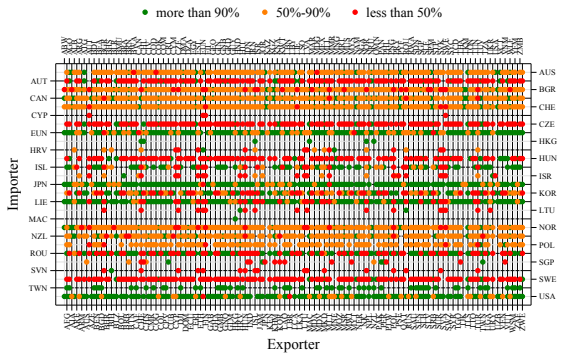
(a) Share of Reporting Countries by Year (in %)



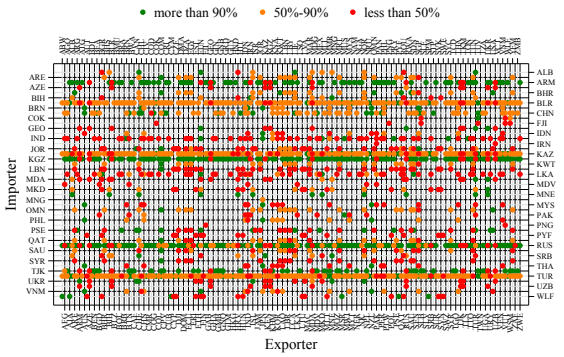
(b) Share of Reported Years by Country (in %)



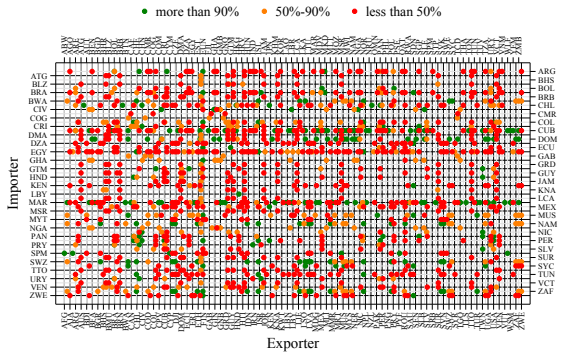
(c) Pref. Tariff — High Income



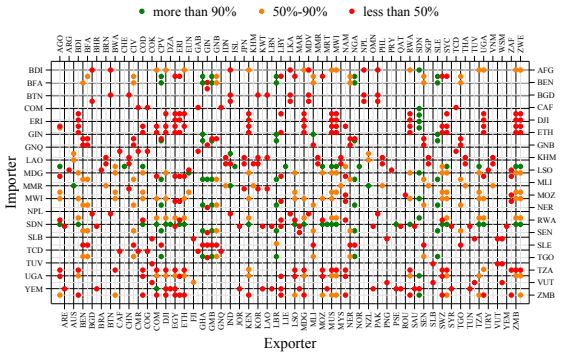
(d) Pref. Tariff — Low/Middle Income: Asia & Europe



(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

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
SDN	—	29,163,733	72%	5,018	1996
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

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
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
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

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
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
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

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
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
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					

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ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
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
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

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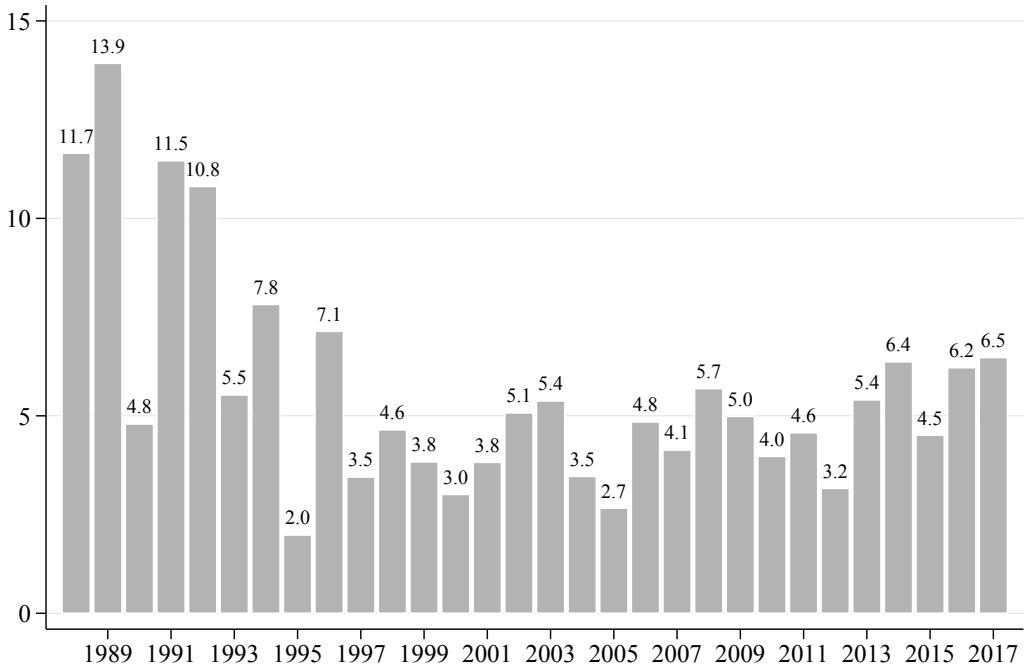
ISO3	GATT/WTO	Nr. of Obs.	Share of Imputed	Nr. of Products	1^{st} av. Year
ISR	1962	29,158,003	43%	5,017	1993
JPN	1955	29,158,003	31%	5,017	1988
KOR	1967	29,163,733	36%	5,018	1988
LIE	1995	27,157,339	84%	4,624	2011
MAC	1991	28,925,427	29%	4,953	1996
NOR	1948	29,163,733	67%	5,018	1988
NZL	1948	29,158,003	42%	5,017	1992
SGP	1973	29,163,733	26%	5,018	1989
TWN	2002	29,163,733	23%	5,018	1989
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%).

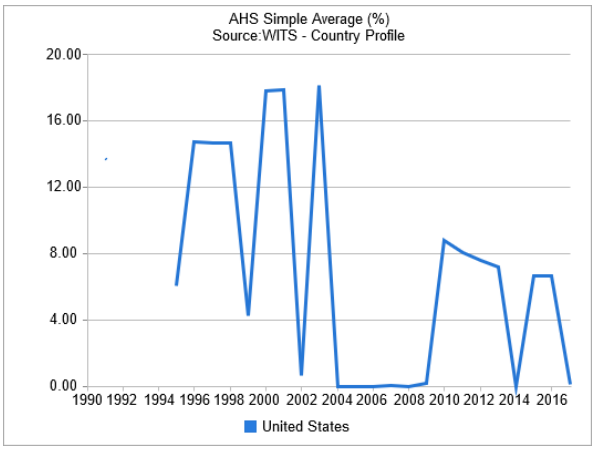
Figure A4: Share of Misreported Tariffs (in %)



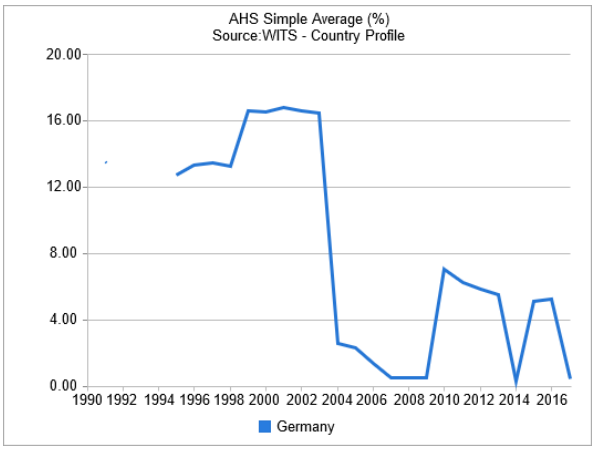
Note: The figure reports the share of misreported preferential tariffs, i.e. the number of preferential tariffs that got falsely reported despite no RTA is in force.

Figure A5: AHS Simple Average Mexico-United States

(a) Effectively Applied Tariff Mexico-United States



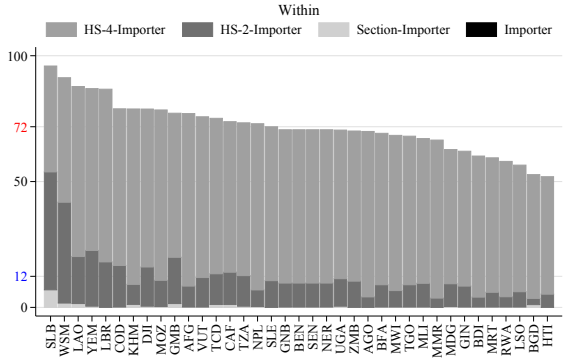
(b) Effectively Applied Tariff Mexico-Germany



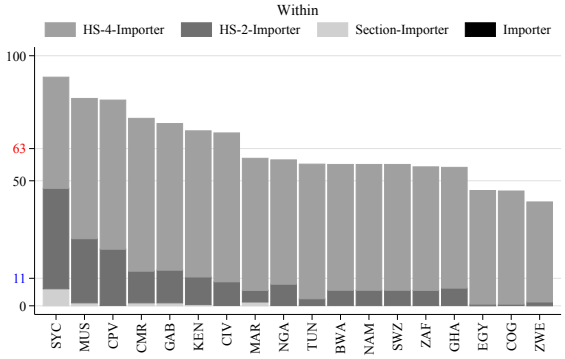
Note: The graph shows the simple average of the effectively applied tariff (in WITS this tariff type is called AHS) that Mexico imposes on imports from the United States (Panel (a)) and Germany (Panel(b)) using the original data that can be downloaded from WITS. NAFTA, the FTA between Mexico, Canada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

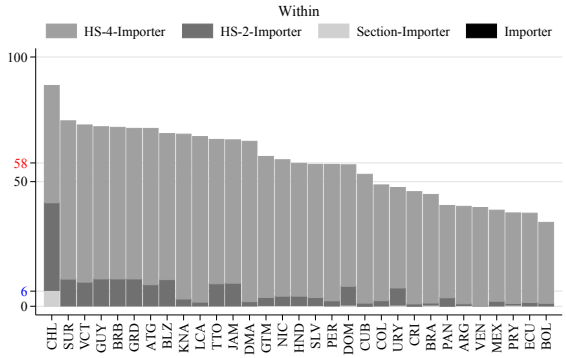
(a) Least Developed Countries



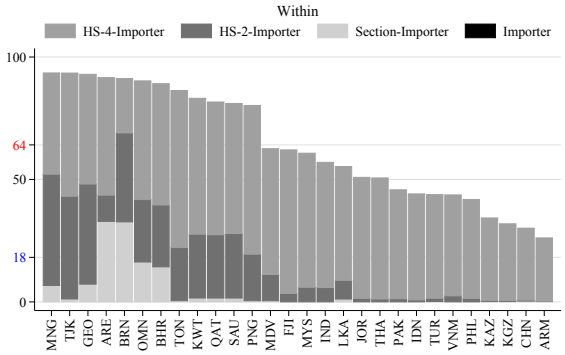
(b) LoM Countries: Africa



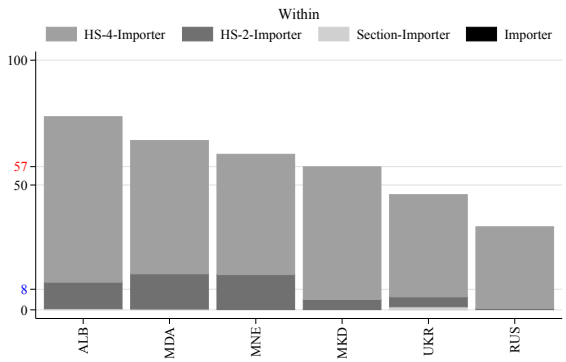
(c) LoM Countries: Americas



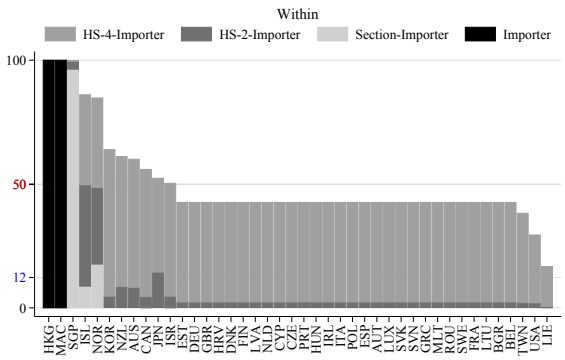
(d) LoM Countries: Asia



(e) LoM Countries: Europe



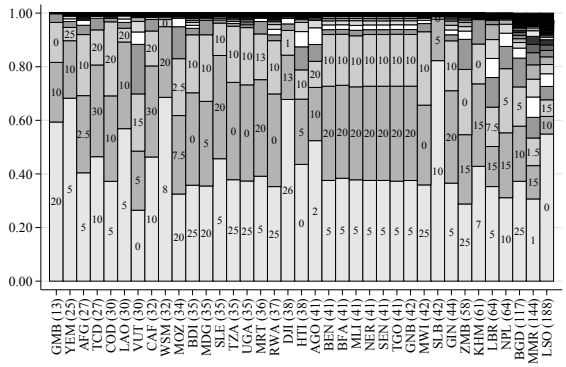
(f) High Income Countries



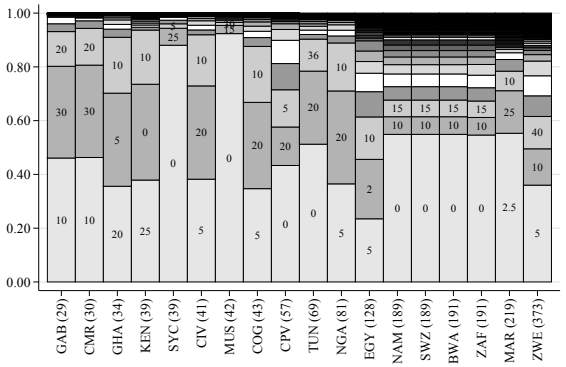
Note: The graph shows the share of same tariffs across countries and within different levels of aggregation. I distinguish between different levels of aggregation (HS-4, HS-2, section, and all products, i.e. the importing country). The red label on the y-axis equals the average share of same tariffs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

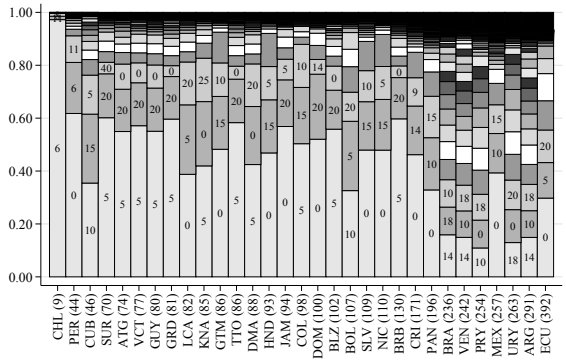
(a) Least Developed Countries



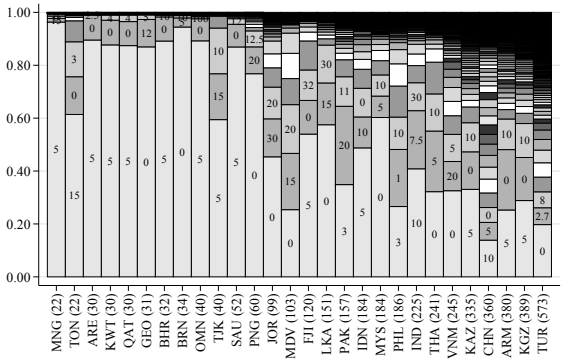
(b) LoM Countries: Africa



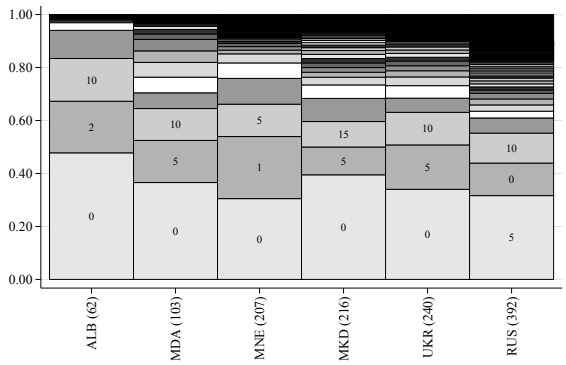
(c) LoM Countries: Americas



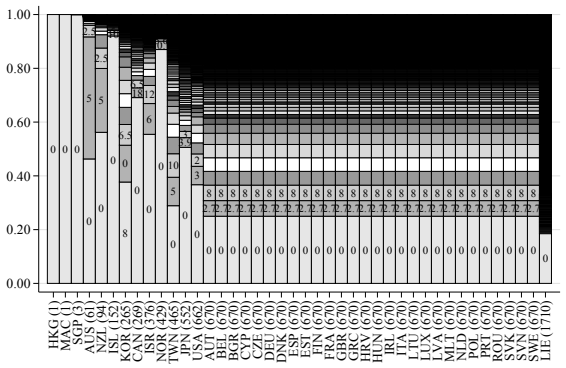
(d) LoM Countries: Asia



(e) LoM Countries: Europe



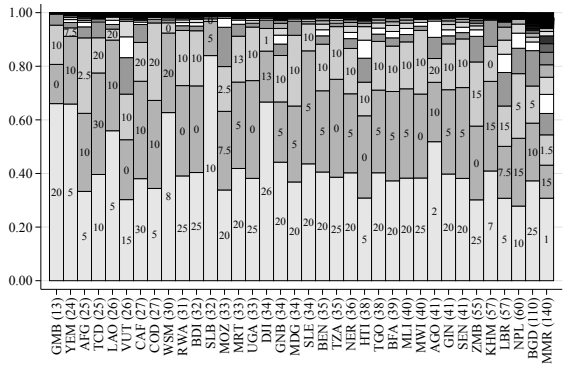
(f) High Income Countries



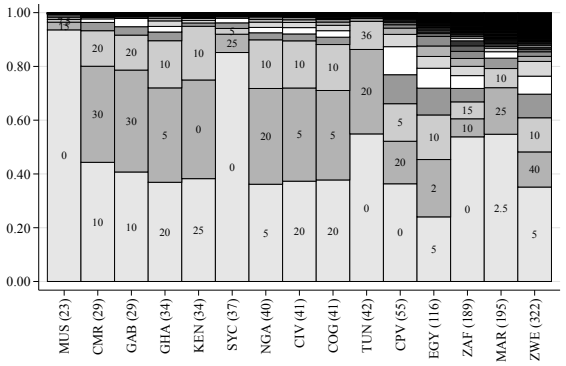
Note: The graph shows the number of unique tariffs a countries has in place. The countries on the x-axis are ordered by the number of total unique tariffs, i.e. the further on the right the more unique tariffs. Whenever two countries have the same total number of unique tariffs the countries are ordered 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)

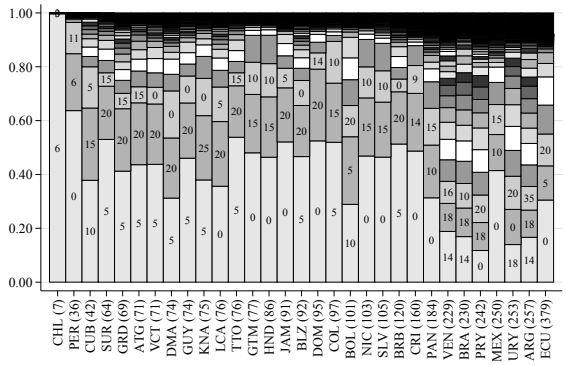
(a) Least Developed Countries



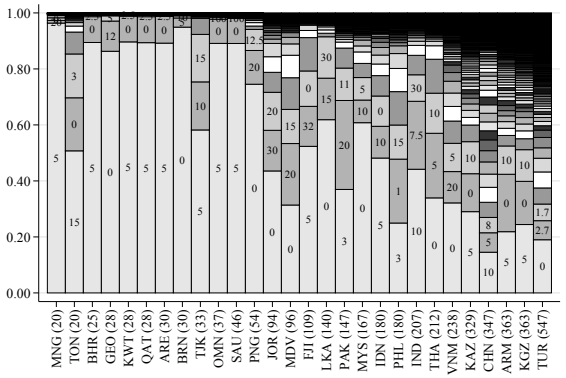
(b) LoM Countries: Africa



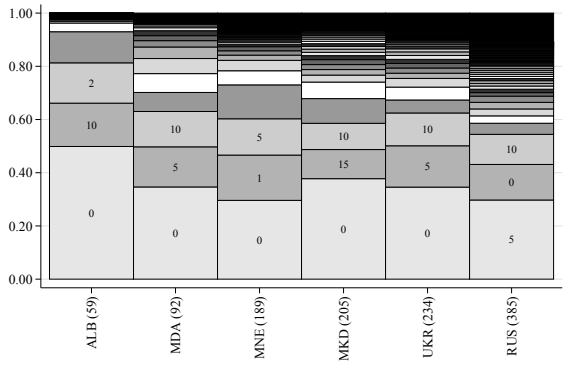
(c) LoM Countries: Americas



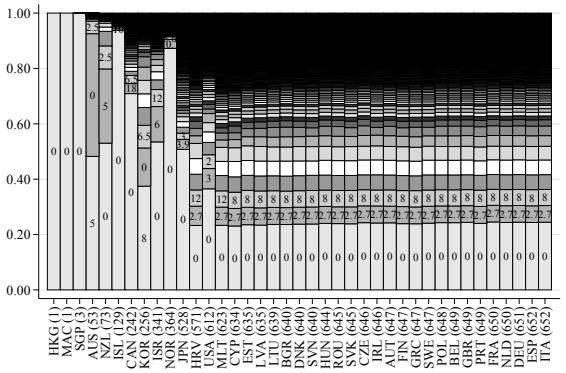
(d) LoM Countries: Asia



(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.

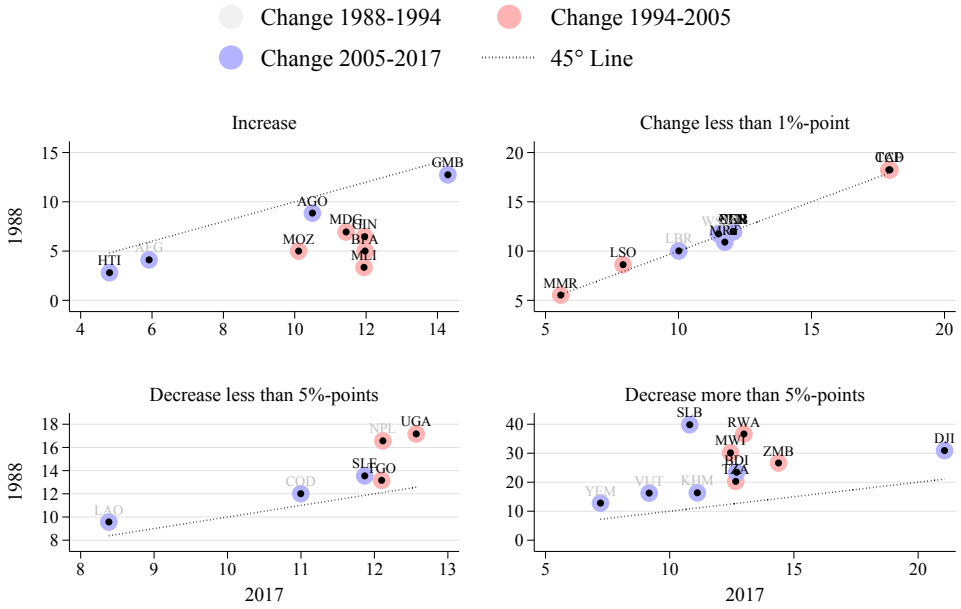
Table A5: Change in MFN Tariffs across Income Groups (Agricultural Products)

	$\Delta T_0^1 = t_1 - t_0$				$B = 1$ if $\tilde{t}_{ik} < t_{ik}^{before}$		
	ΔT_{88}^{17}	ΔT_{05}^{17}	ΔT_{94}^{05}	ΔT_{88}^{94}	P(B)	P(B)	$\Delta T_{88}^{17} \vert B = 0$
	(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

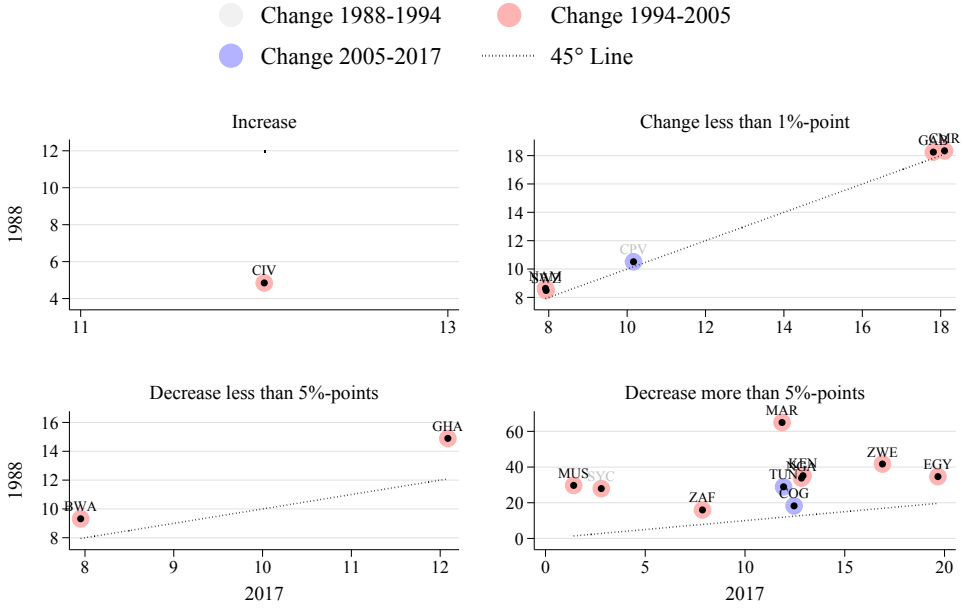
Note: The table shows the regression output of $y_{ik} = \sum_{G=1}^{6} \beta_G I^G + u_{ik}$. In columns (1) to (4) the dependent variable y_{ik} equals the absolute change in the MFN tariff ΔT_0^1 for different time intervals. In column (5) and (6) the dependent variable is the probability of having 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



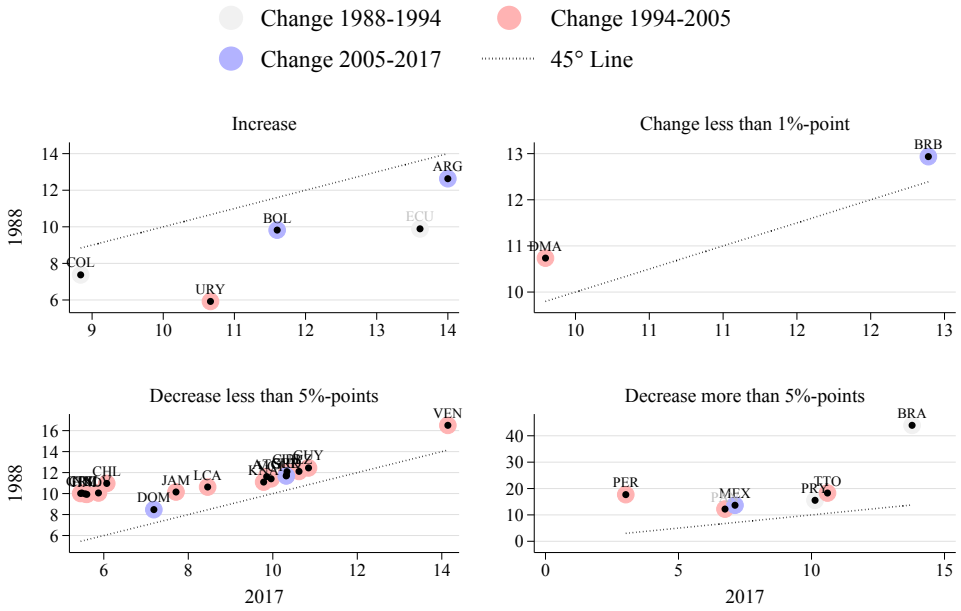
(b) Low and Middle Income Countries: Africa



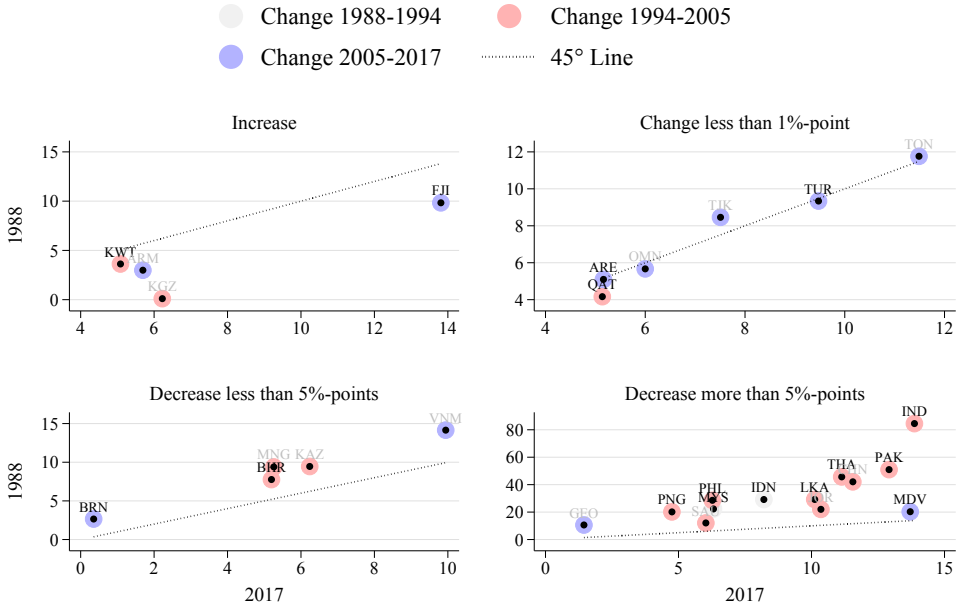
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took 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



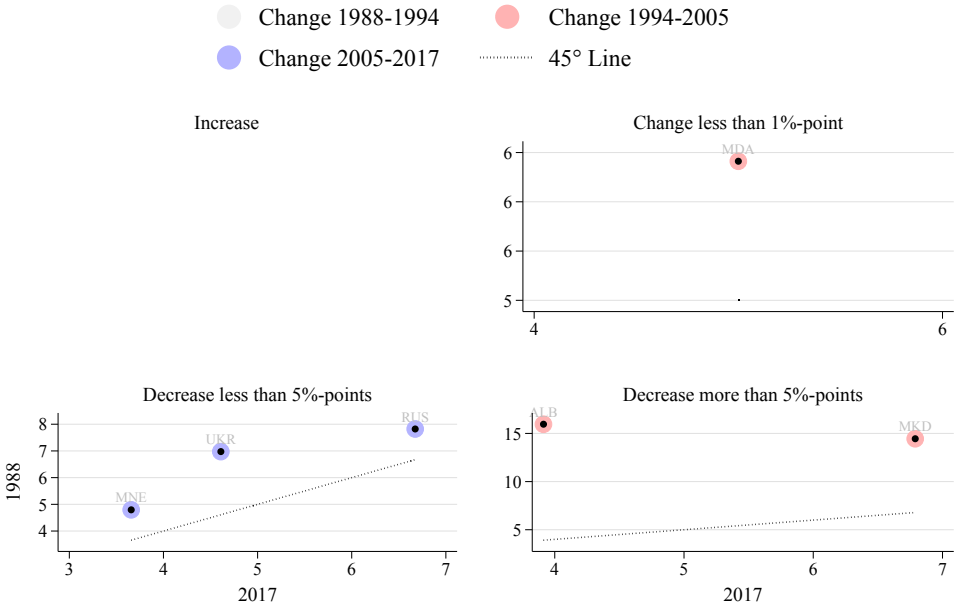
(d) Low and Middle Income Countries: Asia



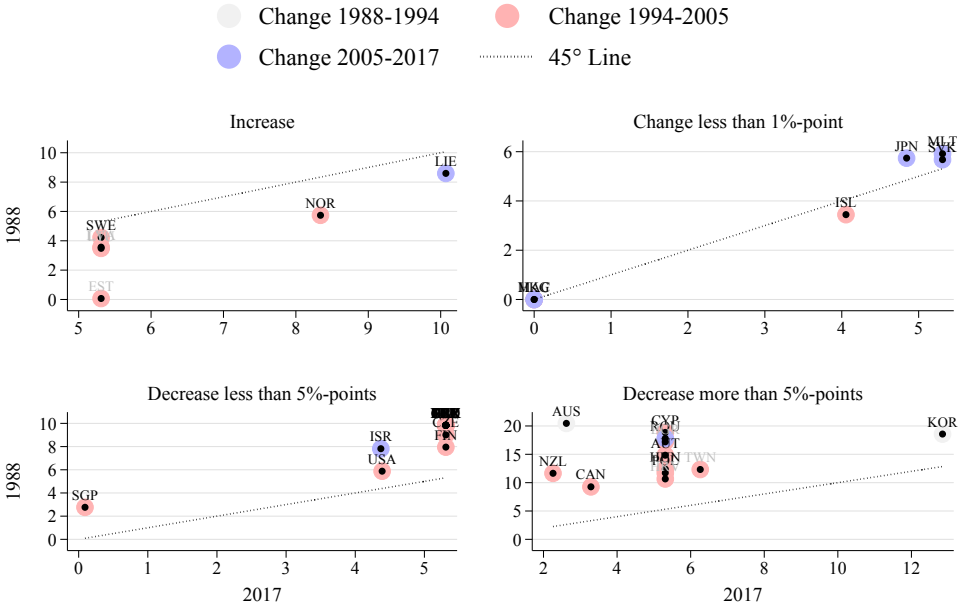
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took 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

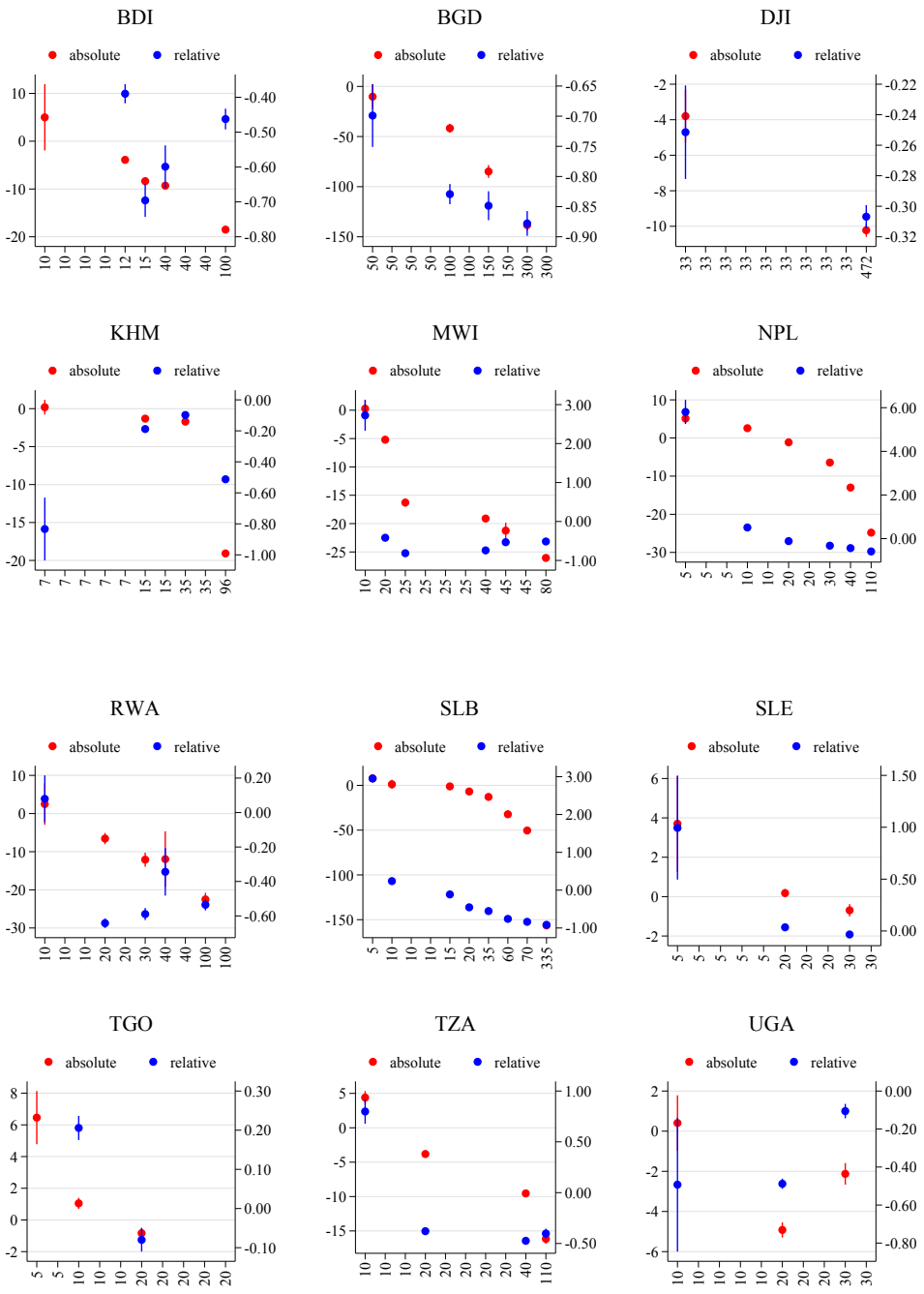


(f) High Income Countries



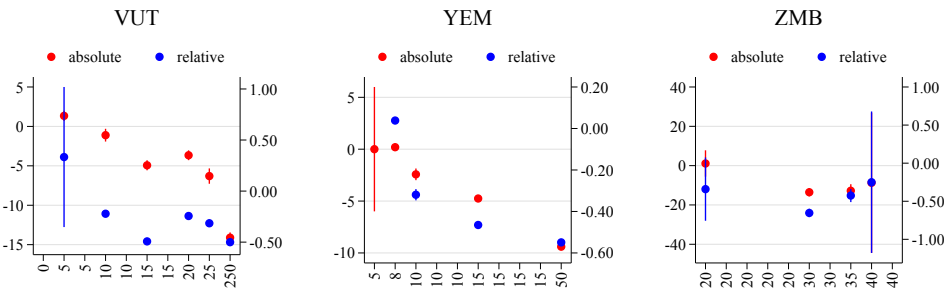
Note: In this graph I compare the simple average in 2017 with the MFN tariff of the first year of available data. Whenever a country is below/above the 45-degree line the simple average decreased/increased in 2017 with respect to the first available year. Furthermore, I show when most of the change took 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



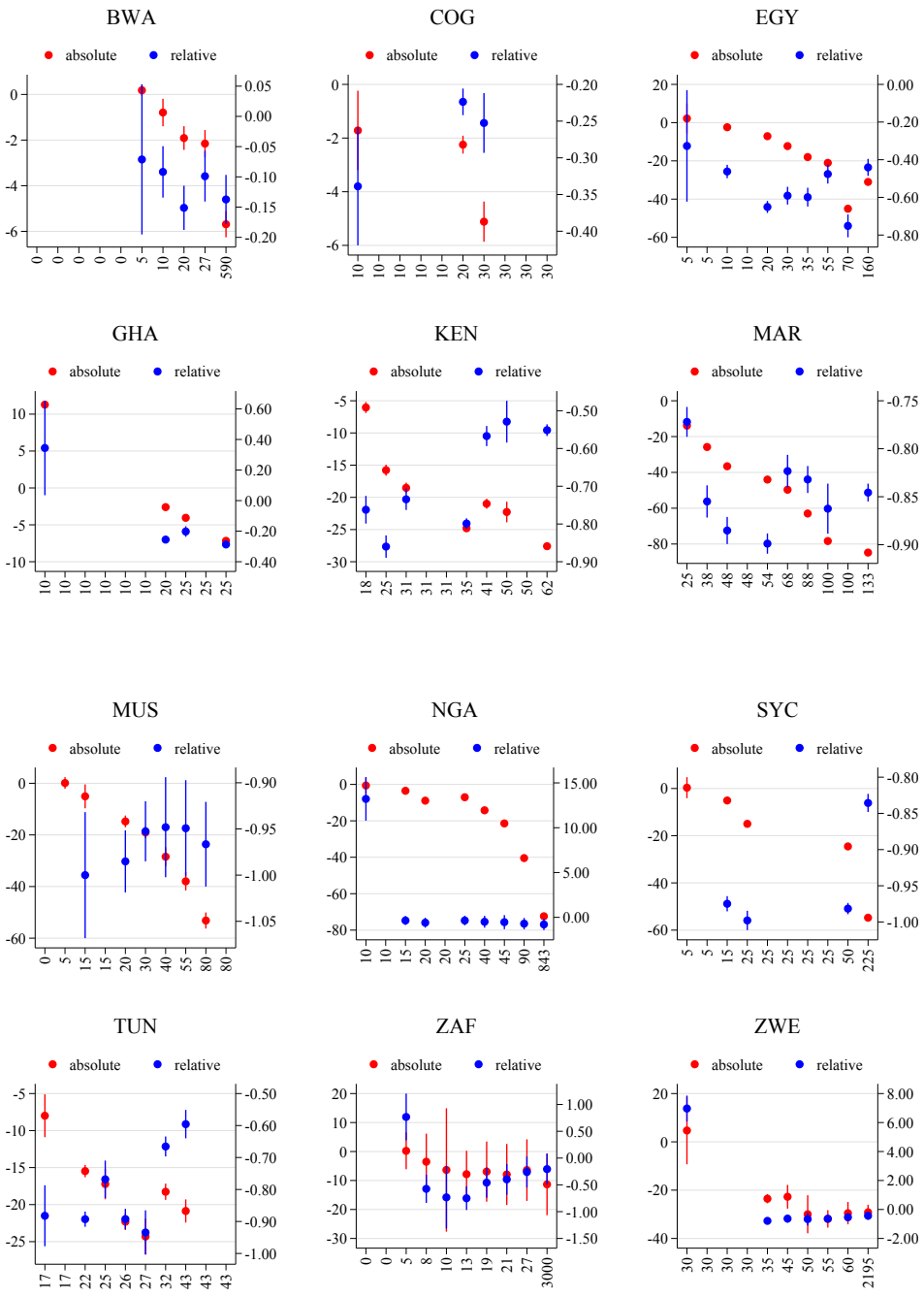
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



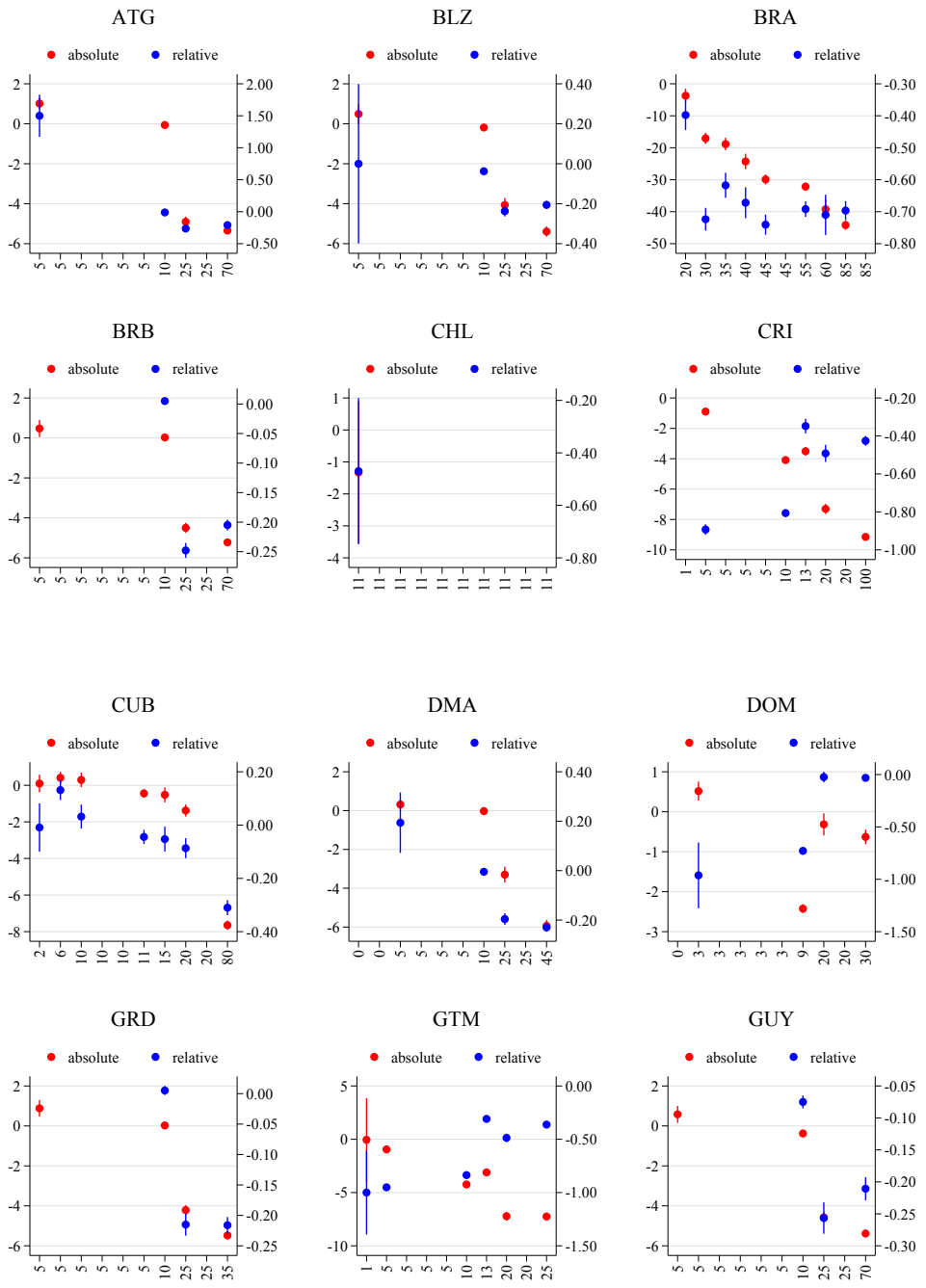
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



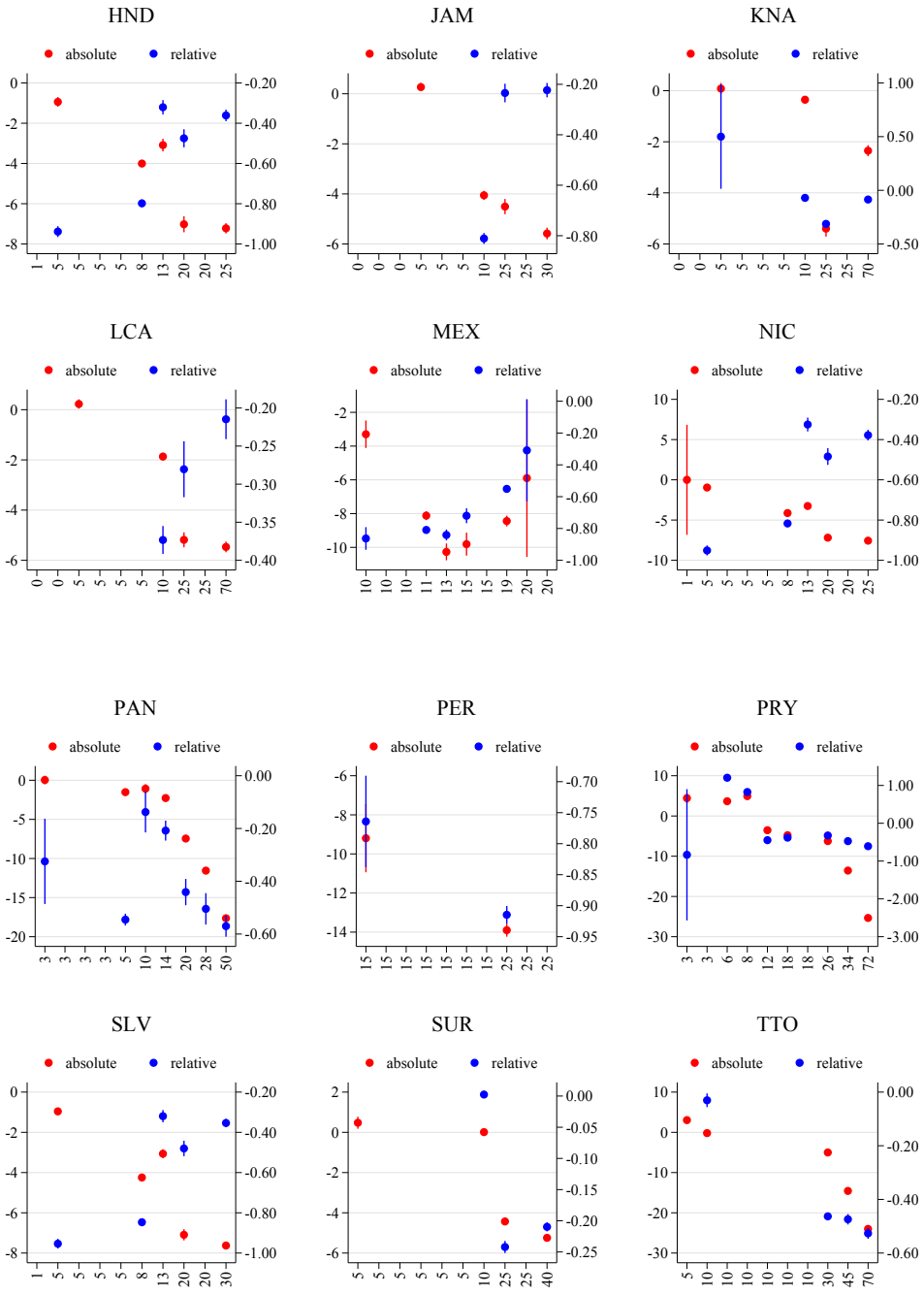
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



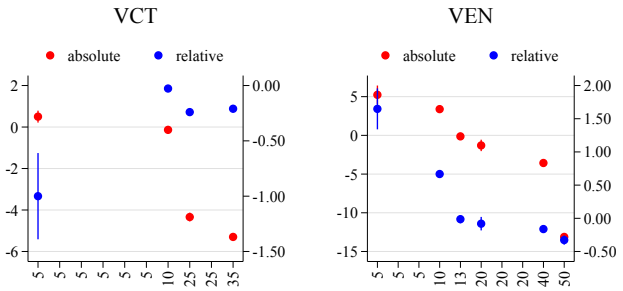
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



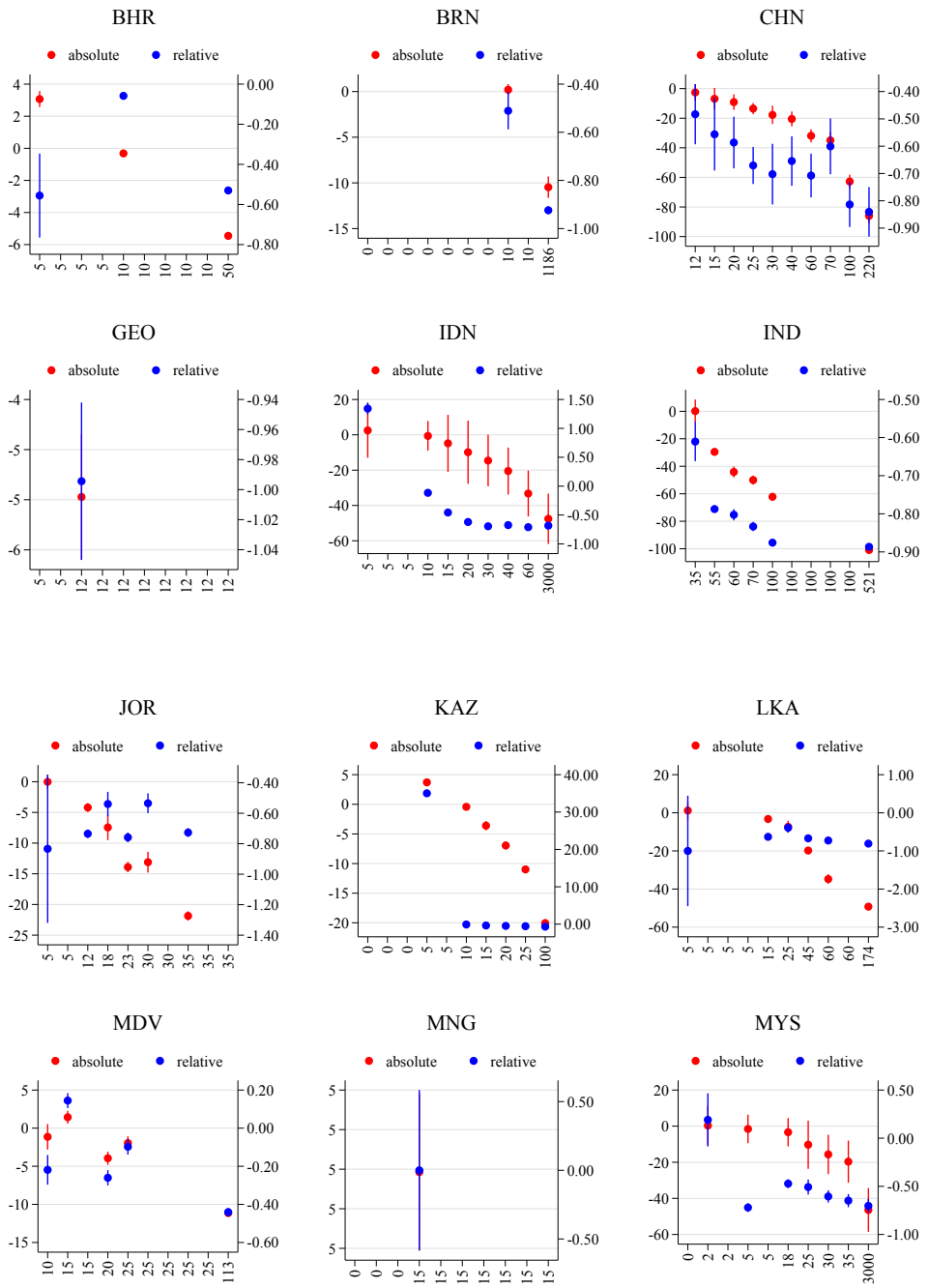
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



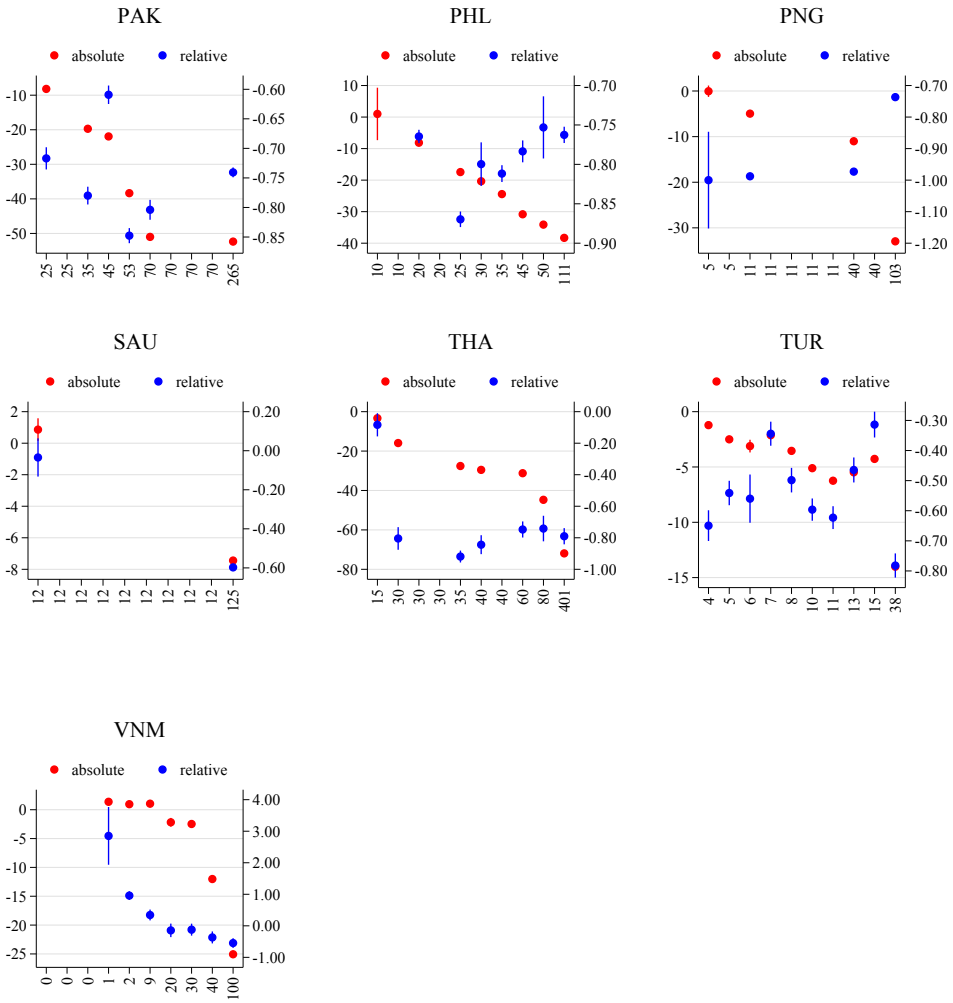
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



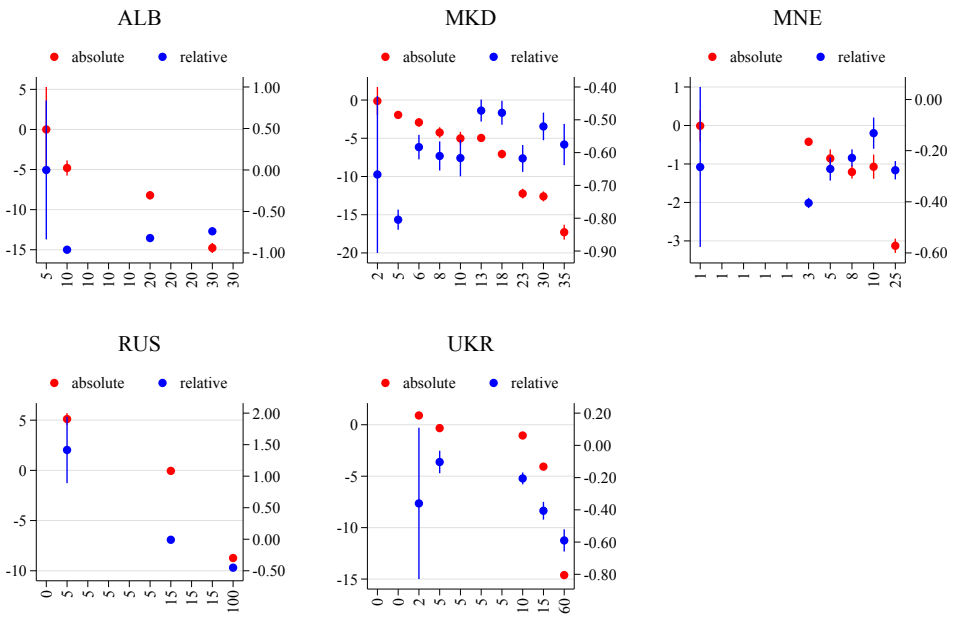
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



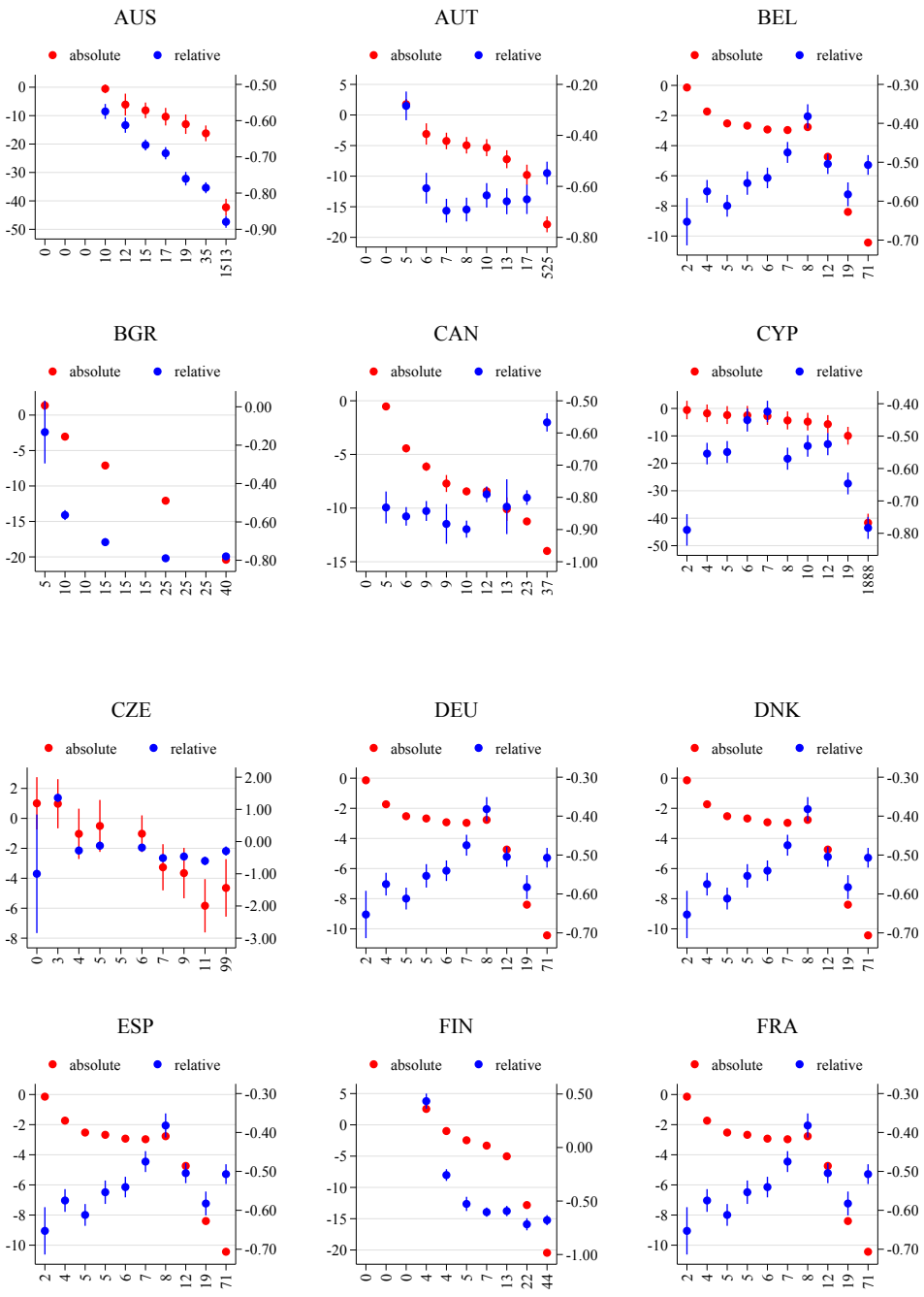
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



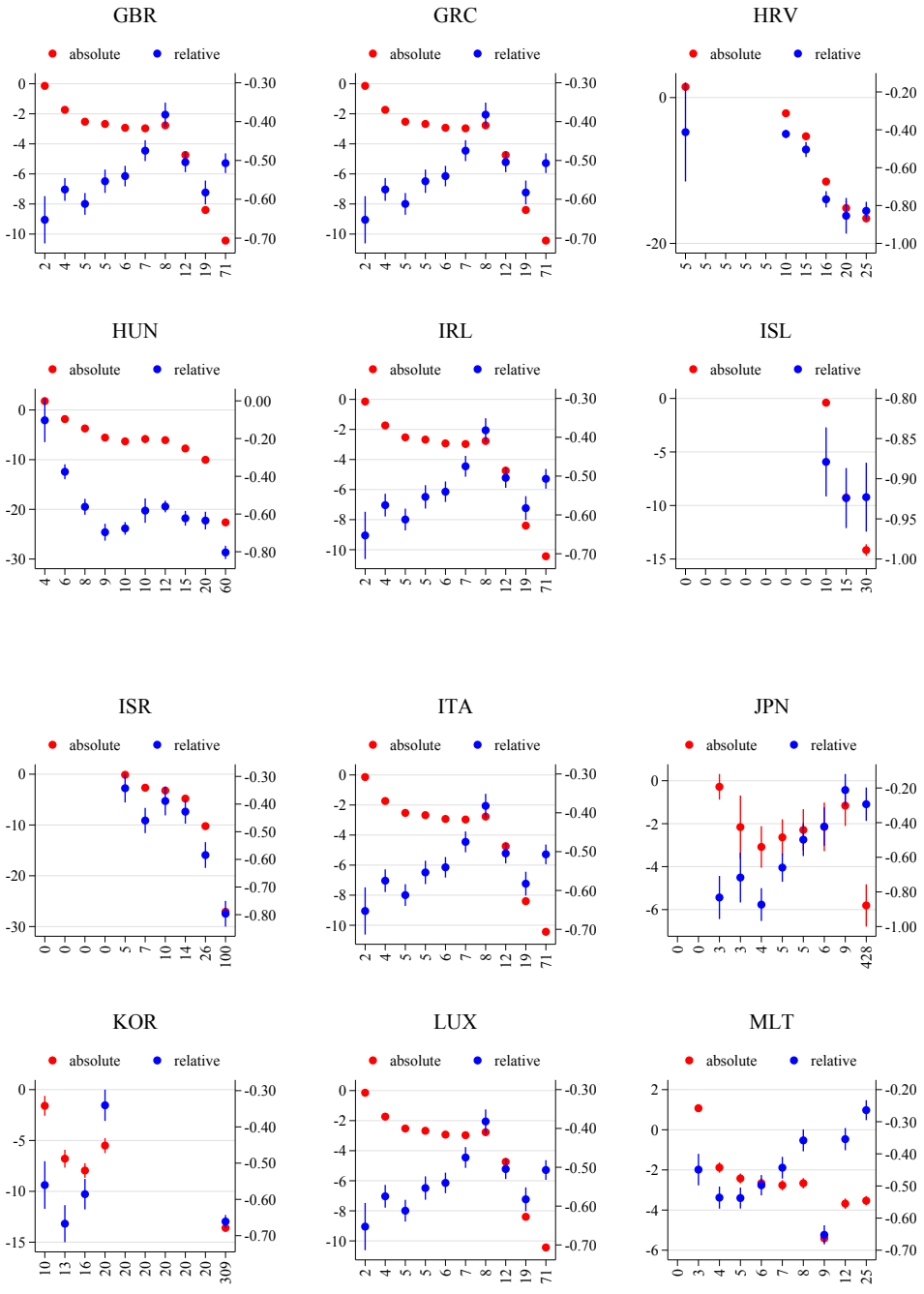
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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



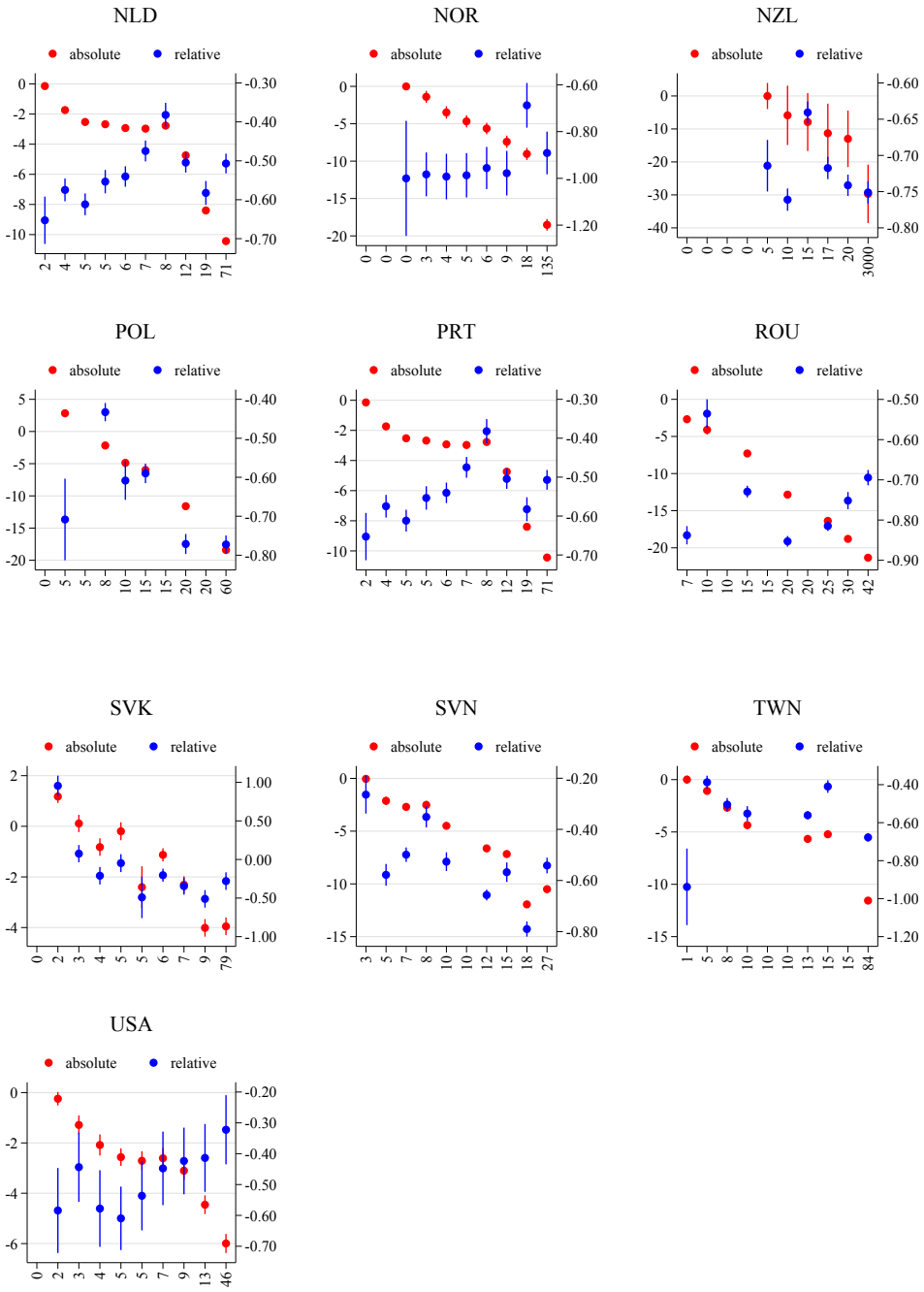
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

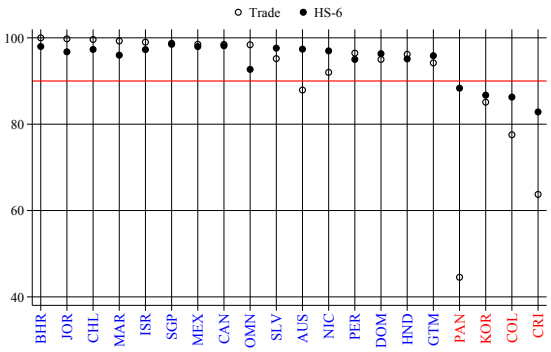
Figure A15: Pattern in Tariff Reductions (2017 – 1988) for High Income Countries *—continued*



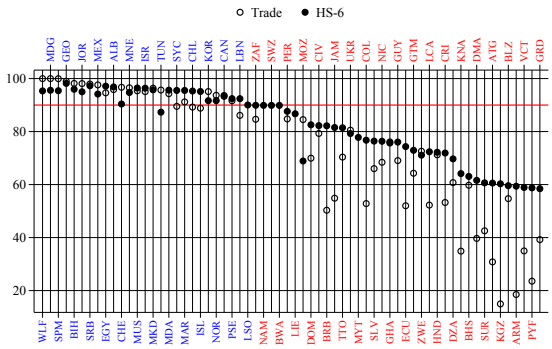
Note: This graph shows the β coefficients and the confidence intervals of the regression equation $y = \sum_{c=1}^{10} \beta_c I_i^c + u_{ik}$. The left axis reports the coefficients when using the absolute difference, the right axis shows the relative difference (see main text for a formal definition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

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

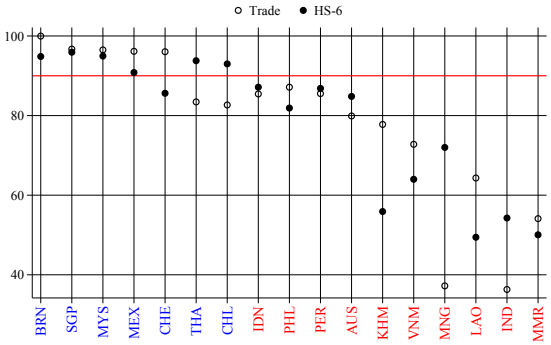
(a) United States



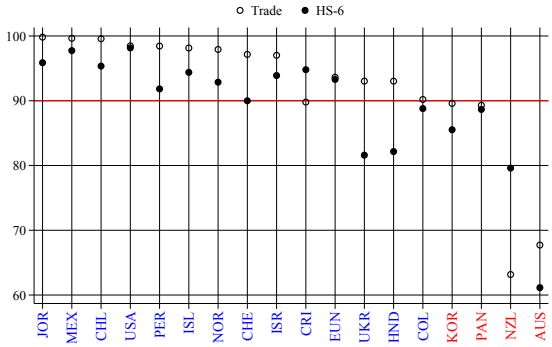
(b) European Union



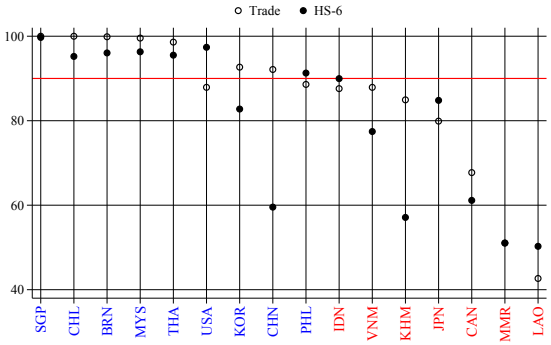
(c) Japan



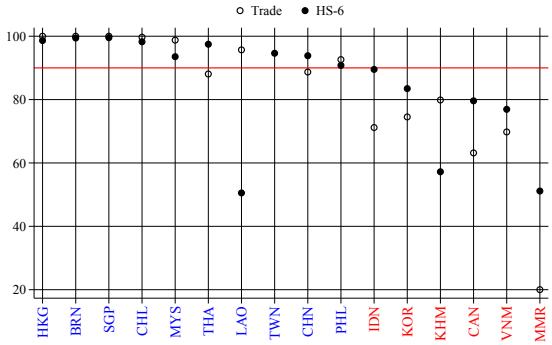
(d) Canada



(e) Australia



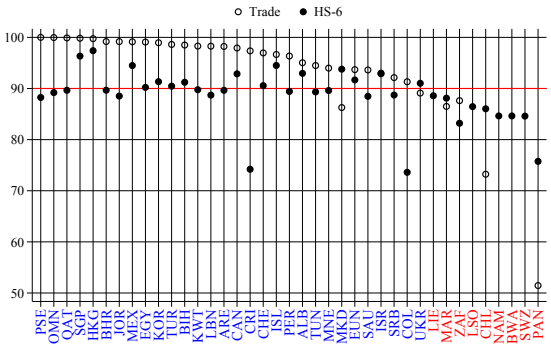
(f) New Zealand



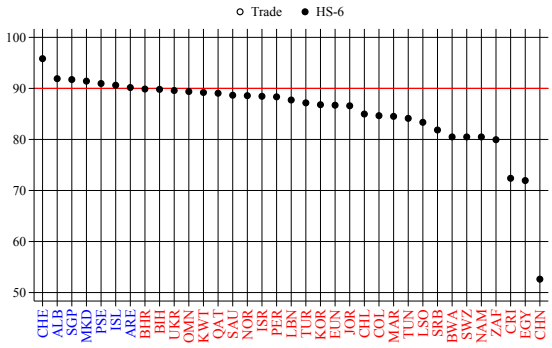
Note: The graph shows the two interpretations of the substantially-all-trade criterion, namely the pairwise share of zero trade and tariff lines with zero tariffs for all North-South country pairs.

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

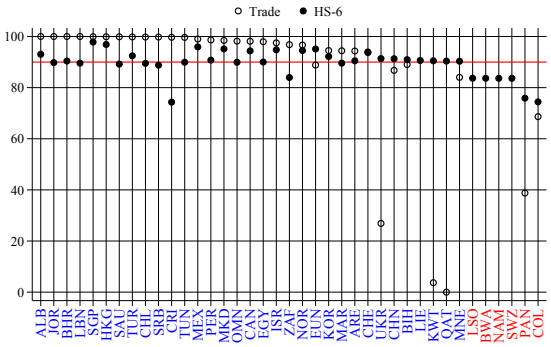
(g) Norway



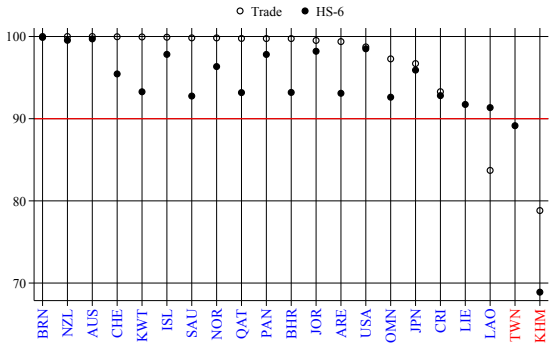
(h) Liechtenstein



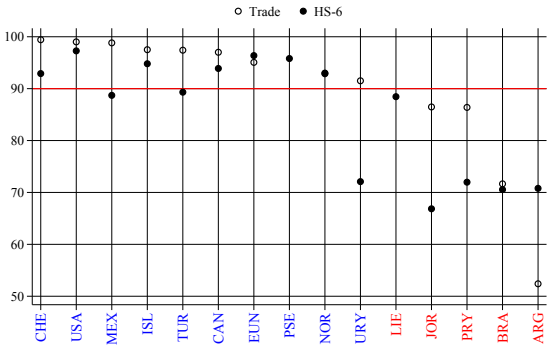
(i) Iceland



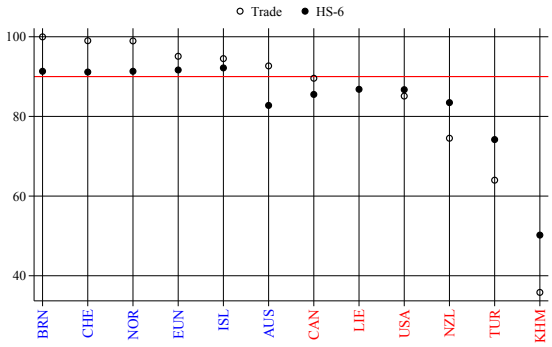
(j) Singapore



(k) Israel

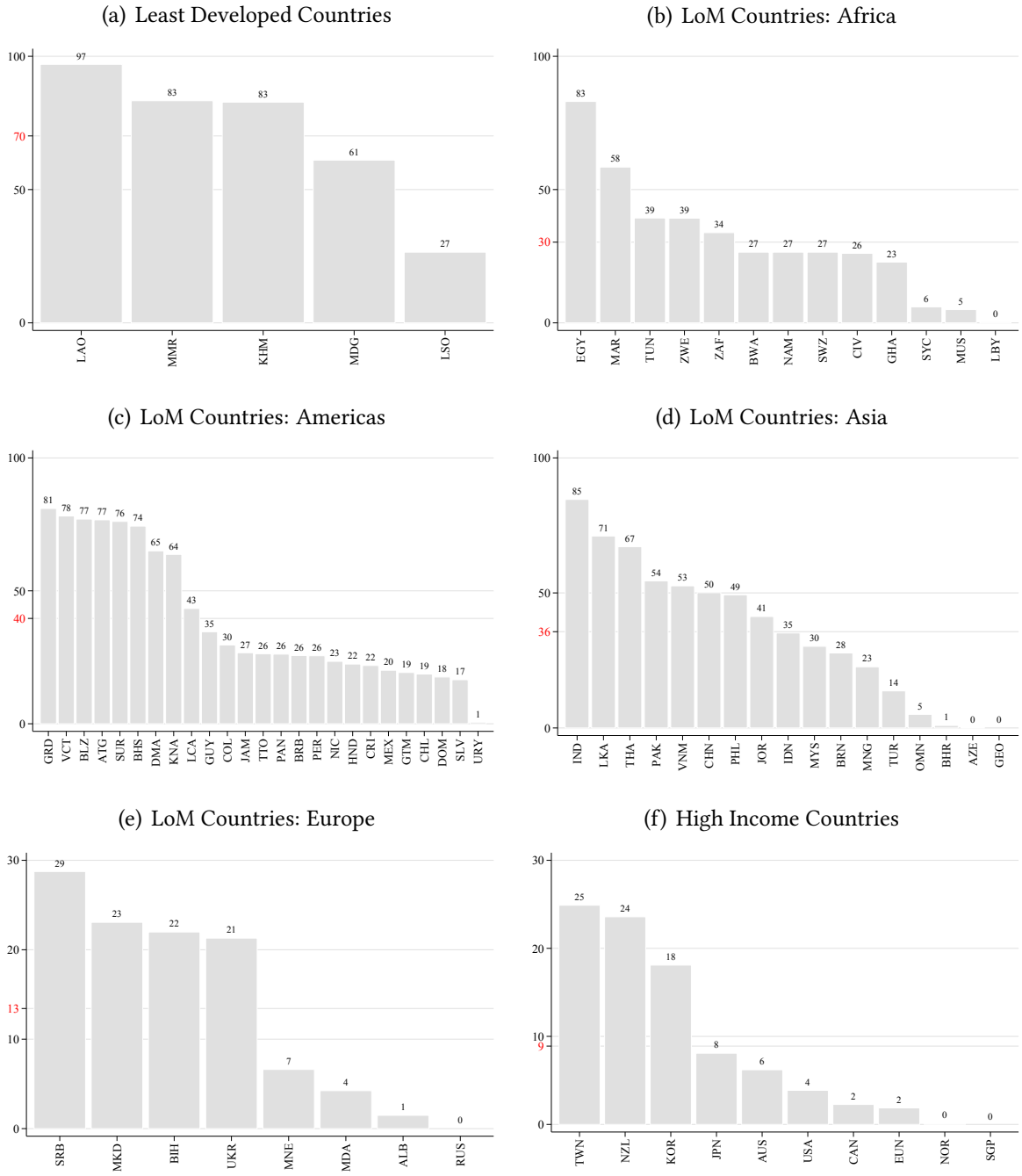


(l) South Korea



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.

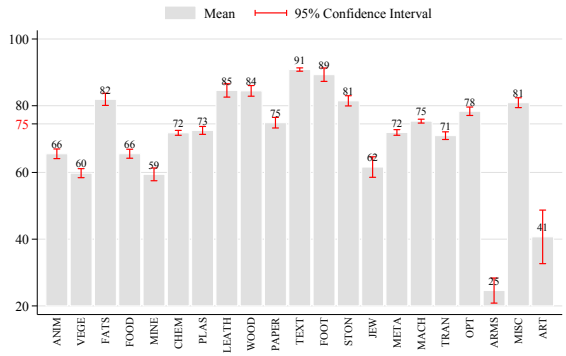
Figure A17: Phasing-In across Countries



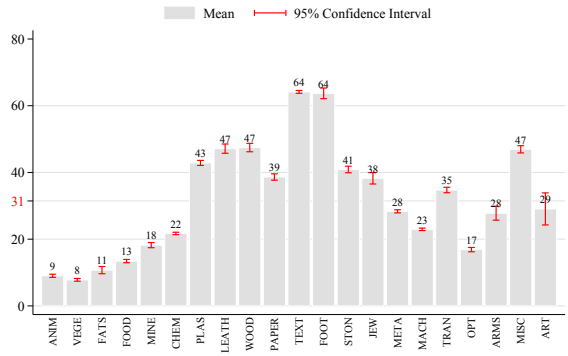
Note: The graph shows the probability of Phasing-In across all countries. The sample is different from the one used in the main analysis because this information is not available for all FTAs but instead only 149. The countries on the x-axis are sorted by descending order.

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

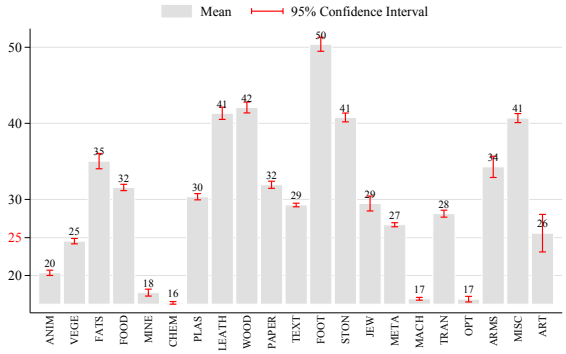
(a) Least Developed Countries



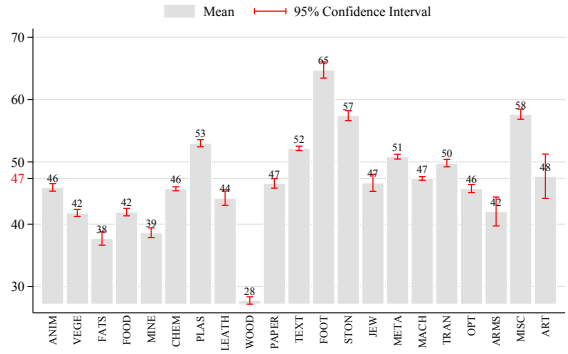
(b) LoM Countries: Africa



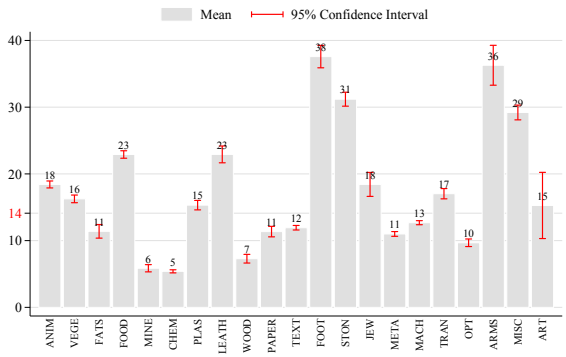
(c) LoM Countries: Americas



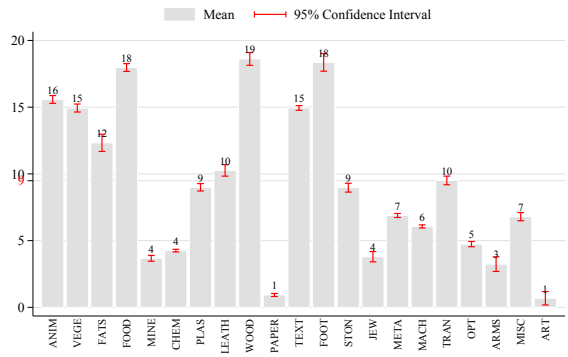
(d) LoM Countries: Asia



(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), Dix-Carneiro and Kovak (2017), Kovak (2013), and Menezes-Filho and Muendler (2011)
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), Liu (1993), Pavcnik (2002), 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	De Loecker et al. (2016), Topalova (2010), and Topalova and Khandelwal (2011)
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.