

The Balance of Concessions in the World Trade Organization*

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Abstract

Reciprocity is a key principle governing the negotiations under the GATT/WTO agreement, which calls for a balance of concessions among the WTO members. In recent years, however, various politicians across the world have voiced concerns about their country's excessive obligations under the WTO and a lack of reciprocation by their trading partners. Our objective in this paper is to evaluate the degree to which the pattern of applied tariffs across WTO members deviates from a balanced-concession condition. To this end, we employ a quantitative trade model and use alternative definitions of reciprocity (based on market access or welfare) to measure the concessions received and given by each country during 1995–2011 for a large set of 64 economies and 20 sectors, relative to the counterfactual of unilateral optimal tariffs. We characterize how the balance of bilateral and multilateral concessions have shifted over time due to changes in applied tariffs and in market sizes, and how they systematically differ across developed WTO members, old developing members, and new developing members.

Key Words: WTO; Bilateral Concession; Market Access; Optimal Tariff; Quantitative Welfare Analysis

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“We believe that trade must be fair and reciprocal. The United States will not be taken advantage of any longer.” — Donald Trump, Address to the UN General Assembly, September 25, 2018.

1 Introduction

Reciprocity is a key principle governing the negotiations under the GATT/WTO agreement, which calls for a balance of concessions among the WTO members. In recent years, however, various politicians across the world have voiced concerns about their country’s excessive obligations under the WTO and a lack of reciprocation by their trading partners. Notably, based on similar grounds, high-level politicians in the United States have argued for reconsidering the obligations of the U.S. under the WTO agreement. Some have even argued that the U.S. should pull out of the WTO altogether.¹ These widespread anti-WTO sentiments in the United States government, which was one of the organization’s principal sponsors from the beginning, has put the future of the organization in doubt.

Our objective in this paper is to map the structure of the balance of concessions in the WTO and evaluate the resilience of the organization to the departure or downgraded cooperation of its principal members such as the United States. To this end, we employ a quantitative trade model and use alternative definitions of reciprocity (based on market access or welfare) to measure the concessions received and given by each country under the WTO during 1995–2011 for a large set of 64 economies and 20 sectors, compared to a world without trade policy cooperation (where individual countries retreat to their unilateral optimal tariffs). We also measure the amounts of market access (welfare gains) that are withheld due to the remaining tariffs. We characterize how the balance of bilateral and multilateral concessions have shifted over time due to changes in applied tariffs and in market sizes, and how they systematically differ across industrial WTO members, old developing members (which join the GATT/WTO before 1995), and new developing members (which join the GATT/WTO after 1995).

A first step in depicting the structure of concessions in the WTO is to develop a meaningful measure of concessions that reflects the objectives and motivations of governments in international trade cooperations. We follow Bagwell and Staiger (1999) by defining the level

¹In a New York Times article, U.S. Senator Josh Hawley calls for the abolition of the WTO, arguing that “its mandate was to promote free trade, but the organization instead allowed some nations to maintain trade barriers and protectionist workarounds, like China, while preventing others from defending themselves, like the United States.”

of concessions associated with a tariff cut as the resulting change in the trade volume at original prices. Specifically, the concession (in terms of market access) given by a country is the increase in its imports from each of its trading partners by restraining from levying its unilateral optimal tariff. Vice versa, the concession received by a country from a trading partner is the additional market access the country enjoys if the trading partner maintains its applied tariffs instead of withdrawing from the WTO (and all other trade agreements) and levying its unilateral optimal tariffs.

In addition to the measure based on market access, we also evaluate concessions based on welfare (i.e., real income). That is, the concession (in terms of welfare) given by a country is the welfare gain enjoyed by each of its trading partners when the country restrains from levying its optimal tariff. This concept is closely related to the welfare analysis of trade war and trade talks by Ossa (2014) in a static game and Mei (2020) in a repeated game. In particular, Mei (2020) evaluates the self-enforceability of trade agreements (given each country's one-period gain from deviation and the future loss as a result of the deviation). One may argue that the minimum discount factor Mei (2020) finds is related to the balance of concessions. Nonetheless, both studies conduct the analysis with a relatively small set of individual countries (less than 10) and a year of data (2007). Hence, they do not address the issue of changes in the balance of concessions over the years and on a bilateral basis for many developing trading economies of policy interest. Given that the market size and trade policies of developing countries have shifted significantly since 1995, it is useful to characterise the balance of concession under the WTO along both cross-sectional and temporal dimensions.

Given the measured concessions, we evaluate whether the level of bilateral exchange of concessions differ systematically across the development status (and the vintage of WTO membership) of bilateral country pairs, and whether any asymmetry pattern identified change over the years. The analysis is motivated by the observations that tariff commitments under the GATT/WTO vary substantially across countries: while advanced industrial countries engaged in substantial tariff cuts across many sectors, most developing countries have retained various degrees of flexibility to set their import tariffs unilaterally. The substantial asymmetry in the level of tariffs across countries may indicate that developing countries received more market access concessions from industrial countries than they gave. In fact, a favorable treatment of developing countries would be consistent with the spirit of *special and differential treatment provisions* in the WTO.²

Subramanian and Wei (2007), however, find that, holding other factors constant, indus-

²The WTO Agreements contain special provisions which give developing countries special rights and which give developed countries the possibility to treat developing countries more favorably than other WTO members. This includes provisions requiring all WTO members to safeguard the trade interests of developing countries.

trial countries import about 40% less from developing countries than from other industrial countries. They interpret this result as indicating higher tariffs on the products of interest to developing countries. By simulating the bilateral exchange of market access that WTO tariff cuts confer (relative to the counterfactual of unilateral optimal tariffs), we complement their ex-post analysis and provide a direct evaluation of whether industrial WTO members receive more concessions than developing WTO members do, and whether old developing members receive more concession relative to new members (or vice versa). These concessions (measured against the counterfactual of optimal tariffs) take into account potential productivity and market size changes over time, and hence offers a more precise depiction of the market power and outside option of member countries at each given point in time, relative to mere comparisons based on trade volumes.

The remainder of this paper is organized as follows. In Section 2, we lay out the general equilibrium model that we use to simulate counterfactual equilibria. In Section 3, we formally define the alternative measures of concessions (based on market access or welfare) and discuss their merits and limitations. Section 4 presents the anatomy of concessions in the WTO across years bilaterally and multilaterally. In Section 5, we analyze how the level of bilateral exchange of concessions differ across the development status (and the vintage of WTO membership) of bilateral country pairs. Section 6 concludes.

2 Model

Consider a multi-country and multi-sector setup. The goods are differentiated by the origin of production i , destination of consumption j , and sector, in terms of both production technology and preferences. We take the activities in the service sectors as exogenous (whose quantities of production, consumption, and trade flows remain fixed in counterfactual exercises) and group them into one aggregate sector s . The set M of non-service sectors (including agriculture, mining, and manufacturing) are indexed by $k \in \{1, 2, \dots, K\}$.

2.1 Setup

Let U_j^M denote utility obtained from non-service sectors in country j , with a nested Cobb-Douglas CES structure such that:

$$U_j^M = \prod_{k \in M} \left(\sum_{i=1}^N b_{ij,k} \tilde{q}_{ij,k}^{\rho_k} \right)^{\frac{\mu_{j,k}^M}{\rho_k}}, \quad (1)$$

where $\tilde{q}_{i,j,k}$ is the quantity consumed in country j of variety i in sector k , $b_{i,j,k} \in \mathbb{R}_+$ is a constant taste shifter, $\sigma_k \equiv 1/(1 - \rho_k)$ corresponds to the elasticity of substitution across varieties in sector k , and $\mu_{j,k}^M \equiv \frac{\mu_{j,k}}{\mu_j^M}$ represents the share of expenditure on sector k among non-service sectors (where $\mu_{j,k}$ is country j 's share of expenditure on sector k , and $\mu_j^M \equiv \sum_{l \in M} \mu_{j,l}$ is the total share of expenditure on non-service sectors in country j).

Production technology follows the Ricardian structure, with labour as the only factor of production. Let $\bar{a}_{i,j,k}$ denote the exogenous unit labour requirement to produce a good of sector k in country i for consumption in country j . Given perfectly competitive markets, the producer price $p_{i,j,k}$ equals:

$$p_{i,j,k} = \bar{a}_{i,j,k} \omega_i^M,$$

where ω_i^M is the wage rate in country i (for non-service sectors). The consumer price $\tilde{p}_{i,j,k}$ at the destination equals:

$$\tilde{p}_{i,j,k} = (1 + t_{i,j,k})(1 + \tau_{i,j,k})p_{i,j,k}, \quad t_{ii,k} = 0, \quad (2)$$

where $t_{i,j,k}$ and $\tau_{i,j,k}$ are respectively the ad valorem tariff rate and trade cost factor faced by goods shipped from country i to country j in sector k .

Given the CES structure within each sector, the share of expenditure allocated to varieties of origin i is:

$$\lambda_{i,j,k} = b_{i,j,k}^{\sigma_k} \left(\frac{\tilde{p}_{i,j,k}}{P_{j,k}} \right)^{1-\sigma_k} \quad (3)$$

with the price index $P_{j,k}$ for sector k in country j equal to:

$$P_{j,k} = \left(\sum_n b_{n,j,k}^{\sigma_k} \tilde{p}_{n,j,k}^{1-\sigma_k} \right)^{\frac{1}{1-\sigma_k}}. \quad (4)$$

It follows that wage income of country i (for non-service sectors) is:

$$\begin{aligned} \omega_i^M L_i^M &= \sum_j \sum_{k \in M} \frac{\tilde{p}_{i,j,k} \tilde{q}_{i,j,k}}{1 + t_{i,j,k}} \\ &= \sum_j \sum_{k \in M} \frac{\lambda_{i,j,k} \mu_{j,k}^M Y_j^M}{1 + t_{i,j,k}}, \end{aligned} \quad (5)$$

where the aggregate expenditure Y_j^M of country j on non-service sectors, by budget constraint, is equal to the sum of wage income, tariff revenues, and trade deficit TD_j^M of these

sectors:

$$\begin{aligned}
Y_j^M &= \omega_j^M L_j^M + \sum_{k \in M} \sum_i \frac{t_{ij,k}}{1+t_{ij,k}} \tilde{p}_{ij,k} \tilde{q}_{ij,k} + TD_j^M \\
&= \omega_j^M L_j^M + \sum_{k \in M} \sum_i \frac{t_{ij,k}}{1+t_{ij,k}} \lambda_{ij,k} \mu_{j,k}^M Y_j^M + TD_j^M.
\end{aligned} \tag{6}$$

Given the tariffs $\{t_{ij,k}\}$, an equilibrium is a vector of variables $\{\omega_j^M, Y_j^M, \lambda_{ij,k}, P_{j,k}^M\}$ that satisfies conditions (2)–(6) for all ij, k , conditional on the set of parameters $\{\tau_{ij,k}, b_{ij,k}, \bar{a}_{ij,k}, \sigma_k\}$ and observables $\{\mu_{j,k}^M, \mu_j^M, TD_j^M\}$. Given (1), we have the welfare of country j (derived from non-service sectors) as:

$$W_j = \left(\frac{Y_j^M}{\prod_{k \in M} P_{j,k}^{\mu_{j,k}^M}} \right)^{\mu_j^M}. \tag{7}$$

2.2 Counterfactual Changes

In counterfactual exercises, we introduce changes in the tariff into the system. Applying the hat-algebra approach popularized by Dekle et al. (2008), the system of equilibrium conditions can be re-written in terms of changes as:

$$\hat{\lambda}_{ij,k} = \left(\frac{1+t'_{ij,k} \hat{\omega}_i^M}{1+t_{ij,k}} \right)^{1-\sigma_k} (\hat{P}_{j,k})^{\sigma_k-1}, \tag{8}$$

$$(\hat{P}_{j,k})^{1-\sigma_k} = \sum_i \lambda_{ij,k} \left(\frac{1+t'_{ij,k} \hat{\omega}_i^M}{1+t_{ij,k}} \right)^{1-\sigma_k}, \tag{9}$$

$$\hat{\omega}_i^M \omega_i^M L_i^M = \sum_j \sum_{k \in M} \frac{\hat{\lambda}_{ij,k} \hat{Y}_j^M \lambda_{ij,k} \mu_{j,k}^M Y_j^M}{1+t'_{ij,k}}, \tag{10}$$

$$\hat{Y}_j^M Y_j^M = \hat{\omega}_j^M \omega_j^M L_j^M + \sum_{k \in M} \sum_i \left(\frac{t'_{ij,k}}{1+t'_{ij,k}} \hat{\lambda}_{ij,k} \hat{Y}_j^M \lambda_{ij,k} \mu_{j,k}^M Y_j^M \right) + TD_j^{M'}, \tag{11}$$

where $\hat{x} \equiv x'/x$ indicates the ratio of the counterfactual value x' to the factual value x of an endogenous variable. This implies changes in welfare to be:

$$\hat{W}_j = \left(\frac{\hat{Y}_j^M}{\prod_{k \in M} \hat{P}_{j,k}^{\mu_{j,k}^M}} \right)^{\mu_j^M}. \tag{12}$$

We start the analysis by allowing trade deficits in the model. Following the literature

(see, e.g., Caliendo and Parro, 2015), we assume the trade deficit of each country to be a constant share of world output. This implies that $TD_j^{M'} = \delta_j \sum_i \hat{\omega}_i^M \omega_i^M L_i^M$, where $\delta_j \equiv TD_j^M / \sum_i \omega_i^M L_i^M$. Note that $\sum_j TD_j^{M'} = -\sum_j TD_j^{S'} = -\sum_j TD_j^S$ by trade balance at the world level (in the first equality) and by keeping the service sector activities fixed (in the second equality where TD_j^S indicates country j 's trade deficit in the service sector), while at the same time, $\sum_j TD_j^{M'} = \sum_i \hat{\omega}_i^M \omega_i^M L_i^M$. Thus, the structure effectively keep the world output fixed (or equivalently, normalizes the changes in variables relative to changes in the world output). As an alternative, we also consider a balanced trade scenario in which trade deficits are purged from the data as in Ossa (2014). More details are to be discussed in Section 4.

2.3 Map the Model to the Data

Given data on trade flows $x_{ij,k}$ and applied tariff rates $t_{ij,k}$, we measure the parameters and variables required in the counterfactual analysis (8)–(11) as follows:

$$\lambda_{ij,k} = \frac{x_{ij,k}}{\sum_i x_{ij,k}}; \quad \mu_j^M = \frac{\sum_{k \in M} \sum_i x_{ij,k}}{\sum_{k \in M} \sum_i x_{ij,k} + \sum_i x_{ij}^S}; \quad \mu_{j,k}^M = \frac{\sum_i x_{ij,k}}{\sum_{k' \in M} \sum_i x_{ij,k'}};$$

$$\omega_i^M L_i^M = \sum_{k \in M} \sum_j \frac{x_{ij,k}}{1 + t_{ij,k}}; \quad Y_j^M = \sum_{k \in M} \sum_i x_{ij,k};$$

$$TD_j^M = \sum_{k \in M} \sum_i \left(\frac{x_{ij,k}}{1 + t_{ij,k}} - \frac{x_{ji,k}}{1 + t_{ji,k}} \right); \quad \delta_j = \frac{TD_j^M}{\sum_i \omega_i^M L_i^M}.$$

We obtain production and bilateral trade data (in intermediate and final goods combined) from the OECD-WTO Trade in Value Added (TiVA) database. The 2016 edition records trade flows for 63 economies (and a residual Rest of the World) in 34 sectors (based on ISIC Rev. 3) for years 1995–2011. The methodology and assumptions underlying the construction of the TiVA database can be found in OECD-WTO (2012).³ See Tables 1 and 2 for the list of economies and sectors. We aggregate service sectors into one combined sector. This amounts to a total of 20 individual sectors to be used in the subsequent analysis. In the optimal tariff analysis and measure of concession, we consider countries in the European Union (EU) as one combined entity in setting trade policy. The membership size of the EU increased from 15 to 27 during the period 1995–2011. Correspondingly, the set of individual economy entities

³More details about the dataset are provided at <http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>. Tables are available from <https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm>.

analyzed reduced from 50 (in the period 1995–2003), to 40 (in 2004–2006), and to 38 (in 2007–2011). The data on tariffs are sourced from the TRAINS database, downloaded via the World Integrated Trade Solution (WITS) interface.⁴

We estimate the trade elasticity ($\sigma_k - 1$) following the approach in Caliendo and Parro (2015). In particular, the trade structure in the current model implies that:

$$\ln \frac{x_{in,k}x_{nj,k}x_{ji,k}}{x_{ni,k}x_{jn,k}x_{ij,k}} = (1 - \sigma_k) \ln \frac{\tilde{t}_{in,k}\tilde{t}_{nj,k}\tilde{t}_{ji,k}}{\tilde{t}_{ni,k}\tilde{t}_{jn,k}\tilde{t}_{ij,k}} + \varepsilon_{inj,k} \quad (13)$$

where $\tilde{t}_{ij,k} = 1 + t_{ij,k}$. We implement the regression using the panel of country pairs in the period 1995–2011 for each sector $k \in M$. The estimates of $\sigma_k - 1$ are reported in Table 2. See the footnote therein for further details of the implementation.

3 Measure of Concessions

We define concession given by a country as the gain (in terms of market access or welfare) of its trading partners when the country restrains from levying its unilateral optimal tariffs. In other words, we measure the difference in each trading partner’s market access to the country (or correspondingly, difference in welfare) under the applied tariff structure relative to the counterfactual scenario in which the importing country imposes its unilaterally-optimal tariff rates. The optimal tariff rates are endogenously calculated given the factual trade flows, production, and tariff structures across countries and sectors. We find country j ’s unilaterally optimal tariffs by searching for the set of tariffs that maximize the increase in country j ’s welfare, namely:

$$\max_{t'_{ij,k}} \hat{W}_j \quad (14)$$

given (12) subject to the counterfactual equilibrium conditions (8)–(11), within the parameter space:

$$t'_{ij,k} = \begin{cases} t'_{j,k}, & \text{if } i \neq j; \\ 0, & \text{if } i = j. \end{cases}$$

The optimal tariff vector $\{t'_{j,k}\}_k$ is simulated for one economy at a time, given the other economies’ factual trade policies.

⁴<https://wits.worldbank.org/>.

3.1 Market Access Concession

We follow Bagwell and Staiger (1999) by defining the level of concessions associated with a tariff cut as the resulting change in the trade volume at original prices. Specifically, the concession (in terms of market access) given by a country is the increase in its imports from each of its trading partners by restraining from levying its unilateral optimal tariff. In other words, the concession given by an importing country j to its trading partner i in terms of market access is the gain in i 's export value to market j under the factual tariffs (with trade agreements in place) relative to the counterfactual value, measured at initial prices, if country j levies its optimal tariffs:

$$\begin{aligned} Concession_{ij}^{MA} &\equiv P_{ij}(Q_{ij} - Q'_{ij}) \\ &\equiv \sum_{k \in M} \frac{\tilde{p}_{ij,k} \tilde{q}_{ij,k}}{1 + t_{ij,k}} - \frac{1}{\hat{\omega}_j^M} \sum_{k \in M} \frac{\tilde{p}'_{ij,k} \tilde{q}'_{ij,k}}{1 + t'_{ij,k}}. \end{aligned} \quad (15)$$

Since market access is measured at initial prices and quantity traded in the service sector is kept unchanged under counterfactuals, the formula above reflects changes in the market access in non-service sectors only. Balance of concession can then be measured for a country pair as follows:

$$BoC_{ij}^{MA} = \frac{Concession_{ij}^{MA} - Concession_{ji}^{MA}}{Concession_{ij}^{MA} + Concession_{ji}^{MA}}, \quad (16)$$

which indicates how much more country j 's concession to i is compared to country i 's concession to j , as a fraction of the total exchange of market access. An index closer to zero corresponds to a more balanced exchange of concession. Similarly, we can measure a country's total concession offered and received relative to its trading partners as:

$$BoC_j^{MA} = \frac{\sum_{i \neq j} (Concession_{ij}^{MA} - Concession_{ji}^{MA})}{\sum_{i \neq j} (Concession_{ij}^{MA} + Concession_{ji}^{MA})}. \quad (17)$$

A larger positive index value indicates that country j has provided more concessions to the rest of the world than it has received in return, and vice versa with a more negative index value.

3.2 Welfare Concession

In addition to market access, we may also measure concessions in terms of welfare changes. The concession rendered by an importing country j to its trading partner i in terms of welfare is the gain in i 's welfare under the factual tariffs (with trade agreements in place) relative

to the counterfactual value, should country j impose its unilateral optimal tariffs. In other words,

$$Concession_{ij}^W = \left[1 - \hat{W}_i(\{t'_{j,k}\}) \right] \times \mu_i^M \times GDP_i, \quad (18)$$

where $\hat{W}_i(\{t'_{j,k}\})$ indicates country i 's counterfactual welfare (relative to the status quo) should country j impose its optimal tariffs; and GDP_i denotes real GDPs of country i (data on which were extracted from the Penn World Table). Given (18), we can define bilateral and multilateral balance of concessions, BoC_{ij}^W and BoC_j^W , in terms of welfare in similar manners as for the market access.

We now discuss the merits and limitations of the proposed measures. If trading partners were symmetric in size, measuring concessions by market access or welfare changes would lead to identical conclusions. However, when countries are asymmetric, these two measures would generate different levels of bilateral concessions and hence yardsticks of evaluations.

Concessions as measured by market access is the closest definition to the language used in the GATT/WTO agreements. Moreover, as pointed out by Bagwell and Staiger (1999), under various models of international trade, the exchange of market access reflects the core objective of trade negotiations, namely, eliminating the terms of trade externality of unilateral trade policy. On the other hand, using welfare effects as a measure of concessions may be more aligned with a bargaining model of tariff cuts such as Nash bargaining used in Ossa (2014). For practical matters, however, it is unlikely that trade negotiators use a direct measure of welfare effect: For one, it is difficult to come up with a universally-accepted measure of welfare effect.

Another practical way to measure the balance of concessions is to compare the amount of taxes that countries surrender/collect on their bilateral imports (relative to optimal tariffs and free trade, respectively). Tariff revenues, however, do not have a solid theoretical foundation as a measure of granted/withheld trade concessions. An obvious problem with this measure is that low import tariff revenues could be the result of very high tariffs (that result in small import volumes) or low tariffs on imports. This problem may be avoided by using the trade volume under free trade multiplied by the levied ad valorem tariffs as a measure of withheld concessions. Although this variable lacks a theoretical foundation as a measure of concession, it is frequently used to describe the extent of a trade skirmish (such as the recent US-China tariff adjustments).

4 Anatomy of WTO Concessions

To understand the cross-country and temporal patterns of concessions, it is useful to decompose them into the variation due to trade balances, applied tariffs, and market size.

The effects of trade imbalance on concessions could be inferred by comparing the concessions under the factual world (with trade imbalances) and those in a world purged of trade imbalances. In the latter case, we first purge trade imbalances from the data following the methodology in Costinot and Rodríguez-Clare (2014). Effectively, the equilibrium is recalculated by setting trade deficits to zeros. Under the counterfactual world with trade balance, the optimal tariffs and concessions (in market access and welfare) are re-simulated following the formulas in Section 3. Countries such as China and the United States operated with large trade imbalances during the period of the study. This could potentially amplify the extent of concessions received and granted, given a setup where trade deficits are modelled as fixed proportions of world output. Intuitively, countries with large trade deficits have more room to raise import tariffs and hence more potential concessions to offer; on the other hand, exporting countries with large trade surplus benefit more from any given tariff reductions by their trading partners. Removing the trade imbalances from the data will thus tend to reduce the imbalance of concessions between countries with trade deficits and those with trade surpluses in general.

Next, given the counterfactual world equilibrium with trade balance (call this world equilibrium II), we further isolate the effects on concessions due to changes in applied tariffs. This is accomplished by simulating yet another parallel world equilibrium across years where applied tariffs are kept at their levels in 1995 (call this world equilibrium III). The optimal tariffs and concessions (in market access and welfare) are re-simulated across years given this alternative pseudo world. The difference in concessions under the pseudo world II and the pseudo world III can be regarded as the effect on concessions due to changes in applied tariffs. The change in concessions across years computed under the pseudo world III can then be attributed to the effects of market size changes over time. Since the formation of the WTO in 1995, tariffs have reduced by different extents among the members. Meanwhile, market sizes of some economies (such as China and India) have experienced substantial growth. For countries with small drops in applied tariffs since 1995, market size effects will play a predominant role. On the other hand, for countries with considerable cuts in applied tariffs since 1995, their concessions will embody proportionally more the tariff effects.

4.1 Overall Patterns and Trade Imbalance Effects

Figure 1 and Figure 2 summarize each economy's net concession index BoC_j^{MA} (concessions offered net of concessions received as a fraction of total concessions exchanged), given trade deficits and with trade deficits purged respectively. The effects on concessions due to trade imbalance can be inferred from comparison of the measure under these two scenarios.

We have grouped countries by their geographical regions into six sub-plots. Figure 1 shows that in East Asia, Pacific & South Asia, Australia, New Zealand, and Hong Kong are the three economies with positive balance of concessions in market access. This indicates that they granted more concessions to their trading partners than they received in 1995–2011. The reverse is true with economies such as Japan, Korea and Taiwan, which provided net negative concessions. Over the years, the balance of concessions of India increased, and turned from negative to positive in 2005. This was partly driven by large reductions in import tariffs by India in the year. China's net concessions saw a jump in 2002 when it joined WTO. However, its concessions have trended downward since then and turned negative in 2005. Compared with Figure 2, we see that the decrease in its net concessions was largely due to its growing export volumes and trade surplus. With its trade surplus purged, China was more or less in balance in terms of total concessions it granted and received to and from its trading partners. The same applies to the case of Japan, Korea, and Taiwan. These countries generally ran large trade surpluses with respect to their trading partners. With trade surplus purged, their negative net concessions in market access are reduced and close to being zeros. Overall for the economies in East Asia, the degrees of deviations from the balance of concessions were small once trade imbalance is purged; most economies were either hovering around or converging toward the reciprocity condition. Hong Kong was in an opposite situation from the East Asian economies discussed above. Its net concessions were positive with trade imbalance, but became largely negative (and increasingly so) once trade imbalance was purged. Indeed, Hong Kong ran huge trade deficits during the period of study, which correspond to large concessions in market access. When trade imbalance is eliminated, the amount of concessions Hong Kong granted was reduced.

Southeast Asian economies in general were net receivers of market access concessions, even after trade imbalance is purged. The exceptions are Vietnam, Indonesia and Brunei. While in the case of Vietnam, it was a net giver of market access concessions with or without trade imbalance purged, Indonesia's concession index became positive (or more positive) with trade imbalance purged. The effect of trade surplus was especially pronounced for Brunei, having a large negative concession index with trade imbalance in place and a positive concession index instead when trade imbalance is purged.

The effect of trade imbalance on concessions is most evident in the case of the US, whose

trade deficits have increased over the years and who has topped the nations in terms of trade deficits incurred. While it was a large net granter of market access concessions with trade deficits in place, it was a net receiver of market access concessions with the trade imbalance excluded. Canada and Mexico were overall net receivers of concessions in market access, although the gap closed up momentarily during 2005–2010.

Most of the Latin American economies granted more concessions than they received from their trading partners, with the exceptions of Chile and Costa Rica. Although both countries' concessions granted to trading partners have increased over the years, the amount of concessions received grew at an even faster rate.

Turning to Europe, the EU (being one of the largest trading bloc) has granted concessions in amounts very close to what it received. In contrast, Iceland and Norway were net grantors, while Switzerland and Russia were net receivers, of concessions in market access. In the case of Russia, the conclusion reversed if we purge the trade imbalance, with the amount of concessions granted surpassing the concessions received in the 2000s. This again reflects the effect of its trade surplus in this period of study. With trade surplus removed, it leads to smaller amounts of market access concessions received by Russia and hence a less negative (or more positive) position in its balance of concession.

The set of Middle Eastern and African countries were in general net receivers of market access concessions. No significant difference is observed when comparing the concessions with and without trade imbalance. The exception was Saudi Arabia, which ran trade surpluses. When trade imbalance is purged from the data, Saudi Arabia's net concession index turned from being negative to positive.

The net concessions in terms of welfare are summarized in Figure 3 and Figure 4 for the scenario with and without trade imbalance respectively. The net concessions across countries are found to be more dispersed in terms of welfare than market access. With some major exceptions (including China, Japan, the US and the EU), the qualitative patterns are in general consistent with those discussed above based on market access. Importantly, in terms of welfare concessions, China is found to be a large net beneficiary (even with trade imbalance purged). In contrast, Japan, the US and the EU were found to be large net benefactors. Japan and the EU, who were found to be in either negative or balanced positions in terms of market access concessions, are shown to be in large positive positions in terms of welfare concessions. In similar spirits, the US's position in net welfare concession tended to be higher than its position in terms of market access concession, and remained to be positive even after trade imbalance is purged. Nonetheless, it is worthwhile noting that China's net welfare concessions have increased over the years (turning from negative toward balance); in contrast, the US's net welfare concessions have trended downward (if excluding

the effects of its large trade deficits).

4.2 Applied Tariff Effects versus Market Size Effects

Next, we decompose the concessions granted by each economy into effects driven by applied tariffs and effects driven by market size, in the way suggested in the introduction of Section 4. The results are summarized in Figure 5. We note that concessions in market access are predominantly driven by changes in market size. That is, when economies grow and vary in their sizes, optimal tariffs and hence implied concessions change. This effect tends to overwhelm potential changes in concessions due to changes in applied tariff rates.

China and India are two notable exceptions, with sizable applied tariff effects. In the case of China, it started to reduce its unilateral tariffs in the 1990s and with its negotiated accession packages for joining the WTO in 2001, its general tariffs were further lowered. This is reflected in the increasing role of applied tariff effects in the decomposition of market access concessions by China (from 23% in 1996 to nearly 40% in 2002). The share of applied tariff effects remained high for the next few years. However, China's economies grew rapidly in the 2000s and the market size effect started to push back, thereby reducing the relative importance of applied tariff effects to below 40% after 2007.

India is one of the developing countries that have been a member of GATT/WTO since 1948, but import barrier set by India remained high until recent decades, with noticeable reductions starting 2005. This change in tariff structures is well captured in the decomposition diagram of India. In the initial years of the period, a large share of market access granted by India is due to market size effect. In 2005, India halved its tariff rates from the level of 32% in 1995, and further reduced them to 12% in 2011. Correspondingly, the contribution of changes in the applied tariffs to market concessions increased from under 20% to 35% and 44% in 2005 and 2011, respectively.

Among the set of economies studied, Morocco stood out in terms of the importance of applied tariff effects in its market access concessions (on average 78% across years). This is due to the fact that Morocco had an extremely high import tariff rate (59%) to begin with in 1995. It underwent substantial liberalization subsequently, and slashed the tariff rate to 20% in 1996, followed by consecutive reductions of tariffs in the following years. Although its market size has increased over the years, its market access concession remained predominantly determined by changes in its applied tariff rates.

Note that the applied tariff effects could be negative as shown in Figure 5. This could happen if the applied tariffs in a year were more restrictive than in 1995. In this case, the concessions in market access calculated conditional on the applied tariff rates is smaller

than conditional on the 1995 tariff rates. In this case, the difference of the two scenarios, which corresponds to the applied tariff effects, is negative. This happened, for example, during the Asian Financial Crisis to Thailand, Vietnam, and Brazil. The import restrictions were tightened post 1998 in these countries to reduce trade deficits and foreign reserve loss, and resulted in negative applied tariff effects on market access concessions. The situation improved after the recovery period, when the import tariffs were reverted and further reduced in subsequent years, reflected in the switch of the sign and the increased magnitude of the applied tariff effects.

Figure 6 provides the corresponding decomposition of welfare concessions (granted to trading partners) for the same set of economies. Noticeable differences from the market access concessions are the negative applied tariff effects on welfare concession in the cases of Japan, Korea, Singapore and the US, for example. This suggests that although these economies' applied tariffs might not have become more restrictive in terms of market access concessions, they have altered across sectors in a way that exerted more negative welfare impacts (on trading partners) given the world economy structure in the current year. This leads to smaller welfare concessions given the current applied tariffs relative to the 1995 tariff structures, and hence negative applied tariff effects on welfare concessions. Thus, for these countries, the growing market size of their economies contributes to the major brunt of their welfare concessions.

4.3 Ranking in Market Access Concessions

We now compare the dollar amounts of concessions in market access granted and received by major economies (Australia, Brazil, Canada, China, the EU, Japan, Korea, Mexico and the US). These are illustrated in panel (a) and (b) of Figure 7 for 1995, and (c) and (d) for 2011. Market size played a crucial role in determining a country's ranking in terms of the size of concessions. Economies with large domestic markets have more capacity in terms of market access concessions. Similarly, economies with large export volumes have more to benefit given trading partners' reduction of tariffs.

Unsurprisingly, the EU topped the list given its economic size, followed by the US, in terms of market access granted and received. During this period, China climbed up the ladder substantially and replaced Japan by 2011 as the third largest important players in exchange of market access. Korea also overtook Canada and became a key player next to China and Japan. The ranking of concessions granted follows almost the same order as the ranking of concessions received, suggesting the influence of country size.

For the concessions granted by each economy, we further disaggregate them by the major

recipients and the remainder. Similarly, for the concessions received by each economy, we disaggregate them by the major grantors and the residual. The complete decompositions are indicated in Figure 7 for each of the major economies, with beneficiaries (benefactors) sorted in ascending orders according to the size of bilateral market access concessions. The residual entity (excluding the nine economies) given its collective size, however, obscures the ranking of bilateral concessions. To facilitate discussions, we thus illustrate by radial network diagrams (Holtz and Healy, 2018) the decompositions for each bilateral relationship of the nine economies in Figure 8. To read the diagram, each economy's size (in terms concessions granted and received) is indicated by the length it occupies on the circumference of the circle. An arrow pointing outward from the arc indicates the amount of concessions granted by the economy to a trading partner; while an arrow pointing inward represents the concessions received from a trading partner. The width of an arrow indicates the magnitude of concessions exchanged. The arrows for each economy are sorted in a descending order by the size of concession.

In 1995, the market access concessions received by the nine economies were mainly contributed by the US, the EU and Japan (Canada, the EU and Japan were respectively the top three beneficiary of the US's market access concessions). By 2011, China had replaced Japan as the third largest recipient of the US's market access concession. China had similarly replaced the US and became the largest beneficiary of the EU's and Japan's market access concessions. In return, China became the largest contributor of market access concessions received by Japan, and respectively the second and the third largest contributor of market access concessions received by the EU and the US.

Large asymmetry in bilateral exchange of concessions was evident for the US and Canada. The market access granted by the US to Canada was much larger than the concessions Canada gave to the US in 1995. The asymmetry was still observed in 2011, although the extent of imbalance had reduced. The opposite is the case between the US and Mexico; the imbalance between them appeared to have increased between 1995–2011.

The gap between Korea and Japan closed up during the period, with respect to the total size of market concessions granted and received, indicating Korea's large growth in trade volumes. Over time, China had replaced the US as among the top three beneficiaries of Korea's market access concessions. On the other hand, China overtook Japan as among the top three benefactors of the concessions received by Korea.

4.4 Bilateral Concessions

Finally, we look into the bilateral exchange of market access concessions in detail for a selective set of country pairs. These are illustrated in Figures 9–10.

The US has consistently received more market access concession from the EU than the EU from the US, and the magnitude exchanged has increased steadily over the years but for a setback in 2009 following the financial crisis. The increasing amounts of market access exchanged reflect the growing market size of these economies, as their applied tariff rates were relatively stable since 1995. The US was similarly a net recipient of market access concession from Brazil since 2003. Before then, the exchange of concession was nearly balanced. In particular, Brazil went through substantial tariff cuts following 2003; as a result, the amount of market access concessions given by Brazil to the US expanded. In contrast, the US has granted more market access concessions than it received with respect to the Asian economies such as Japan, India, and Vietnam. In particular, with the Generalized System of Preferences (GSP) program granted by the US to India, the US has constantly offered higher levels of concessions to India than the amount it received. In the case of Vietnam, we observe a discrete jump in the amount of concessions it received from the US in 2003 when it joined the WTO. This likely reflects eased import restrictions by the US against Vietnam with the latter's entry into the WTO. Prior to this, in fact, Vietnam received net negative concessions from the US. The net amounts of bilateral exchange between the US and Taiwan saw a change of sign around 2003 (after Taiwan joined the WTO), with Taiwan offering an increasingly larger amount of market access concessions above those offered by the US. In fact, the concessions granted by the US to Taiwan has trended downward in general.

India and Brazil both joined the GATT/WTO in 1948, and had participated in trade liberalization to different extents. In particular, India tended to receive more market concessions than it granted, e.g., with respect to the EU and Brazil. In contrast, Brazil granted more concessions than it received with respect to the EU and Korea. The exchange of market access between these two old developing members (India and Brazil) and new developing members (such as Taiwan and Vietnam, respectively) appeared to be more or less in balance.

As the largest emerging economy, China's concessions to its trading partners have increased over time. Nonetheless, the concessions it received from the US and EU grew even faster and exceeded what it granted in return. Meanwhile, China and Japan's exchange of market access went nearly hand in hand, and remained close to balance. The opposite is the case in its exchange with Taiwan. China has granted substantially more market access concessions to Taiwan than it received from Taiwan, and the gap has grown over the years. China also maintained a close-to-balance condition in its exchange of market access with respect to India and Brazil, although in recent years, it started to receive net concessions

from India and vice versa with respect to Brazil.

5 Asymmetries in Concession across Development Status and Membership Vintage

Given the measured concessions, we evaluate whether the level of bilateral exchange of concessions differ systematically across the development status (and the vintage of WTO membership) of bilateral country pairs, and whether any asymmetry pattern identified change over the years. Toward this end, we construct a normalized index of bilateral concession. Specifically:

$$Concession_{ij}^{MA,n} \equiv \frac{Concession_{ij}^{MA}}{\max Concession_{ij}^{MA}}, \quad (19)$$

where $\max Concession_{ij}^{MA}$ denotes the amount of concession that country j could potentially offer to country i by reducing its tariffs from the unilaterally optimal level to zero. This corresponds to the sum of realized concessions $Concession_{ij}^{MA}$ calculated in (15), from reducing optimal tariffs to factual rates, and potential concessions via further reduction of the factual tariffs to zero. The latter is calculated by setting $t'_{i,j,k} = 0$ in (15) for an importing economy j at a time, and simulate the changes in market access for all i, k given j . Label the corresponding concession $Concession_{ij}^{MA,0}$. It measures the amount of market access that could be further extended if country j 's remaining tariffs were removed; it could also be interpreted as the concession withheld by j . The measure $Concession_{ij}^{MA,n}$ provides an index of the degree to which country j has conceded its market access to country i relative to its maximum capacity to do so.

We regress this measure on the development status of the country pair, controlling for exporter and importer FEs and pertinent trade flows determinants:

$$\begin{aligned} Concession_{ij}^{MA,n} = & \beta_1 * Ind_Ind_{ij} + \beta_2 * Dev_Ind_{ij} + \beta_3 * Ind_Dev_{ij} + \beta_4 * Dev_Dev_{ij} \\ & + \gamma' Z_{ij} + FE_i + FE_j + \epsilon_{ij}, \end{aligned} \quad (20)$$

where Z_{ij} denotes a list of trade costs proxies including: bilateral distance, common language, common currency, colonial relationship and contiguity indicators.⁵ Countries are classified into two development status: industrial countries (IND) and developing countries

⁵The EU and the residual Rest of the World are not included in this set of analysis, as Z_{ij} is not available when i, j involves a group of economies.

(Dev), following Subramanian and Wei (2007). For each of the bilateral development status variable $I^{exp}I^{imp}$, the indicator equals one if the exporter's status is I^{exp} and the importer's status is I^{imp} , and zero otherwise. For example, Ind_Dev_{ij} equals one if the exporter is an industrial country and the importer is a developing country. Following Subramanian and Wei (2007), the list of industrial countries includes Australia, Canada, Switzerland, Iceland, Japan, Norway, New Zealand and USA. Note that all industrial economies in the sample are members and joined the GATT/WTO before 1995. On the other hand, all individual developing economies in the sample became members by the end of the sample period (except Russia in 2012).

Table 3 reports the estimation results of (20) for each year in 1995–2011. We find that the coefficient on Ind_Ind is larger than Dev_Ind , and the difference is statistically significant for all years except in the initial year 1995. Similarly, the coefficient on Ind_Dev is larger than Dev_Dev except in 1995. This suggests that a systematic bias in the applied tariff structure under the GATT/WTO (and other trade agreements) in favor of industrial countries' exports. At the same time, the coefficient on Ind_Ind is found to be larger than Ind_Dev and that of Dev_Ind to be larger than Dev_Dev (except in 1996 and 1997). Thus, the industrial economies also provide relatively larger extents of concessions than the developing economies do (relative to their respective maximum capacities).

This asymmetry may reflect two empirical observations: that the developing economies were given more exemptions from liberalizing their import sectors despite their membership in the GATT/WTO and that their sectors of key export interest (e.g., agriculture) still face heavy protectionism. This pattern of heterogeneity in concessions across development status could be explained by existing theories of trade agreements; see, for example, Bagwell and Staiger (2010, pp. 245–247) for a review. Basically, the two GATT/WTO principles of MFN and reciprocity actually facilitate this outcome, whereby if countries do not actively participate in trade negotiations/tariff reductions, other active players can engineer tariff bargains among themselves that minimize free-riding by third countries. Thus, by retaining domestic market access, the developing economies may also face more resistance expanding their export volumes.

We now evaluate whether the exchange of concessions further differ by the vintage of GATT/WTO membership. In particular, we split developing economies into those that joined the GATT/WTO before 1995 (OldDev) and those that joined the GATT/WTO after 1995 (NewDev). As the Uruguay Round (1986–1995) negotiation outcome imposed more disciplines on the developing economies, and new members' accession packages are subject to more scrutiny and demand from existing members, we may expect the extent of concessions given by the new members to be higher than the old developing members. In particular, we

estimate the following alternative specification:

$$\begin{aligned}
Concession_{ij}^{MA,n} = & \beta_1 * Ind_Ind_{ij} + \beta_2 * OldDev_Ind_{ij} + \beta_3 * NewDev_Ind_{ij} \\
& + \beta_4 * Ind_OldDev_{ij} + \beta_5 * OldDev_OldDev_{ij} + \beta_6 * NewDev_OldDev_{ij} \\
& + \beta_7 * Ind_NewDev_{ij} + \beta_8 * OldDev_NewDev_{ij} + \beta_9 * NewDev_NewDev_{ij} \\
& + \gamma' Z_{ij} + FE_i + FE_j + \epsilon_{ij},
\end{aligned}
\tag{21}$$

For each of the bilateral status variable I^{exp_Imp} , the indicator equals one if the exporter's status is I^{exp} and the importer's status is I^{imp} , and zero otherwise. For example, $NewDev_Ind_{ij}$ equals one if the exporter is a new developing member and the importer is an industrial member. The set of new developing members include: Bulgaria (1996), Latvia (1999), Estonia (1999), Croatia (2000), Lithuania (2001), China (2001), Taiwan (2002), Cambodia (2004), Vietnam (2007) and Russia (2012) with the year of joining the WTO in the parentheses.

Table 4 reports the estimation results of (21) for each year in 1995–2011. Consistent with the previous set of regression results, we find that industrial members provide more concessions to fellow industrial members than to old developing members throughout 1996–2011. Although we also observe this bias between industrial and new developing members in early years, the difference becomes statistically insignificant after 2003. That is, industrial members gave out just as much concessions to new developing members as to fellow industrial members in recent years since 2003. In contrast, old developing members' concessions given to the industrial members continue to dominate those given to fellow developing members (old or new), without significant difference between their concessions given to old and new developing members (except in 2003 and 2004). Similarly, new developing members' concessions given to the industrial members tend to dominate those given to fellow developing members (old or new), without systematic difference between their concessions given to old and new developing members.

Next, given the exporter's development status, we find that industrial members granted significantly more concessions than new developing members to old and new developing members (2001 and 2003 onwards, respectively). The difference in their concessions granted is not significant, however, with respect to industrial trading partners (except in 2006 and 2007). This in some sense implies that new developing members are almost on par with industrial members in the extent of their concessions, especially with respect to the export interest of industrial members. Furthermore, comparing the normalized concession granted by old and new developing members, we find new developing members to provide more concessions than old developing members (to all three categories of exporters, although

the difference is not always significant across years). For example, estimation results show that coefficient of *Ind_NewDev* is larger than that of *Ind_OldDev* typically. This aligns with the notion that new developing members have participated more actively in tariff cut negotiations than old developing members. In reciprocity, new developing members have received more concessions from industrial members as discussed in the previous paragraph.

6 Conclusion

Despite its initial success, the WTO's efficacy to sustain cooperation in multilateral trade liberalization has been increasingly questioned by academics, politicians, and policy makers alike. Concerns have been raised as to whether the exchange of concessions among members continue to be balanced, when the world economic structure has undergone significant changes in the last few decades. In particular, developing economies' weight in the world trade has grown substantially. Tariff structures deemed appropriate by participating members in 1995 might have become grotesquely out of line decades later when the relative market size of trading partners switched in proportions.

In this paper, we characterize the concession of WTO members across years during 1995–2011, and decompose the concessions into variations due to changes in trade imbalance, applied tariff rates, and market size. We show that the overall concessions across all economies have increased in general over the years, and largely due to the expansion in market size. Although initially the industrialized economies as a whole granted more concessions to the rest of the world, by 2002, the balance has tilted such that the developing economies now offered more concessions than they received in return and remained to be the case afterwards. In addition to the growth in developing economies' market size, more tariff reductions undertaken by developing economies (especially the new members) after 2000 have contributed to this switch in the balance of concessions in market access.

Among the industrialized economies, the US indeed was a net benefactor of concessions (more so in terms of welfare than market access) during the period of study, although a large part of these were due to its large trade deficits. Absent the trade deficits, its net concessions have decreased over the years. China, on the other hand, has remained more or less in balance of the concessions it offered and received (but for the increasing trade surplus effect in recent years that reduced its net concession position). In terms of welfare concession, China's net position has improved steadily. Starting out as a net welfare beneficiary of the world trade system, China has closed up its negative position substantially by 2011. Although overall China's concessions have increased over time, the concessions it received from the US and EU grew even faster and exceeded what it granted in return. This might help to explain the

growing tensions between China and these two major economies in recent years.

By adopting estimation specifications that account for country (market) size, we find that the normalized degree of market access concessions aligns well with the pattern of trade negotiations under the GATT/WTO. In particular, the developing economies have been given more exemptions in liberalizing their import restrictions despite their membership in the GATT/WTO. This is notably the case for developing members that were part of the regime prior to 1995. In return, the pattern of negotiated trade liberalization has systematically biased toward industrial economies, which provided more concessions than developing economies to either industrial or developing economies, but also received more concessions from either types of trading partners. A further decomposition by the vintage of the GATT/WTO membership among the developing economies, however, shows that the extent of concessions given by new members were higher than old members and matched nearly those of industrial economies, especially after 2002. In reciprocity, they also have received more concessions than old developing members from industrial member economies.

Some remarks are in order. In this paper, we have abstracted away from the endogeneity of trade imbalance and adopted draconian assumptions about its behavior as the tariffs change (such as proportionality with respect to world output). This is less than ideal and a dynamic trade model that takes into account inter-temporal consumption choice might help address potential distortions to the quantitative evaluations. Second, in calculating optimal tariffs, we have assumed national governments to behave benevolently and maximize aggregate welfare. The presence of political economy could very well alter the endogenous optimal tariffs and the perceived concessions by each national government. Nonetheless, it is debatable whether we should adopt the optimal tariffs or the politically endogenous tariffs as the benchmark in measuring a country's market access concessions, because domestic political economy (and hence the politically endogenous tariff) is not always observable and credible to trading partners, when the nations compare the exchange of concessions in trade negotiations.

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Table 1: Country List

OECD Economies			Non-OECD Economies		
ISO	Country Name	Region	ISO	Country Name	Region
AUS	Australia	East Asia and Pacific	ARG	Argentina	Latin America
AUT	Austria	Europe and Central Asia	BGR	Bulgaria	Europe and Central Asia
BEL	Belgium	Europe and Central Asia	BRA	Brazil	Latin America
CAN	Canada	North America	BRN	Brunei Darussalam	East Asia and Pacific
CHL	Chile	Latin America	CHN	China	East Asia and Pacific
CZE	Czech Republic	Europe and Central Asia	COL	Colombia	Latin America
DNK	Denmark	Europe and Central Asia	CRI	Costa Rica	Latin America
EST	Estonia	Europe and Central Asia	CYP	Cyprus	Europe and Central Asia
FIN	Finland	Europe and Central Asia	HKG	Hong Kong SAR	East Asia and Pacific
FRA	France	Europe and Central Asia	HRV	Croatia	Europe and Central Asia
DEU	Germany	Europe and Central Asia	IDN	Indonesia	East Asia and Pacific
GRC	Greece	Europe and Central Asia	IND	India	South Asia [†]
HUN	Hungary	Europe and Central Asia	KHM	Cambodia	East Asia and Pacific
ISL	Iceland	Europe and Central Asia	LTU	Lithuania	Europe and Central Asia
IRL	Ireland	Europe and Central Asia	MLT	Malta	Middle East and North Africa
ISR	Israel	Middle East and North Africa	MYS	Malaysia	East Asia and Pacific
ITA	Italy	Europe and Central Asia	MAR	Morocco	Middle East and North Africa
JPN	Japan	East Asia and Pacific	PER	Peru	Latin America
KOR	Korea	East Asia and Pacific	PHL	Philippines	East Asia and Pacific
LVA	Latvia	Europe and Central Asia	ROU	Romania	Europe and Central Asia
LUX	Luxembourg	Europe and Central Asia	RUS	Russian Federation	Europe and Central Asia
MEX	Mexico	North America	SAU	Saudi Arabia	Middle East and North Africa
NLD	Netherlands	Europe and Central Asia	SGP	Singapore	East Asia and Pacific
NZL	New Zealand	East Asia and Pacific	THA	Thailand	East Asia and Pacific
NOR	Norway	Europe and Central Asia	TUN	Tunisia	Middle East and North Africa
POL	Poland	Europe and Central Asia	TWN	Taiwan	East Asia and Pacific
PRT	Portugal	Europe and Central Asia	VNM	Vietnam	East Asia and Pacific
SVK	Slovak Republic	Europe and Central Asia	ZAF	South Africa	Sub-Saharan Africa
SVN	Slovenia	Europe and Central Asia	ROW	Rest of the world	Rest of the World
ESP	Spain	Europe and Central Asia			
SWE	Sweden	Europe and Central Asia			
CHE	Switzerland	Europe and Central Asia			
TUR	Turkey	Europe and Central Asia			
GBR	United Kingdom	Europe and Central Asia			
USA	United States	North America			

Note: [†]India is the only economy in South Asia that is separately reported in TiVA.

Table 2: Sector classification and trade elasticity estimate

Sector	TiVA Industry Code	ISIC Rev 3	Sector Description	Trade Elasticity
1	C01T05AGR	01-05	Agriculture, hunting, forestry and fishing	0.45
2	C10T14MIN	10-14	Mining and quarrying	0.80
3	C15T16FOD	15-16	Food products, beverages and tobacco	0.68
4	C17T19TEX	17-19	Textiles, textile products, leather and footwear	1.18
5	C20WOD	20	Wood and products of wood and cork	4.57
6	C21T22PAP	21-22	Pulp, paper, paper products, printing and publishing	5.15
7	C23PET	23	Coke, refined petroleum products and nuclear fuel	0.32
8	C24CHM	24	Chemicals and chemical products	2.89
9	C25RBP	25	Rubber and plastics products	2.02
10	C26NMM	26	Other non-metallic mineral products	2.13
11	C27MET	27	Basic metals	2.38
12	C28FBM	28	Fabricated metal products	0.49
13	C29MEQ	29	Machinery and equipment, nec	1.98 [†]
14	C30T33XCEQ	30-33	Computer, Electronic and optical equipment	1.98 [†]
15	C31ELQ	31	Electrical machinery and apparatus, nec	1.98 [†]
16	C34MTR	34	Motor vehicles, trailers and semi-trailers	1.98 [†]
17	C35TRQ	35	Other transport equipment	2.68
18	C36T37OTM	36-37	Manufacturing nec; recycling	1.98 [†]
19	C40T41EGW	40-41	Electricity, gas and water supply	10.00 [‡]
20	C45CON	45	Construction	NA [§]
	C50T52WRT	50-52	Wholesale and retail trade; repairs	
	C55HTR	55	Hotels and restaurants	
	C60T63TRN	60-63	Transport and storage	
	C64PTL	64	Post and telecommunications	
	C65T67FIN	65-67	Financial intermediation	
	C70REA	70	Real estate activities	
	C71RMQ	71	Renting of machinery and equipment	
	C72ITS	72	Computer and related activities	
	C73T74OBZ	73-74	R&D and other business activities	
	C75GOV	75	Public admin. and defence; compulsory social security	
	C80EDU	80	Education	
	C85HTH	85	Health and social work	
	C90T93OTS	90-93	Other community, social and personal services	
	C95PVH	95	Private households with employed persons	

Note: The table reports the classification of sectors used in the study. The trade elasticity is estimated based on the approach of Caliendo and Parro (2015), corresponding to the regression coefficient of trade flows (in ratios) to tariff variations (in ratios).

[†]The elasticity estimates for these sectors are negative, and are replaced by the mean across sectors with positive elasticity estimates. [‡]The elasticity estimate for this sector is negative, and is replaced by a large number (10). The choice is based on the consideration that trade flows and tariffs are sparse in this sector. Using a large elasticity value mutes the optimal tariff consideration in this sector and neutralizes its role in the analysis. [§]Tariffs (which are required for the elasticity estimation)

are not observed for these sectors.

Table 3: Asymmetry in Bilateral Market Access Concession across Development Status

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<i>Panel A: Estimation Results</i> (Dependent Variable — $Concession_{ij}^{MA,n}$)																	
Ind_Ind	0.985*** (0.0964)	0.902*** (0.0954)	0.952*** (0.0931)	0.961*** (0.0935)	1.039*** (0.0920)	0.955*** (0.0814)	1.025*** (0.0843)	1.230*** (0.0836)	1.424*** (0.0913)	1.432*** (0.114)	1.529*** (0.110)	2.026*** (0.121)	1.878*** (0.127)	1.907*** (0.119)	1.898*** (0.113)	1.554*** (0.123)	1.637*** (0.118)
Dev_Ind	0.891*** (0.0986)	0.771*** (0.0991)	0.735*** (0.0988)	0.824*** (0.0973)	0.869*** (0.0965)	0.776*** (0.0858)	0.824*** (0.0883)	1.008*** (0.0868)	1.135*** (0.0927)	1.188*** (0.119)	1.383*** (0.112)	1.858*** (0.124)	1.662*** (0.132)	1.766*** (0.125)	1.756*** (0.117)	1.383*** (0.132)	1.457*** (0.123)
Ind_Dev	0.776*** (0.0910)	0.860*** (0.0891)	0.866*** (0.0879)	0.819*** (0.0899)	0.856*** (0.0879)	0.761*** (0.0764)	0.853*** (0.0812)	1.054*** (0.0797)	1.243*** (0.0872)	1.248*** (0.116)	1.397*** (0.111)	1.866*** (0.121)	1.731*** (0.132)	1.761*** (0.121)	1.676*** (0.112)	1.346*** (0.124)	1.437*** (0.115)
Dev_Dev	0.738*** (0.0970)	0.717*** (0.0965)	0.679*** (0.0976)	0.690*** (0.0974)	0.653*** (0.0964)	0.544*** (0.0852)	0.630*** (0.0903)	0.798*** (0.0859)	0.926*** (0.0938)	0.915*** (0.124)	1.142*** (0.118)	1.596*** (0.129)	1.380*** (0.138)	1.481*** (0.128)	1.425*** (0.120)	1.117*** (0.135)	1.191*** (0.125)
Method	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trade Cost Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,256	2,256	2,256	2,256	2,256	2,256	2,256	2,256	2,256	1,406	1,406	1,406	1,260	1,260	1,260	1,260	1,260
<i>Panel B: Hypothesis Test of H_0</i>																	
Ind_Ind = Dev_Ind	0.127	0.026	0.001	0.026	0.008	0.002	0.001	0.000	0.000	0.000	0.020	0.009	0.002	0.028	0.029	0.015	0.005
Ind_Dev = Dev_Dev	0.444	0.003	0.001	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ind_Ind = Ind_Dev	0.000	0.420	0.078	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.009	0.001	0.007	0.005	0.000	0.000	0.000
Dev_Ind = Dev_Dev	0.000	0.175	0.129	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

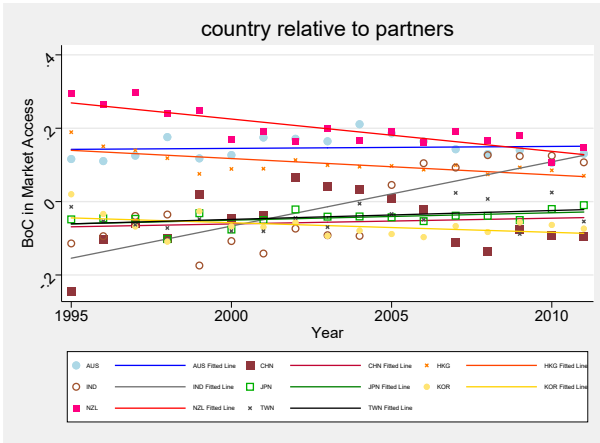
Notes for Panel A: Tobit estimation of equation (20). The dependent variable $Concession_{ij}^{MA,n} \equiv Concession_{ij}^{MA} / \max Concession_{ij}^{MA}$ indicates the extent of concession importing country j grants to exporting country i , as a fraction of its maximum possible concession. Countries are classified into two development status: industrial countries (IND) and developing countries (Dev). For each of the bilateral development status variable $I^{exp} I^{imp}$, the indicator equals one if the exporter's status is I^{exp} and the importer's status is I^{imp} , and zero otherwise. The list of trade cost proxy variables included are: bilateral distance, common language, common currency, colonial relationship and contiguity. Significance: *** (1%), ** (5%), and * (10%). Note for Panel B: The p -value statistics for the tests are shown in Panel B.

Table 4: Asymmetry in Bilateral Market Access Concession across Development Status and GATT/WTO Membership Vintage

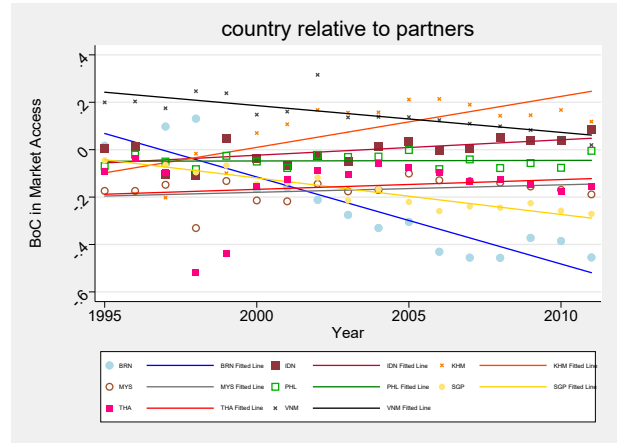
Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<i>Panel A: Estimation Results (Dependent Variable — $Concession_{ij}^{MA,n}$)</i>																	
Ind_Ind	0.990*** (0.0958)	0.907*** (0.0947)	0.958*** (0.0928)	0.962*** (0.0932)	1.042*** (0.0918)	0.955*** (0.0806)	1.029*** (0.0836)	1.231*** (0.0833)	1.422*** (0.0912)	1.434*** (0.114)	1.529*** (0.110)	2.021*** (0.122)	1.873*** (0.128)	1.895*** (0.119)	1.893*** (0.112)	1.546*** (0.124)	1.632*** (0.119)
OldDev_Ind	0.913*** (0.0986)	0.798*** (0.0983)	0.752*** (0.0986)	0.838*** (0.0973)	0.879*** (0.0963)	0.794*** (0.0856)	0.841*** (0.0879)	1.014*** (0.0868)	1.135*** (0.0933)	1.178*** (0.120)	1.369*** (0.112)	1.829*** (0.125)	1.635*** (0.132)	1.734*** (0.125)	1.720*** (0.117)	1.351*** (0.133)	1.437*** (0.124)
NewDev_Ind	0.797*** (0.100)	0.780*** (0.101)	0.800*** (0.101)	0.808*** (0.102)	0.941*** (0.0959)	0.777*** (0.0860)	0.874*** (0.0916)	1.063*** (0.0900)	1.300*** (0.0909)	1.371*** (0.113)	1.494*** (0.106)	1.965*** (0.119)	1.841*** (0.126)	1.876*** (0.117)	1.936*** (0.113)	1.591*** (0.124)	1.604*** (0.115)
Ind_OldDev	0.786*** (0.0908)	0.869*** (0.0890)	0.868*** (0.0878)	0.823*** (0.0901)	0.860*** (0.0883)	0.756*** (0.0765)	0.848*** (0.0814)	1.049*** (0.0801)	1.235*** (0.0868)	1.247*** (0.116)	1.400*** (0.112)	1.865*** (0.121)	1.738*** (0.131)	1.768*** (0.120)	1.681*** (0.112)	1.350*** (0.124)	1.437*** (0.115)
OldDev_OldDev	0.738*** (0.0970)	0.716*** (0.0967)	0.685*** (0.0979)	0.687*** (0.0974)	0.654*** (0.0965)	0.537*** (0.0848)	0.633*** (0.0900)	0.798*** (0.0858)	0.924*** (0.0938)	0.923*** (0.124)	1.148*** (0.119)	1.597*** (0.129)	1.380*** (0.138)	1.468*** (0.128)	1.430*** (0.119)	1.114*** (0.135)	1.191*** (0.126)
NewDev_OldDev	0.692*** (0.0905)	0.792*** (0.0889)	0.772*** (0.0920)	0.718*** (0.0950)	0.745*** (0.0866)	0.612*** (0.0784)	0.722*** (0.0850)	0.875*** (0.0803)	1.101*** (0.0904)	1.048*** (0.115)	1.196*** (0.109)	1.628*** (0.121)	1.473*** (0.127)	1.522*** (0.116)	1.481*** (0.108)	1.228*** (0.123)	1.283*** (0.113)
Ind_NewDev	0.938*** (0.0926)	0.924*** (0.0945)	0.960*** (0.0914)	0.935*** (0.0917)	1.044*** (0.0886)	0.978*** (0.0825)	0.985*** (0.0831)	1.200*** (0.0811)	1.320*** (0.0947)	1.411*** (0.118)	1.484*** (0.105)	1.921*** (0.114)	1.673*** (0.129)	1.838*** (0.113)	1.832*** (0.106)	1.463*** (0.118)	1.580*** (0.112)
OldDev_NewDev	0.912*** (0.0983)	0.787*** (0.101)	0.754*** (0.101)	0.816*** (0.0994)	0.840*** (0.0978)	0.752*** (0.0925)	0.732*** (0.0921)	0.925*** (0.0865)	0.987*** (0.0963)	1.069*** (0.121)	1.236*** (0.114)	1.671*** (0.123)	1.367*** (0.137)	1.634*** (0.120)	1.619*** (0.114)	1.283*** (0.127)	1.356*** (0.119)
NewDev_NewDev	0.902*** (0.0945)	0.901*** (0.0961)	0.905*** (0.0971)	0.855*** (0.0981)	0.960*** (0.0912)	0.796*** (0.0872)	0.848*** (0.0890)	1.000*** (0.0831)	1.136*** (0.0944)	1.212*** (0.114)	1.306*** (0.107)	1.625*** (0.116)	1.431*** (0.129)	1.585*** (0.112)	1.617*** (0.106)	1.366*** (0.120)	1.404*** (0.110)
Method	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit	Tobit
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trade Cost Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,256	2,256	2,256	2,256	2,256	2,256	2,256	2,256	2,256	1,406	1,406	1,406	1,260	1,260	1,260	1,260	1,260
<i>Panel B: Hypothesis Test of H_0</i>																	
Ind_Ind = OldDev_Ind	0.213	0.066	0.002	0.047	0.011	0.006	0.002	0.000	0.000	0.000	0.011	0.003	0.001	0.012	0.008	0.006	0.003
Ind_Ind = NewDev_Ind	0.004	0.049	0.016	0.018	0.109	0.002	0.014	0.006	0.050	0.332	0.551	0.380	0.619	0.715	0.458	0.476	0.600
OldDev_Ind = NewDev_Ind	0.100	0.796	0.509	0.670	0.376	0.784	0.628	0.465	0.009	0.008	0.065	0.063	0.008	0.029	0.003	0.002	0.012
Ind_OldDev = OldDev_OldDev	0.332	0.002	0.001	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ind_OldDev = NewDev_OldDev	0.053	0.081	0.048	0.032	0.016	0.000	0.003	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000
OldDev_OldDev = NewDev_OldDev	0.435	0.185	0.187	0.616	0.137	0.161	0.129	0.172	0.002	0.057	0.426	0.626	0.169	0.368	0.433	0.103	0.127
Ind_NewDev = OldDev_NewDev	0.635	0.012	0.001	0.033	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.007	0.000
Ind_NewDev = NewDev_NewDev	0.528	0.673	0.321	0.155	0.127	0.000	0.004	0.000	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.126	0.001
OldDev_NewDev = NewDev_NewDev	0.881	0.072	0.031	0.557	0.068	0.428	0.059	0.203	0.011	0.044	0.288	0.507	0.415	0.481	0.980	0.300	0.478
Ind_Ind = Ind_NewDev	0.480	0.816	0.969	0.672	0.966	0.720	0.461	0.585	0.120	0.706	0.427	0.086	0.001	0.300	0.245	0.144	0.349
OldDev_Ind = OldDev_NewDev	0.995	0.863	0.969	0.704	0.484	0.455	0.037	0.050	0.008	0.035	0.009	0.001	0.000	0.048	0.028	0.172	0.100
NewDev_Ind = NewDev_NewDev	0.143	0.097	0.113	0.480	0.767	0.768	0.665	0.258	0.008	0.010	0.002	0.000	0.000	0.000	0.000	0.001	0.002
Ind_OldDev = Ind_NewDev	0.016	0.381	0.101	0.053	0.001	0.000	0.011	0.001	0.139	0.006	0.132	0.309	0.269	0.197	0.002	0.032	0.004
OldDev_OldDev = OldDev_NewDev	0.005	0.239	0.213	0.023	0.000	0.000	0.060	0.003	0.250	0.009	0.113	0.159	0.819	0.002	0.000	0.001	0.000
NewDev_OldDev = NewDev_NewDev	0.001	0.075	0.020	0.018	0.000	0.001	0.023	0.007	0.549	0.008	0.067	0.958	0.549	0.342	0.018	0.024	0.032

Note: See Table 3 footnote. Tobit estimation of equation (21). Countries are classified under three main categories: industrial countries (IND), developing countries that joined GATT/WTO before 1995 (OldDev) and developing countries that joined WTO after 1995 (NewDev). For each of the bilateral status variable $I^{exp_I^{imp}}$, the indicator equals one if the exporter's status is I^{exp} and the importer's status is I^{imp} , and zero otherwise.

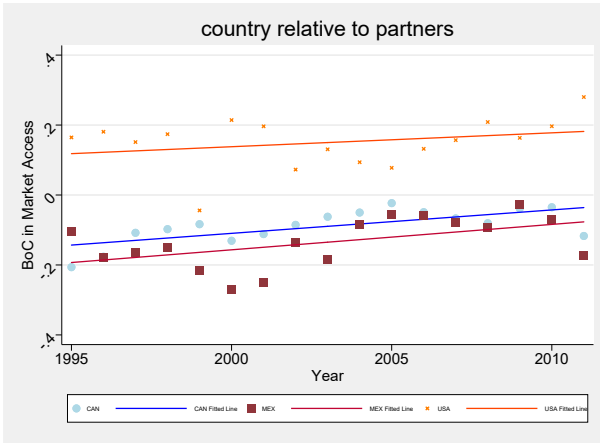
Figure 1: Balance of Market Access Concession (with trade imbalance)



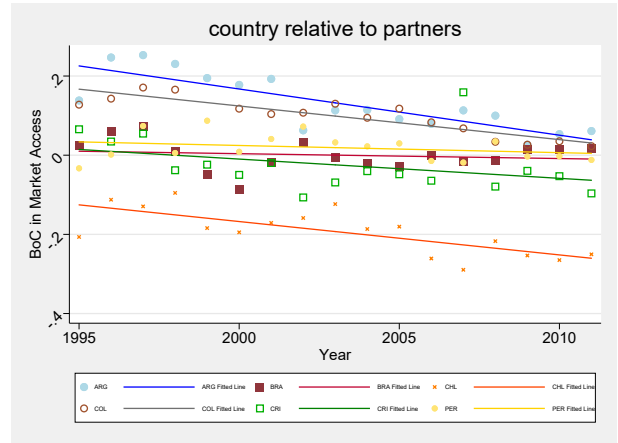
(a) East Asia and Pacific & South Asia



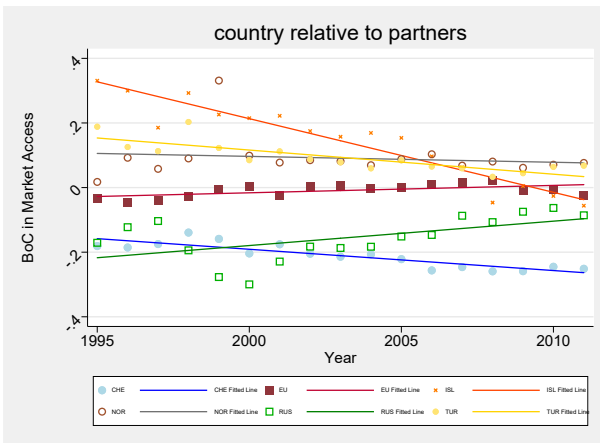
(b) Southeast Asia



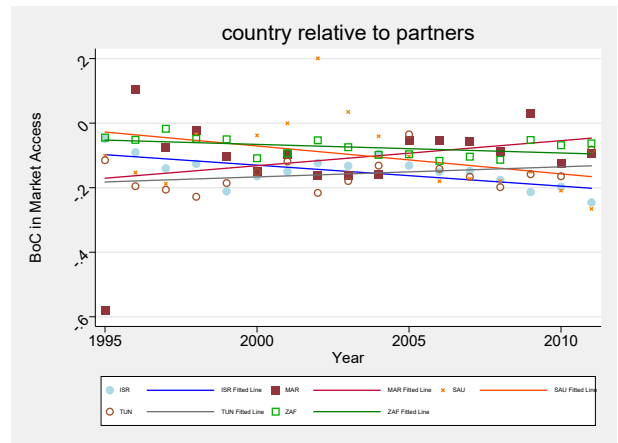
(c) North America



(d) Latin America

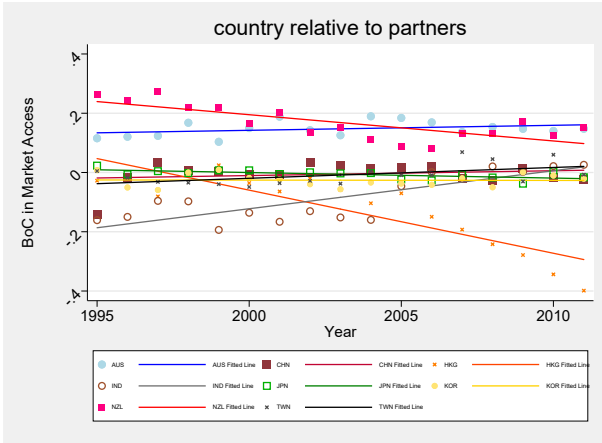


(e) Europe and Central Asia

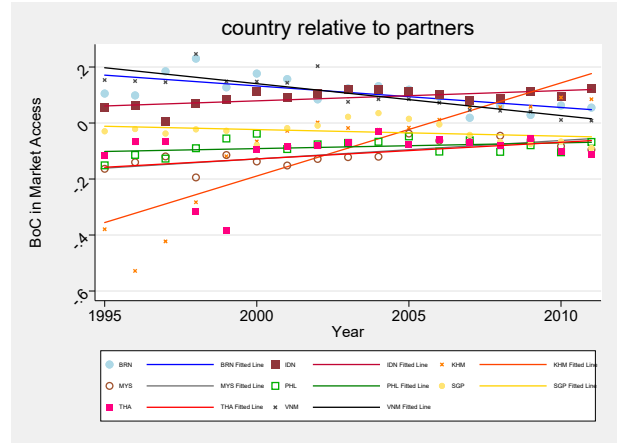


(f) Middle East and Africa

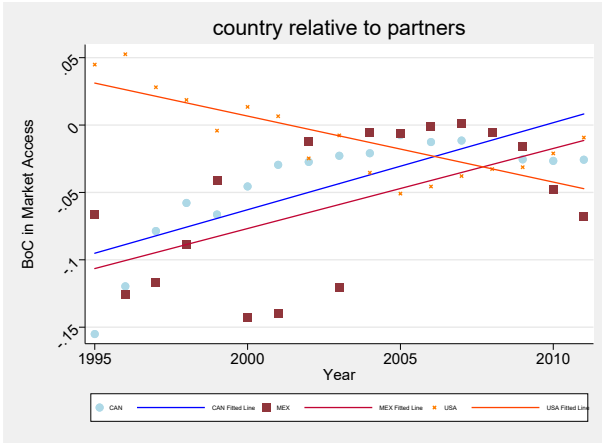
Figure 2: Balance of Market Access Concession



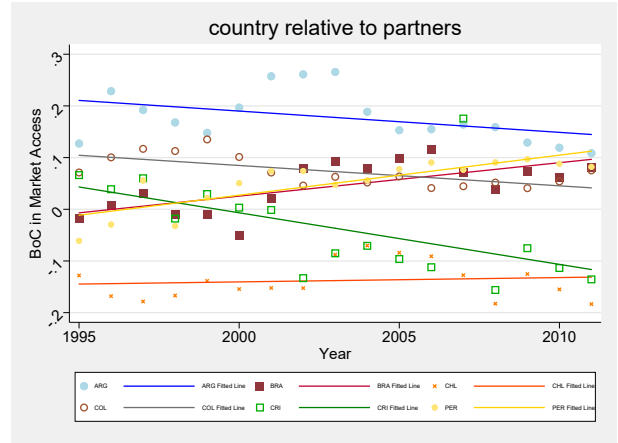
(a) East Asia and Pacific & South Asia



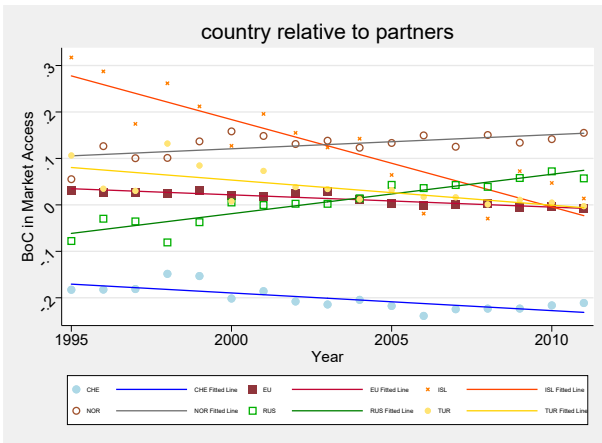
(b) Southeast Asia



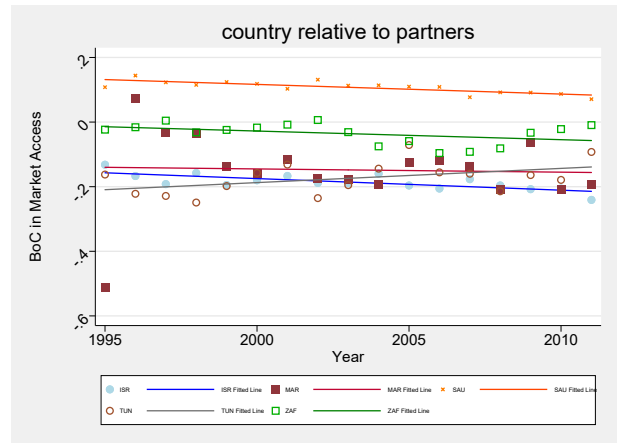
(c) North America



(d) Latin America

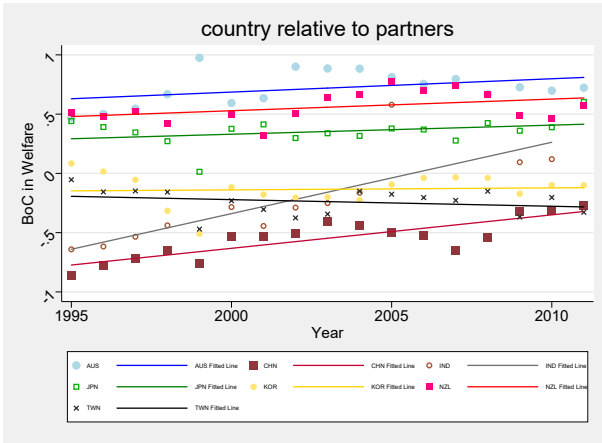


(e) Europe and Central Asia

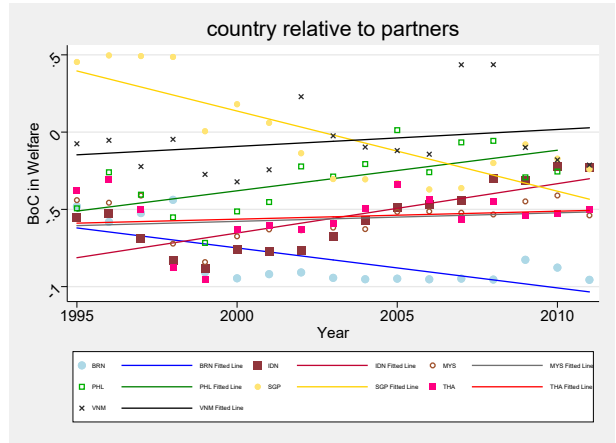


(f) Middle East and Africa

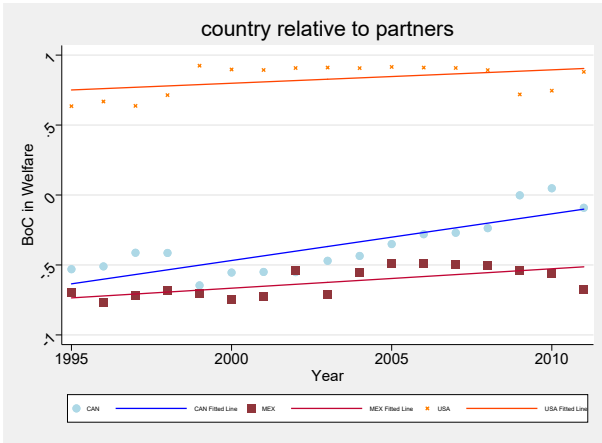
Figure 3: Balance of Welfare Concession (with trade imbalance)



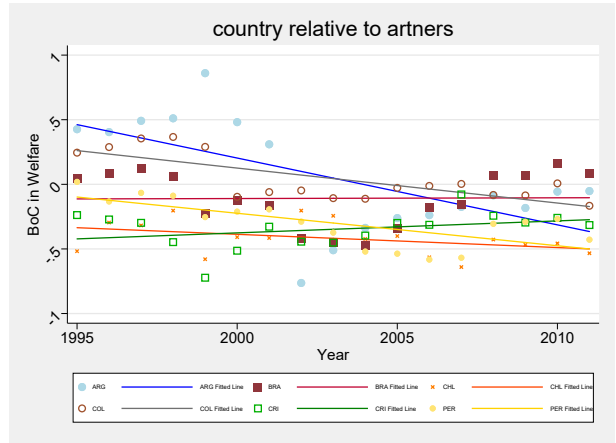
(a) East Asia and Pacific & South Asia



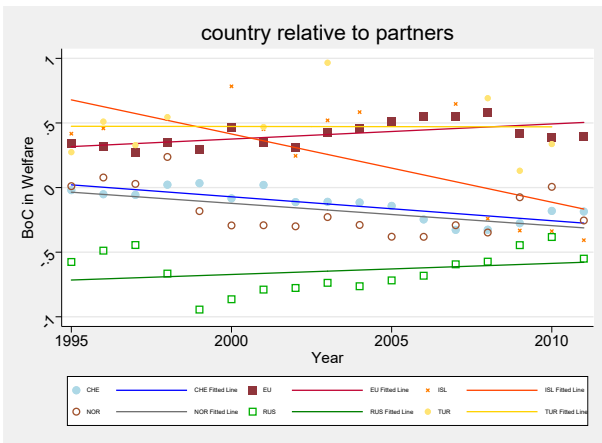
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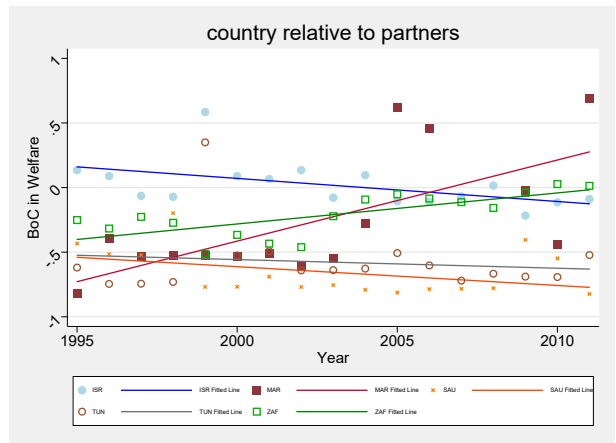
(c) North America



(d) Latin America

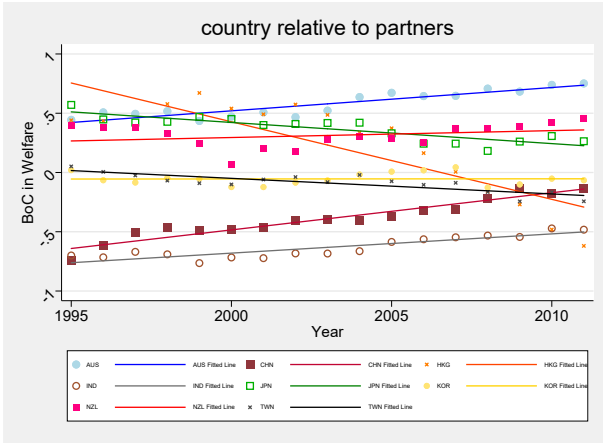


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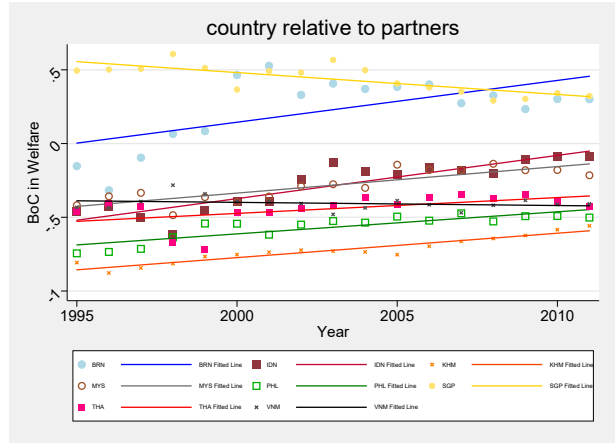


(f) Middle East and Africa

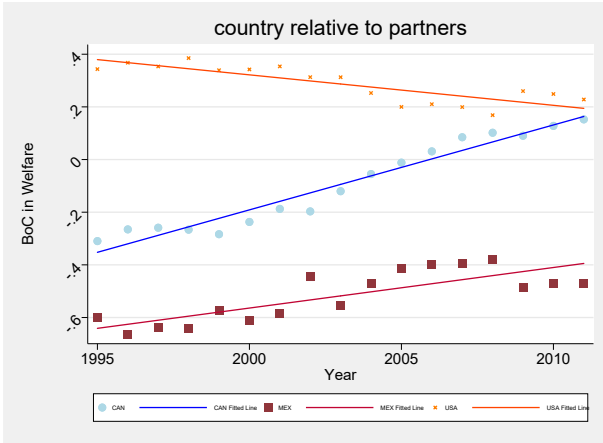
Figure 4: Balance of Welfare Concession



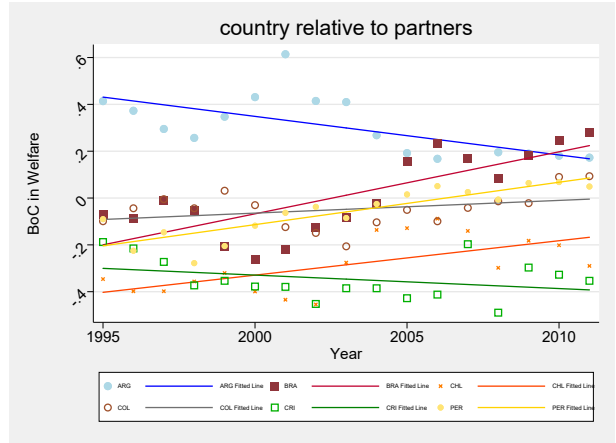
(a) East Asia and Pacific & South Asia



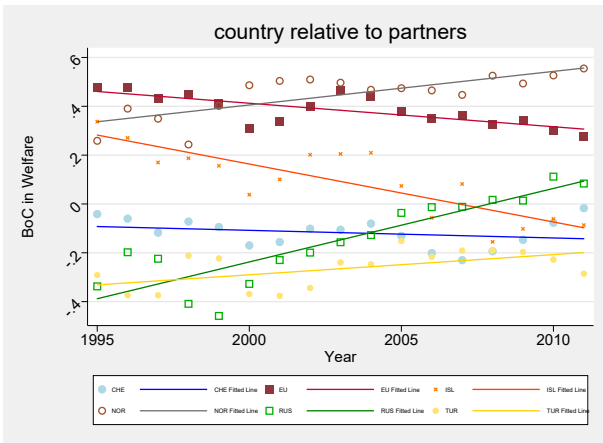
(b) Southeast Asia



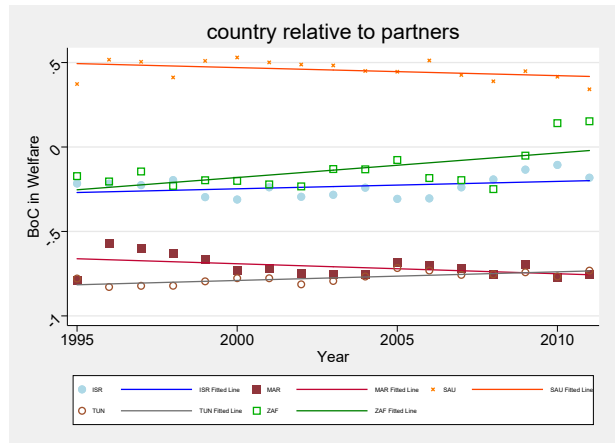
(c) North America



(d) Latin America

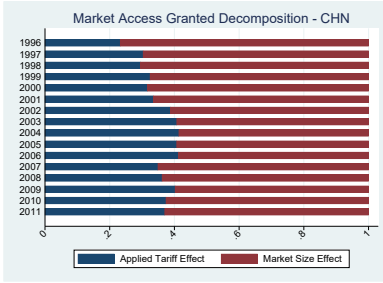


(e) Europe and Central Asia

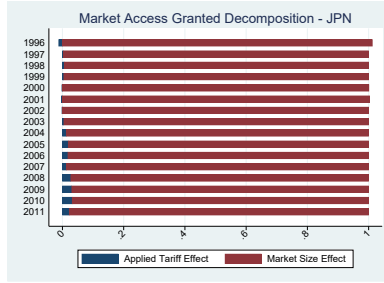


(f) Middle East and Africa

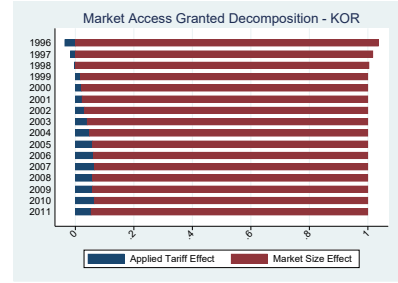
Figure 5: Decomposition of Market Access Concession



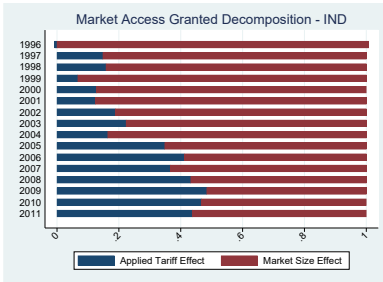
China



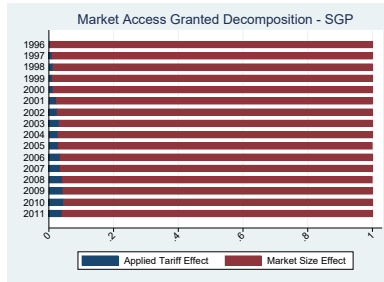
Japan



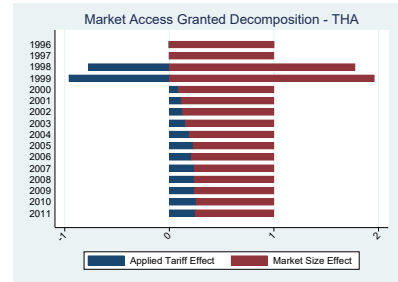
Korea



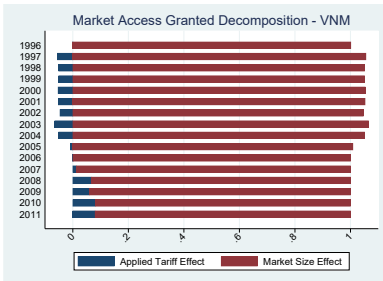
India



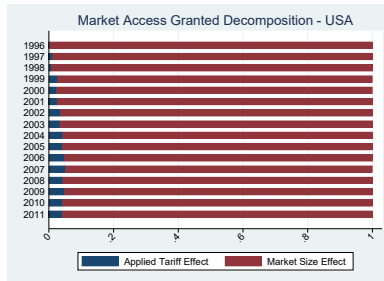
Singapore



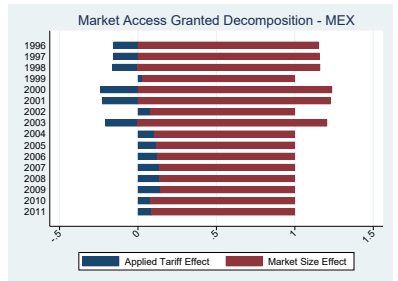
Thailand



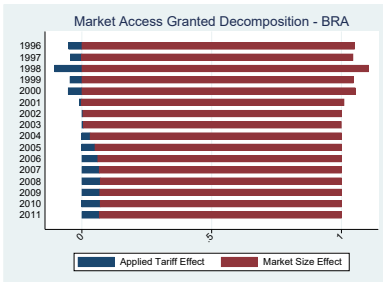
Vietnam



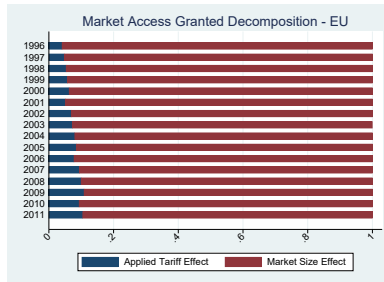
United States



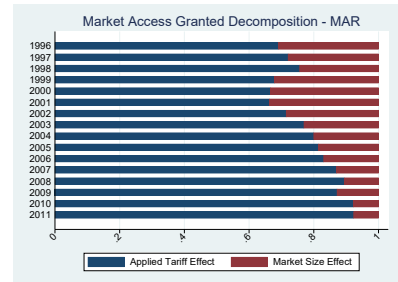
Mexico



Brazil

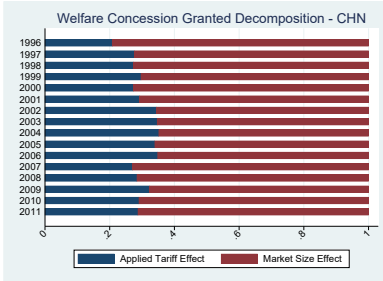


European Union

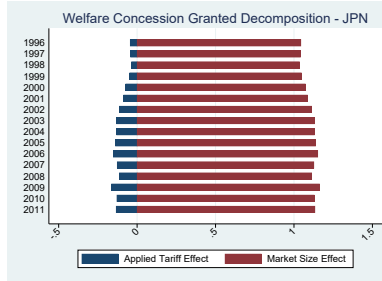


Morocco

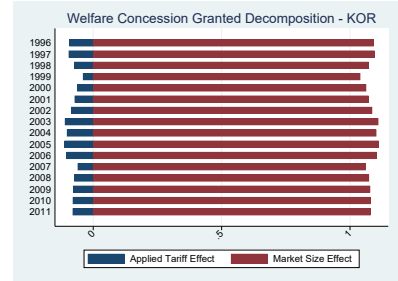
Figure 6: Decomposition of Welfare Concession



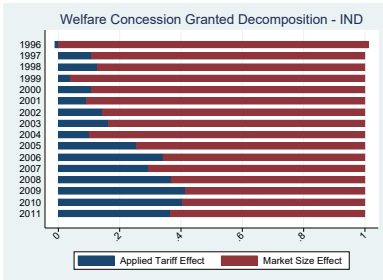
China



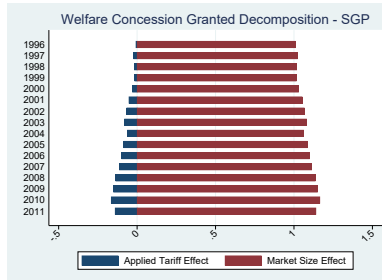
Japan



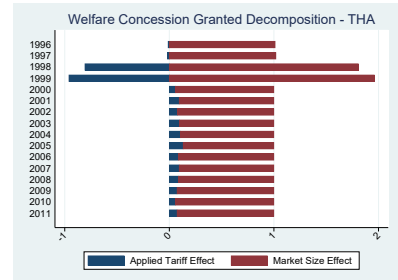
Korea



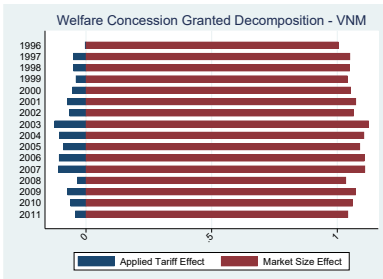
India



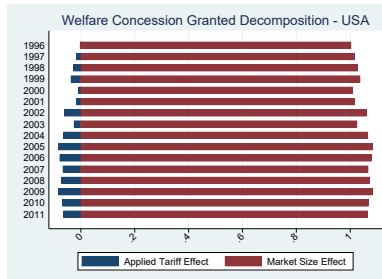
Singapore



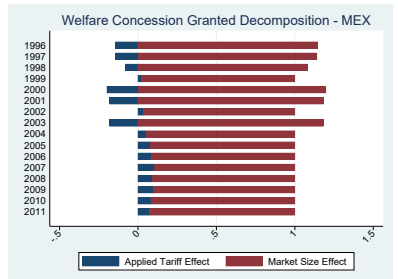
Thailand



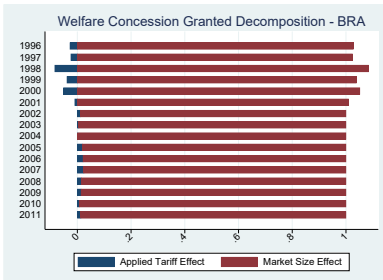
Vietnam



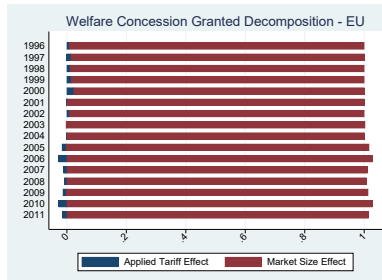
United States



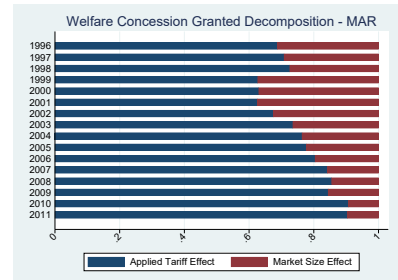
Mexico



Brazil

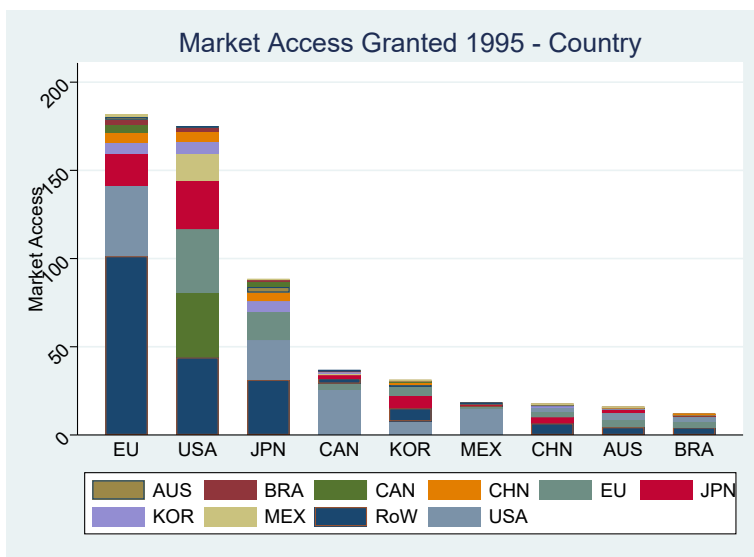


European Union

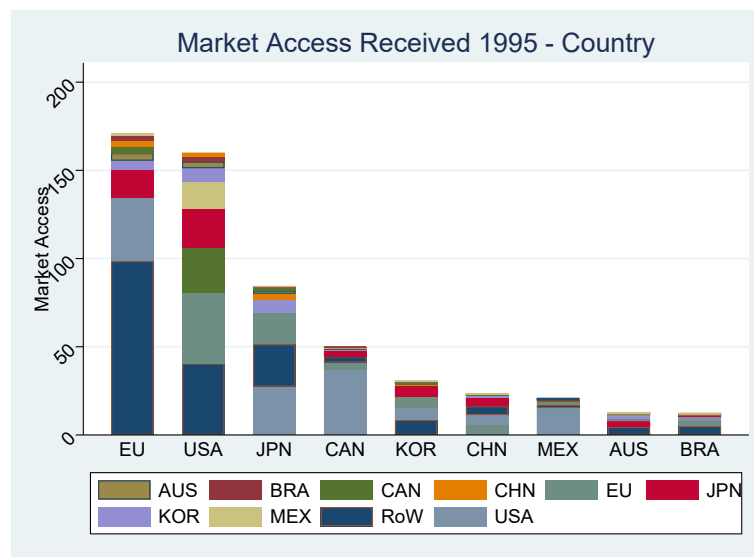


Morocco

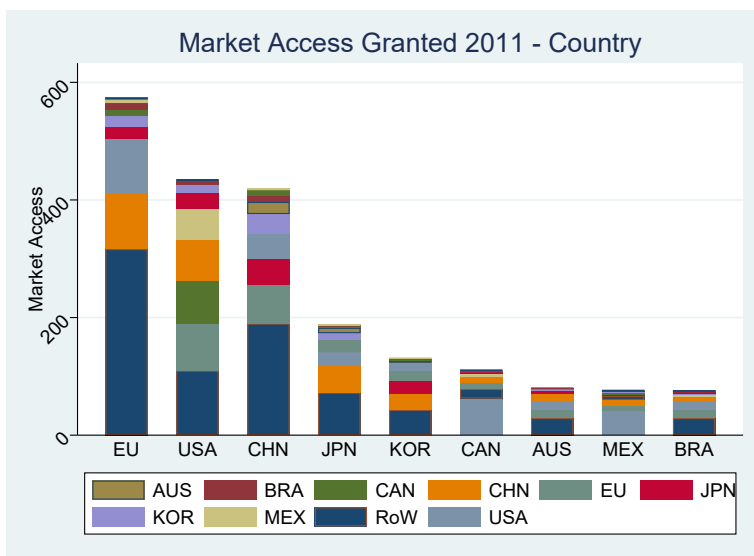
Figure 7: Market Access Granted and Received — Ranking



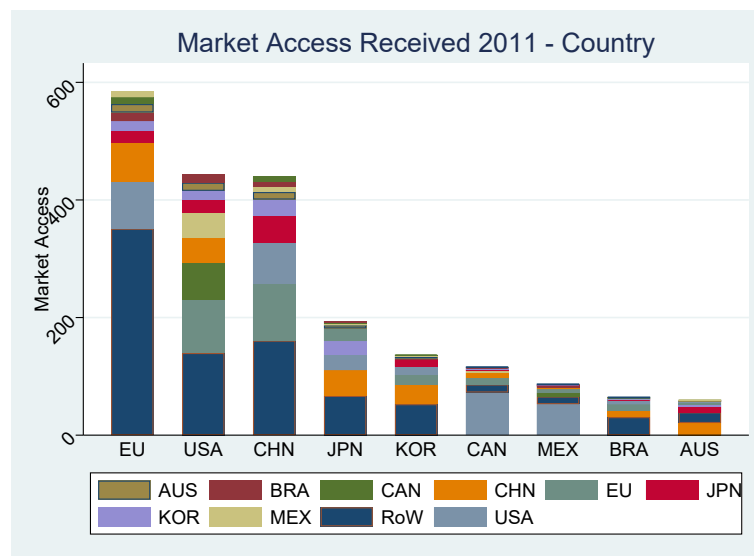
(a)



(b)



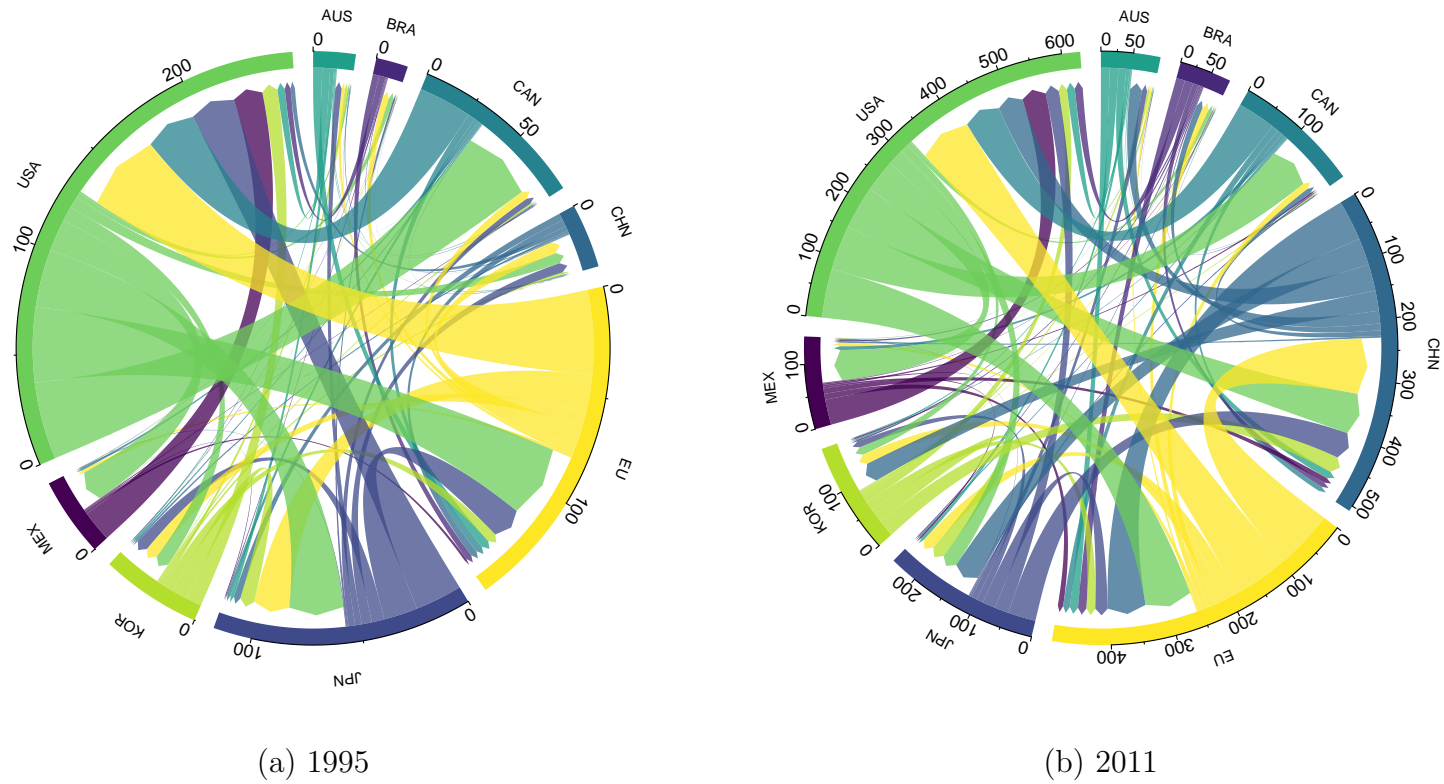
(c)



(d)

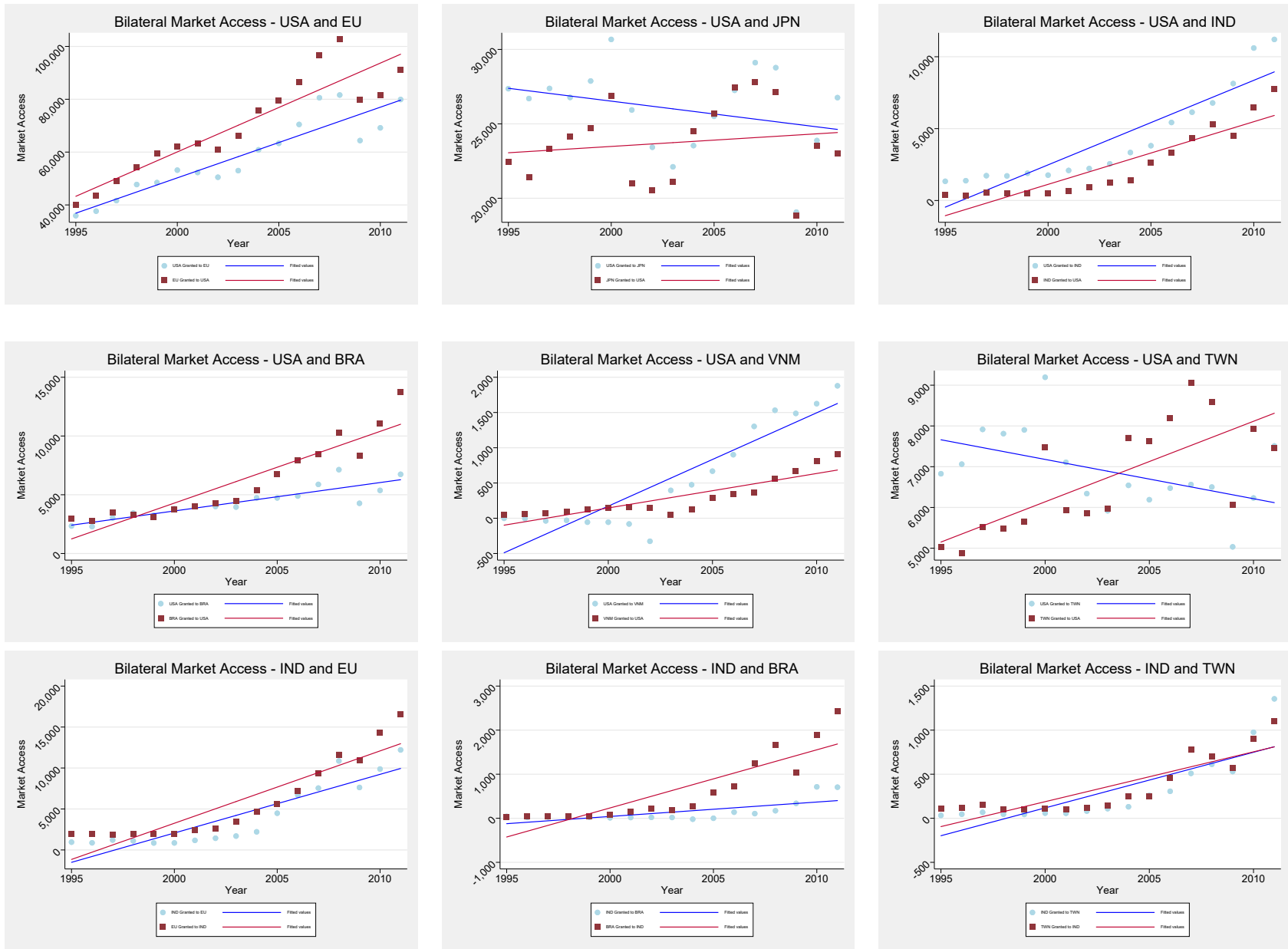
Note: The concessions are in billion US\$.

Figure 8: Market Access Granted and Received — Network



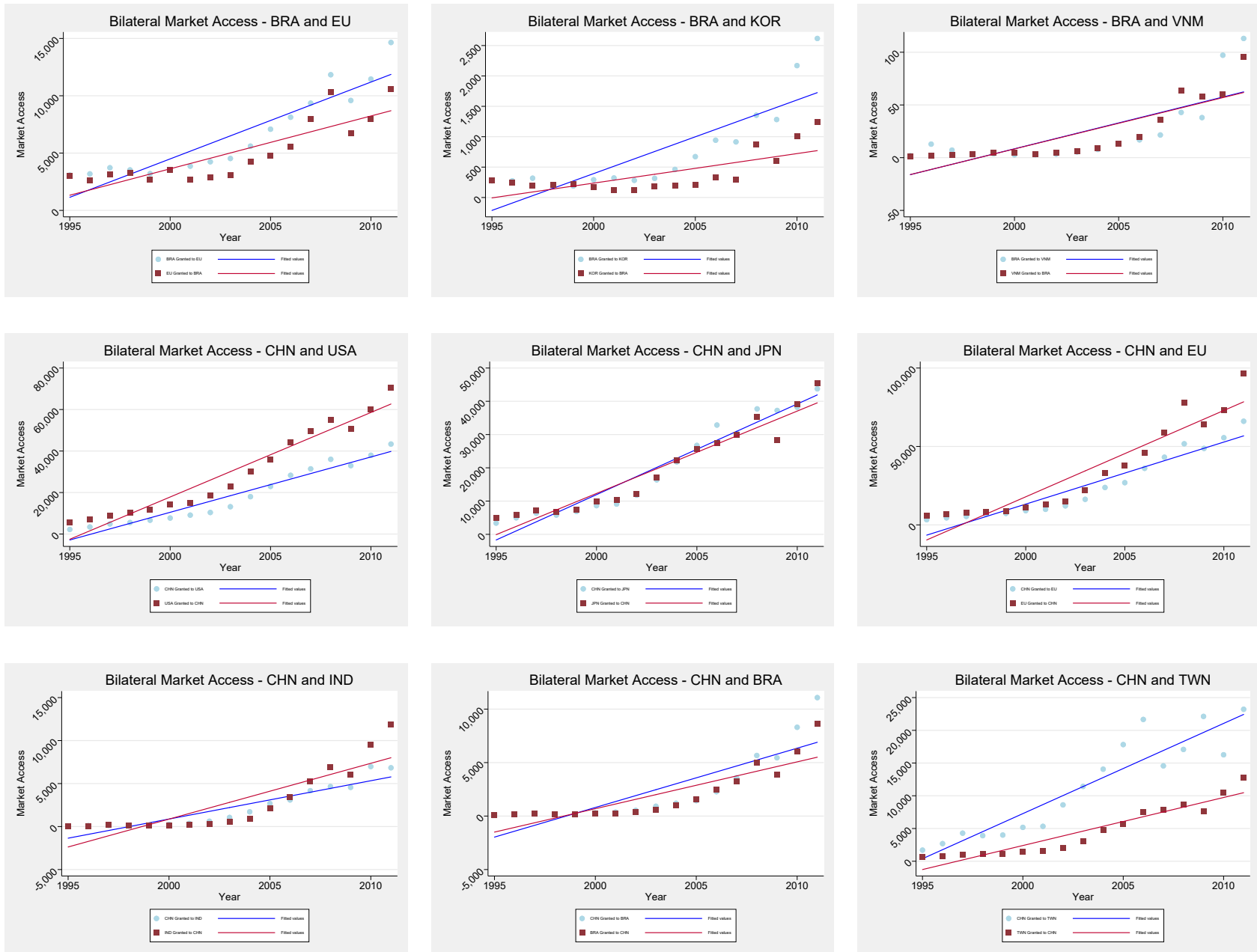
Note: The concessions are in billion US\$.

Figure 9: Bilateral Market Access Concession — Part I



Note: The concessions are in million US\$.

Figure 10: Bilateral Market Access Concession — Part II



Note: The concessions are in million US\$.