



How bilateral trade deals get in the way of multilateral agreements: Why WTO is marginalized[☆]

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Received 5 January 2023; Received in revised form 18 April 2023; Accepted 20 May 2023

Available online xxxx

Abstract

We use a ‘Nash in Nash’ framework within a computable general equilibrium model to determine the welfare maximizing set of bilateral trade agreements for countries in the Trans-Pacific Partnership. Comparing these agreements to an agreement involving all countries/sectors, we find that welfare is always larger in the multilateral agreement. This is because several sectors are often excluded from the bilateral agreements, and not all countries would have a bilateral agreement with others. The sectors that are often excluded from the agreements are agriculture, as these sectors are often deemed ‘sensitive’ in negotiations and are protected by high initial tariffs.

Published by Elsevier Inc. on behalf of The Society for Policy Modeling.

JEL classification code: F1; Q17

Keywords: Trade agreements; Nash in Nash; Equilibrium; Welfare

1. Introduction

The withdrawal of the Trans-Pacific Partnership (TPP) and the pivot to bilateral agreements by the U.S. is one example of the change in global trade policy noted by Bekkers (2019) and

[☆] The findings and conclusions in this publication are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy.

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Koopman et al. (2020)—i.e., the pull-back from globalization.¹ Proponents for the bilateral approach argue that these agreements can achieve more since they are individually negotiated rather than considering the benefits of more than two countries and that multilateral agreements have become too unwieldy and large (Richter, 2014).² In addition, it is noted that for wealthier countries, such as the U.S., bilateral negotiations create more leverage given the much greater size of their economy relative to potential partners (Williams, 2018). The opposing view is that bilateral trade agreements take long to negotiate, and that each new agreement must be ratified (by Congress for the U.S., for example) (Wharton, 2017). In a global sense, bilateral agreements also have the difficulty that they are often implemented one at a time, so that the gains made in the negotiations, e.g., tariff reductions, opening a new tariff-rate quota (TRQ), removal of non-tariff measures (NTMs), might not be relevant if countries provide more access to others in future agreements.

In addition to what agreements to pursue, there is a question of what goods to include in any trade agreement. That is, despite the best trade outcome for the world being free trade, most nations impose restrictions on imports that are usually advocated by and greatly benefit a small minority of producers in a country at the expense of consumers (Salvatore, 2019). This is particularly the case for agriculture, with several commodities deemed to be ‘sensitive’ due to heavy lobbying from interest groups (Jean et al., 2010). In terms of further WTO multilateral reform, Brooks (2019) argues that the failure for additional reform is in part because of agriculture. And there has been a failure to reform many of these sectors over time. For example, Griffith et al. (1993) note that many developed countries isolate domestic dairy producers from world market conditions. Twenty years later, it was still noted that the dairy sector was one of the most protected sectors in the world (Owen and Winchester, 2014).³

To determine which path is optimal for countries in the case of TPP, we use a ‘Nash in Nash’ approach in an applied general equilibrium model (GTAP). General equilibrium models are very popular for analyzing a wide range of issues, including the effect of trade reforms (Ghaith et al., 2021). Our model iterates over solutions for bilateral agreements for every combination of traded sectors with every other TPP partner. We assume that the country negotiates and enters into the bilateral agreement which maximizes its welfare as long as it does not lower the welfare of its partner in the agreement (i.e., every country will accept a deal which does not lower its welfare). In subsequent iterations (i.e., the Nash aspect), each country reviews its existing bilateral agreements and, depending on the trade agreements that are most beneficial, it may keep the agreements in place, modify them, or even cancel them altogether, again if the partner in the agreement is not made worse off. Once we arrive at a Nash equilibrium for the bilateral

¹ They also question the role of the World Trade Organization (WTO) in the absence of large-scale multilateral reform. Beckman et al. (2021) and Breuss (2022) also note that countries are pursuing agreements with regional trade agreements (RTAs), such as the Association of Southeast Asian Nations (ASEAN).

² The trade policy spectrum spans bilateral and RTAs, and the number of each of these vary among countries. According to the WTO (2023), every country except for Mauritania is a member of an RTA or a common market. Salvatore (2019) also notes that “practically all nations impose some restrictions on the free flow of international trade”. We refer to large-scale multilateral agreements as those involving the entire WTO. We refer to multilateral agreements as trade agreements between *more* than two partners and bilateral trade agreements as between two countries. Note that the WTO refers to all trade agreements with two or more partners as regional trade agreements. RTAs are authorized under the WTO and are encouraged because they might lead to more global multilateral reform (Koopman et al., 2020). The number of these agreements are over 350 in 2022 (WTO, 2021a).

³ In addition, dairy was also one of the last agriculture sectors to support TPP; although 80% of farmers from Wisconsin (the 2nd largest dairy producing state) opposed the provisions for dairy in TPP (Feedstuffs, 2016).

agreements, we compare the results to one of a multilateral agreement, examining which approach generates the largest welfare gains. We focus on ‘sensitive’ commodities.

2. Methodology

To identify a set of bilateral trade agreements among the TPP countries that would be reached by countries acting in their own interest, we formulate and solve an iterative game where each country evaluates all possible bilateral trade agreements with every other country and enters into such bilateral agreements that maximize its welfare (equivalent variation, EV) without making their partners worse off. The algorithm works as follows: in the first iteration, each region takes turn in deciding on joining a bilateral agreement with every other country among the TPP countries. The order of regions taking turns is fixed as is the order in which every region will be approached, e.g., if a region starts an iteration, it will start all future iteration and it will be the first region to be approached by every other region. We can represent the decision as: region (r) makes an offer of a bilateral agreement with region (s) covering a set of sectors (c) which maximizes region r 's EV. We represent the sectors included in trade agreements as a cube (three-dimensional matrix), $T_{r,s,c}$ of ones and zeroes with r, s, c . $T_{r,s,c} = 1$ if sector c is included in the bilateral agreement offered by r to s , otherwise $T_{r,s,c} = 0$. We require that bilateral agreements be symmetrical, e.g., if a sector c is offered to be included in a bilateral agreement between r to s then it will be included in the agreement offered by s to r .

In each iteration, the offering country considers all possible changes to its trade agreements with every other country. We represent the changes to the trade agreements with a three-dimensional matrix, B , with offering country, partner country and sector representing the three dimensions. This (B) takes three possible values at each cell: 0 to keep the sector in the agreement, -1 to remove a sector from the agreement, and 1 to add a sector to the agreement. Again, we require that changes to agreements be symmetrical, meaning that $T + B$ is symmetrical across countries, e.g., if a country proposes removal of a sector from its agreement, its protection will be reinstated by the partner country as well.

In each iteration, the offering country considers all possible B 's (changes to the agreement) where its own EV is improved, and the partner's EV is no worse than under the initial state of agreements T ; the set of welfare improving B s is thus:

$$B^* = \forall B: EV_{r,T+B} > EV_{r,T} \wedge EV_{s,T+B} \geq EV_{s,T} \quad (1)$$

If B^* is not an empty set, the offering country then proposes $\hat{B} \in B^*$ which maximizes its own welfare:

$$\hat{B} = \operatorname{argmax}_{B \in B^*} EV_{r,T+B} \quad (2)$$

Because \hat{B} does not make the partner country worse off, we assume that this agreement will be accepted. Finally, once \hat{B} has been accepted, we update the set of trade agreements:

$$T = T + \hat{B} \quad (3)$$

Equations (1–2) are ultimately decided based on whether concluding a bilateral agreement leads to greater welfare gains than doing nothing. During an iteration, each of the twelve TPP countries evaluates equations (1–2) for all eleven partners. Given that the first (offering) region seeks the welfare maximizing agreement, while the second region merely accepts anything offered by the first region that does not make it worse off, the equations need to be evaluated $12 \times 11 = 132$ times. This means that even the country that is last to negotiate is given the

opportunity to offer its own welfare-maximizing bilateral agreements to those countries with which it may have already agreed on different bilateral agreements.

After all the games end in the first iteration, the model continues for additional iterations, under the same assumptions, except the current trade regime now includes the existing bilateral agreements agreed to in the previous iteration. Hence, countries will only adopt new bilateral agreements or modify the existing ones if they maximize the welfare for the first region without making the second region worse off. The Nash equilibrium concept is introduced here in that all regions in the subsequent iterations know what each other is doing—hence they make a participation decision. The model concludes at the point when no country benefits by changing their participation decision.

To make our framework operational, we use the latest (version 11) GTAP database and GTAP model to evaluate each bilateral trade agreement's impact. In our scenario, we consider twelve countries (those that were part of the TPP) out of fifteen regions included in the model, and ten sectors.⁴ There are several important restrictions that we included in formulating the game. First, countries are only allowed to consider two possible states for each sector: either a sector is fully included in the bilateral trade agreement, or it is not included and its tariffs remain unchanged.⁵ Second, when countries agree on including a sector in their bilateral trade agreement, its tariff is reduced to the level that the country indicated during TPP negotiations, and that rate is available to every other country, i.e., if a bilateral agreement is concluded with another country, that country will get the same preferential rates. Finally, we repeat our approach with ten random orderings of countries entering the negotiations to confirm the results of our approach more generally.

2.1. Tariffs in TPP

Initial tariff rates are noted in [Table 1](#)—these provide a range across the sectors and the two largest rates (all bilateral tariffs require numerous tables, which are available upon request from the authors). Some general trends emerge from this data, which could impact what sectors are included in the bilateral trade agreements. 1st: Brunei, Peru, and Singapore tend to have zero duty rates for most sectors initially. Brunei and Singapore are expected since their small size dictates that they have to be open to trade to keep domestic prices low. The only product that they have a tariff on is processed food, which is the sector that every TPP country has a tariff on. Peru tends to have low Most Favored Nation (MFN) rates, in general ([WTO, 2021b](#))—and they also have a trade agreement with almost every country in TPP. 2nd: No country has a tariff on services. [Jafari and Tarr \(2017\)](#) note this, and they also calculate NTMs on services, but in this work, we only consider tariffs.⁶ 3rd: All countries, except for Singapore, have a tariff on manufacturing, and the tariff tends to be highest in Australia and New Zealand. 4th: Dairy is

⁴ The regions are TPP countries: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam, and the USA; the EU, China, and the Rest of the World (ROW). The sectors are several agricultural sectors with high tariff rates: rice, other crops, other crops, other agriculture, cattle/beef, raw dairy and dairy products, and other meat. The other sectors are: resources, processed food, manufacturing, services.

⁵ This assumption is quite reasonable for the vast majority of sectors, especially for manufacturing where there are only a few instances of a sector being excluded in tariff liberalization (e.g., automobiles or automobile parts). Agriculture is the main exception; hence, our work breaks out agriculture into several different sectors.

⁶ As noted in [Fugazza and Maur \(2008\)](#) and [Beckman et al. \(2021a\)](#), NTMs are often a larger barrier in ad-valorem terms but collecting data on this is very intensive and beyond the scope of this work.

Table 1
Initial Tariffs for the TPP Countries (ranges, the sectors with highest rates of protection are listed).

	Australia	Burmei	Canada	Chile	Japan	Malaysia	Mexico	New Zealand	Peru	Singapore	Vietnam	USA
Australia	0–2 (mnf: 2)	0–2 (pfd: 2)	0–4 (ocr: 4; dai: 2)	0	0–26 (dai: 26; cbf: 26)	0–40 (ric: 40; pfd: 12)	0–16 (pfd: 16; cbf: 15)	0	0–6 (cbf: 6; pfd: 2)	0	0–7 (pfd: 7; res: 4)	0–3 (pfd: 3; dai: 1)
Burmei	0	0	0–13 (pfd: 13)	0	0–1 (pfd: 1)	0	0–3 (mnf: 3)	0	0–3 (mnf: 3)	0	0–1 (res: 1)	0–9 (mnf: 9)
Canada	0–2 (pfd: 2; mnf: 2)	0–5 (pfd: 5)	0	0–6 (dai: 6)	0–24 (cbf: 24; res: 19)	0–2 (mnf: 2; pfd: 2)	0–2 (pfd: 2)	0	0–1 (pfd: 1)	0	0–12 (cbf: 12; oag: 11)	0–5 (dai: 5; pfd: 1)
Chile	0	0	0	0	0–53 (res: 53; dai: 29)	0–6 (pfd: 6; res: 2)	0	0	0	0	0–15 (pfd: 15; res: 11)	0
Japan	0–6 (mnf: 6)	0–3 (pfd: 3)	0–8 (dai: 8; pfd: 4)	0–2 (res: 2; pfd: 1)	0	0–40 (ric: 40; pfd: 6)	0–18 (cbf: 18; oag: 8)	0–5 (dai: 5; mnf: 5)	0–4 (res: 4; mnf: 2)	0	0–18 (ric: 18; dai: 12)	0–19 (dai: 19; ric: 5)
Malaysia	0	0	0–8 (dai: 8; pfd: 2)	0	0–22 (dai: 22; pfd: 3)	0	0–8 (oag: 8; pfd: 7)	0	0–4 (oag: 4; mnf: 3)	0	0–1 (res: 1; mnf: 1)	0–6 (dai: 6; oag: 2)
Mexico	0–5 (mnf: 5; ocr: 2)	0	0–4 (dai: 4)	0–5 (dai: 5)	0–24 (cbf: 24; res: 12)	0–14 (pfd: 14; mnf: 2)	0	0–4 (ocr: 4; mnf: 3)	0–1 (res: 1)	0–21 (pfd: 21)	0–11 (pfd: 11; oag: 11)	0
New Zealand	0	0	0–6 (dai: 6; oag: 2)	0	0–27 (dai: 27; cbf: 20)	0–1 (pfd: 1; mnf: 1)	0–18 (pfd: 18; cbf: 12)	0	0–6 (res: 6; omt: 3)	0	0–6 (pfd: 6; cbf: 4)	0–18 (oag: 18; dai: 9)
Peru	0–3 (mnf: 3; omt: 2)	0	0	0	0–11 (res: 11; pfd: 2)	0–3 (res: 3; ocr: 3)	0–1 (oag: 1; res: 1)	0–3 (mnf: 3; res: 2)	0	0	0–22 (res: 22; oag: 11)	0–1 (pfd: 1)
Singapore	0	0	0–46 (dai: 46; pfd: 12)	0	0–22 (dai: 22; pfd: 11)	0–37 (pfd: 37; ric: 20)	0–11 (pfd: 11; oag: 10)	0	0	0	0–13 (pfd: 13; res: 2)	0

(continued on next page)

Table 1 (continued)

	Australia	Bornei	Canada	Chile	Japan	Malaysia	Mexico	New Zealand	Peru	Singapore	Vietnam	USA
Vietnam	0	0	0–6 (mnf: 6; ocr: 2)	0–3 (ric: 3)	0–18 (dai: 18; pfd: 2)	0–20 (ric: 20; pfd: 3)	0–17 (oag: 17; pfd: 15)	0–1 (mnf: 1)	0–3 (mnf: 3; oag: 2)	0	0	0–7 (mnf: 7; ric: 5)
USA	0–1 (mnf: 1)	0–6 (pfd: 6)	0–30 (dai: 30; pfd: 3)	0	0–35 (cbf: 35; dai: 26)	0–40 (ric: 40; pfd: 20)	0	0–3 (res: 3; mnf: 3)	0	0	0–11 (cbf: 11; pfd: 7)	0

Source: [International Trade Commission \(2021\)](#)

Note: Cbf represents beef, dai represents dairy, mnf represents manufacturing, oag represents other agriculture, ocr represents other crops, omt represents other meat, pfd represents processed food, res represents resources, ric represents rice. Importers are columns, exporters are rows.

heavily protected by many countries. Dairy, rice, and sugar TRQs have been maintained in the WTO, which has led to relatively higher tariffs compared to other sectors (Beckman et al., 2017). 5th: Tariffs on agricultural products tend to be much higher than those for manufacturing. Beckman (2021) notes that only twelve out of 114 countries had a lower average tariff on agriculture compared to non-agriculture—and 10 of those twelve have very low tariffs on both sectors.

The TPP rates are noted in Table 2 and indicate that most tariff rates would have been reduced to zero. The sector where the most protection was to remain was in agriculture, the exception being manufacturing in Japan. The tariff in this sector of 9.03% is largely because of the tariff on petroleum/coal products. For those remaining sectors with tariffs, Canada's dairy and Japan's rice and beef tariffs are the most prominent, but apart from Japan's rice, they do represent improvements on the initial rates (which were 50% and 35% in the highest instances). One other consideration is that many of the TPP countries had bilateral trade agreements with each other (or a regional agreement, in the case of the North American Free Trade Agreement (NAFTA)), but tariff rates still existed on many sectors. TPP would have replaced many of these with duty-free access.

3. Modeling results

We first examine which countries would have bilateral agreements with each other to show how these agreements get in the way of multilateral agreements.

3.1. Bilateral agreements in TPP

For the bilateral scenario, it takes 20 iterations to arrive at the final Nash solution. First, we note that there is an increase in welfare for TPP partners of \$24.5 billion (in the final, Nash solution). Despite the increase in total welfare for the TPP countries, some countries have a decrease in welfare in this simulation—Brunei, Malaysia, and the USA (Table 3).^{7,8} These three countries all have an increase in their exports but examining the welfare results in detail can provide information on the welfare loss. Welfare is broken out into three components in our model (Beckman, 2021): allocative efficiency—an optimal distribution of goods and services—which involves the redistribution of resources to other sectors; terms of trade (ToT), which is the ratio of export prices to import prices for a region; and investment, how well a region can attract foreign investment, based on the profitability of the region given the change in scenario. As noted in the first column of Table 3, all TPP countries have an increase in allocative efficiency—the increase is highest for Japan, indicating that trade agreements lead Japan to re-allocate resources to more efficient producing sectors. ToT effects are mixed. In general, ToT effects globally will be around zero (any slight deviation will be computation error)—the total impact for TPP countries is positive (\$12.9 billion), indicating that the rest of the world not involved in TPP loses welfare from this measure. But within the TPP countries, some countries

⁷ Gilbert et al. (2018) also estimate that some countries would experience welfare losses—and similar to our result, Japan and Vietnam are among the countries that have the largest welfare gains. Even though these countries are estimated to have a loss in welfare, the loss would be greater if they do not join TPP.

⁸ This experiment is conducted with the regions in alphabetical order. We also conducted scenarios where the order is changed and find similar results to the ones presented—in particular, that welfare from the bilateral agreements is never greater than that from the multilateral agreement. Some additional insight into these results are presented later.

Table 2
Final Tariffs Negotiated Under the TPP.

	Australia	Brunei	Canada	Chile	Japan	Malaysia	Mexico	New Zealand	Peru	Singapore	Vietnam	USA
Rice	0	0	0	0	243.25	0	0	0	0	0	0	0
Other crops	0	0	0	0	0	0	0	0	0	0	0	0
Other ag	0	0	0	0	0.00	0.00	0	0	0	0	0	0
Beef	0	0	0	0	4.77	0	0	0	0	0	0	0
Other meat	0	0	0.00	0	0.00	0	0	0	0	0	0	0
Dairy	0	0	23.87	0	0	0	0	0	0	0	0	0
Processed food	0	0	0.09	0	0	0.00	0	0	0	0	0.00	0
Resources	0	0	0	0	0.00	0	0	0	0	0	0	0
Manufacturing	0	0	0.00	0	9.03	0.00	0	0	0	0	0	0
Services	0	0	0	0	0	0	0	0	0	0	0	0

Source: ITC, 2021

Note: A '0.00' refers to the presence of a tariff in the sector; however, aggregating all the products within the sector leads to a final tariff that is not different than zero.

Table 3
CGE Results from the Scenario Comparing Bilateral with a Multilateral Agreement.

	Bilateral Agreements				Multilateral Agreement			
	Welfare (\$ million)				Welfare (\$ million)			
	Allocative efficiency	Terms of Trade	Investment	Total	Allocative efficiency	Terms of Trade	Investment	Total
Australia	547	658	-14	1191	547	680	-17	1210
Brunei	0	-111	37	-73	0	-112	37	-75
Canada	221	1162	6	1388	340	1498	35	1873
Chile	263	9050	148	9461	263	9083	150	9496
Japan	9286	-1716	260	7830	9569	1279	451	11,299
Malaysia	250	-310	3	-57	257	-333	-3	-79
Mexico	139	807	-71	875	122	636	-53	705
New Zealand	28	294	-15	308	46	315	-14	347
Peru	3	147	-10	140	5	169	-10	164
Singapore	244	685	-45	884	323	852	-59	1116
Vietnam	504	4058	20	4581	505	3860	22	4387
USA	442	-1847	-648	-2052	478	-2557	-975	-3053

have a ToT loss. This drives the total loss for Brunei, Malaysia, and the USA. The impact is relatively small except for the latter, investigating further indicates that the USA has a loss from a decrease in the price of their manufacturing and services exports. Note that Japan is also estimated to have a decrease in their ToT, but the larger increase in allocative efficiency outweighs this loss. The change in welfare from investment is relatively small.

Chile has the biggest welfare increase, and at the same time, the largest decrease in total exports. This result is largely because they have a large decrease in exports (and production) of almost every sector except for the resources sector. There, they have an increase in exports of 38%, which coupled with an increase in the price of their resources, leads to the large welfare gain. Thus, the bilateral agreements seem to encourage a shift in production/trade focus for Chile—which bilateral agreements are now discussed.

Table 4 presents the results for what sectors and what countries have bilateral trade agreements for the initial simulation. This initial simulation is when countries have exclusive access to their potential bilateral trade partner's market. There are 66 potential bilateral agreements that could be reached, and nine sectors which these bilateral agreements could cover. First, note that results indicate that no bilateral agreement would include tariff reform in all 9 sectors. The most is seven sectors in the Mexico-New Zealand agreement. There are five other additional agreements that cover six sectors (Australia-Canada, Australia-Mexico, Australia-USA, Canada-Singapore, and Japan-New Zealand). In total there is the possibility for a trade agreement covering $66 * 9 = 594$ sectors/partners, but we find that only 110 would be covered. And results indicate that one country (Malaysia) would not enter in an agreement with any TPP partner. The model indicates that the USA would only enter into an agreement with Australia—a country that they already have an agreement with. The model indicates that Australia would enter into the most trade agreements—with all countries except for Malaysia and Singapore.

The final Nash solution indicates some differences from the initial scenario (Table 5), indicating that countries change their decision based on what others are doing (the specific welfare-CGE results presented before in Table 3 are based on this final Nash solution). The first thing to notice is that there are more agreements than what occurred in the initial iteration. That

Table 4
Bilateral Partnerships from the First Iteration of the Bilateral Scenario.

	Australia	Burmei	Canada	Chile	Japan	Malaysia	Mexico	New Zealand	Peru	Singapore	Vietnam	USA
Australia	—	—	—	—	—	—	—	—	—	—	—	—
Burmei	mnf, pfd	—	—	—	—	—	—	—	—	—	—	—
Canada	dai, mnf, oag, ocr, pfd, res	—	—	—	—	—	—	—	—	—	—	—
Chile	mfn, pfd	—	—	—	—	—	—	—	—	—	—	—
Japan	mnf, res	mnf, res	—	mnf, res	—	—	—	—	—	—	—	—
Malaysia	—	—	—	—	—	—	—	—	—	—	—	—
Mexico	cbf, mnf, ocr, omt, pfd, res	oag, res	oag, res	dai	oag, ocr, omt, pfd, res	—	—	—	—	—	—	—
New Zealand	res	mnf, oag, ocr, omt, res	mnf, oag, ocr, omt, res	mnf	dai, oag, ocr, omt, pfd, res	cbf, dai, mnf, oag, omt, pfd, res	—	—	—	—	—	—
Peru	mnf, omt, pfd, res	—	—	—	oag, ocr, pfd, res	mnf, oag, pfd, res	mnf, ocr, omt, pfd, res	—	—	—	—	—
Singapore	—	—	mnf, oag, ocr, omt, pfd, res	mnf	dai, omt, pfd, res	mnf, oag, omt, pfd, res	—	—	mnf, pfd	—	—	—
Vietnam	mnf	cbf, mnf, oag	cbf, mnf, oag	mnf, omt, ric	dai, oag, pfd, res	mnf, oag, omt, pfd	—	mnf	mnf, oag	—	—	—
USA	dai, oag, mnf, omt, pfd, res	—	—	—	—	—	—	—	—	—	—	—

Note: Cbf represents beef, dai represents dairy, mnf represents manufacturing, oag represents other agriculture, ocr represents other crops, omt represents other meat, pfd represents processed food, res represents resources, ric represents rice.

is, in the first iteration, the model estimates that just a little over half (34 of the 66 possibilities) of the bilateral agreements would not take place. In the Nash equilibrium, there are only twelve instances where a bilateral agreement does not take place. Thus, once regions are aware that others are making agreements, they make similar agreements so that they do not lose more welfare from not doing anything. There are eleven instances where a bilateral agreement features only tariff reform of a single sectors; but many of the agreements feature reform for several sectors. There are 17 instances of agreements including at least half of the sectors.

Finally, we note that there are some sectors that tend to be included in the bilateral agreements more than others (and likewise, those that are not often included). [Figure 1](#) presents those sectors that are included in a bilateral trade agreement, for both the initial simulation and the final Nash equilibrium. First, note that those sectors with the highest average tariff across all TPP countries tend to be those included in trade agreements the least. Those are the agricultural sectors: *cbf* (beef), *dai* (dairy), and *ric* (rice). These three sectors also tend to have the largest increase in inclusion in trade agreements between the initial and the Nash solution—indicating that as more countries get access, more countries join so that they also receive access. For example, rice was only included once in the first iteration, and six times in the final iteration. Apart from having one of the three highest initial tariffs, rice was also the highest tariff for all of the instances where it was reformed in the Nash scenario—often involving Malaysia. Second, those instances that tend to be included in bilateral agreements the most, also tend to have the highest trade values. *Mfg* (manufacturing) is the sector included in the most agreements for both the initial and the Nash solutions, and its trade value is more than 3 times that of all the other sectors combined (except for services, which, since there is no change in the tariff, is not considered). The two other sectors with the largest trade values (*res* (resources) and *pdf* (processed food)) are the also the sectors that are included the 2nd and 3rd most across both the initial and Nash solutions.

3.2. Multilateral agreement results

To address the question of bilateral versus multilateral agreements, we also discuss the results for the multilateral simulation (i.e., TPP). First, note that the multilateral agreement with all the TPP countries would lead to an increase in their welfare by \$27.4 billion ([Figure 2](#)). This is depicted as the red line in the figure. (The simulations noted in the figure represent further scenarios that we undertake, as will be explained later.) This welfare increase is higher than that for the bilateral case—indicating that (at least in the case of TPP), a multilateral agreement leads to a larger welfare than that for bilateral agreements.⁹ But, as noted in [Table 3](#), welfare is not always greater for each individual country. The difference is only \$1 million for Brunei, but the USA (a difference of \$1 billion), Mexico (a difference of \$170 million) and Malaysia (a difference of \$21 million) all have sizeable differences between bilateral and multilateral agreements. The largest welfare difference occurring for the USA suggests that their bilateral approach to TPP could have been warranted.

[Table 3](#) also breaks down the welfare change by type, which sheds some light into why the USA has a larger welfare decrease. Again, the USA has an increase in allocative efficiency, but also a larger decrease in ToT. The ToT decrease is despite the USA having the largest increase in exports (tied with Vietnam), as the sectors that they are exporting more of have a decrease in

⁹ Although many of the TPP studies in the literature consider complete tariff liberalization, Gilbert (2018) notes that excluding some products leads to a drastic cut in trade gains—in particular, for agriculture. Their results, excluding liberalization in sensitive products are echoed here as not all sectors are liberalized in each agreement.

Table 5
Bilateral Partnerships from the Last Iteration of the Bilateral Scenario.

	Australia	Bornei	Canada	Chile	Japan	Malaysia	Mexico	New Zealand	Peru	Singapore	Vietnam	USA
Australia	—	—	—	—	—	—	—	—	—	—	—	—
Bornei	pdf	—	—	—	—	—	—	—	—	—	—	—
Canada	dai, mnf, oag, ocr, omt, pfd, res	mnf, pfd	—	—	—	—	—	—	—	—	—	—
Chile	pdf	—	oag	—	—	—	—	—	—	—	—	—
Japan	dai, mnf, oag, ocr, pfd, res	mnf	mnf, oag, ocr, res	dai, mnf, oag, omt, res	—	—	—	—	—	—	—	—
Malaysia	ric	mnf, oag, ocr	mnf, oag, res	mnf	—	—	—	—	—	—	—	—
Mexico	cbf, mnf, ocr, omt, pfd, res	—	oag, res	dai	cbf, oag, omt, pfd, res	mnf, oag, ocr, omt, pfd, res	—	—	—	—	—	—
New Zealand	mnf, res	mnf, oag, ocr, omt, res	mnf, oag, ocr, res	mnf	dai, oag, ocr, omt, pfd, res	mnf, oag, ocr, pfd	cbf, dai, mnf, oag, omt, pfd, res	—	—	—	—	—
Peru	mnf, omt, pfd, res	—	cbf, ocr, res	—	oag, ocr, pfd, res	oag, ocr, res	mnf, oag, pfd, res	cbf, mnf, omt, pfd, res	—	—	—	—
Singapore	—	—	mnf, oag, ocr, omt, pfd, res	mnf	dai, omt, pfd, res	mnf, oag, pfd, ric	mnf, oag, omt, pfd, res	—	mnf, pfd	—	—	—
Vietnam	mnf	—	cbf, mnf, oag	mnf, omt, pfd	dai, oag, pfd, res	oag, pfd, ric	cbf, mnf, oag, ocr, omt, pfd	mnf, omt	mnf, oag, ocr, omt	mnf, ocr	—	—
USA	mnf, res	pfd, res	—	dai, mnf, oag, ocr, omt, pfd, res, ric	cbf, dai, oag, ocr, omt, pfd, res, ric	dai, mnf, oag, ocr, omt, pfd, res, ric	dai, mnf, res, oag, ocr, omt, pfd, res, ric	cbf, mnf, oag, ocr, omt, pfd, res	dai, mnf, ocr, omt	oag	cbf, dai, mnf, oag, ocr, omt, pfd, ric	—

Note: Cbf represents beef, dai represents dairy, mnf represents manufacturing, oag represents other agriculture, ocr represents other crops, omt represents other meat, pfd represents processed food, res represents resources, ric represents rice.

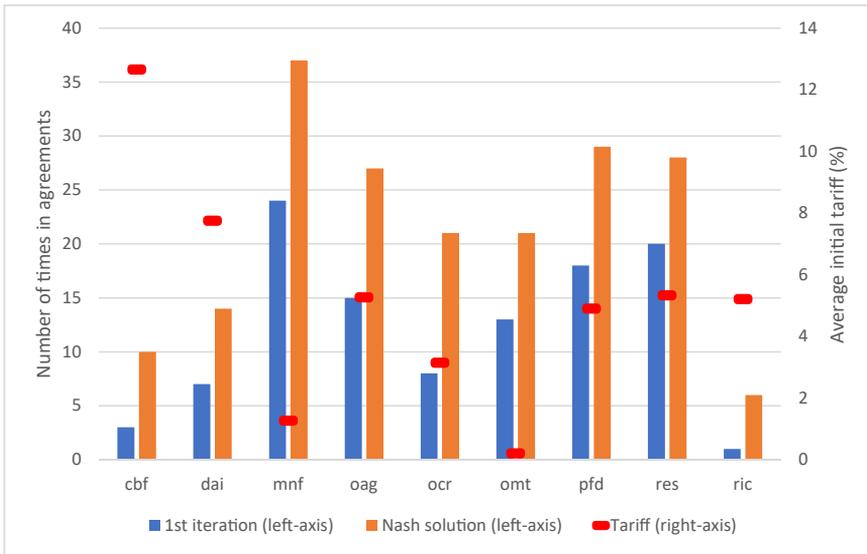


Fig. 1. Number of Times a Sector is Included in a Trade Agreement for the Bilateral Scenario. Note: : Cbf represents beef, dai represents dairy, mnf represents manufacturing, oag represents other agriculture, ocr represents other crops, omt represents other meat, pfd represents processed food, res represents resources, ric represents rice

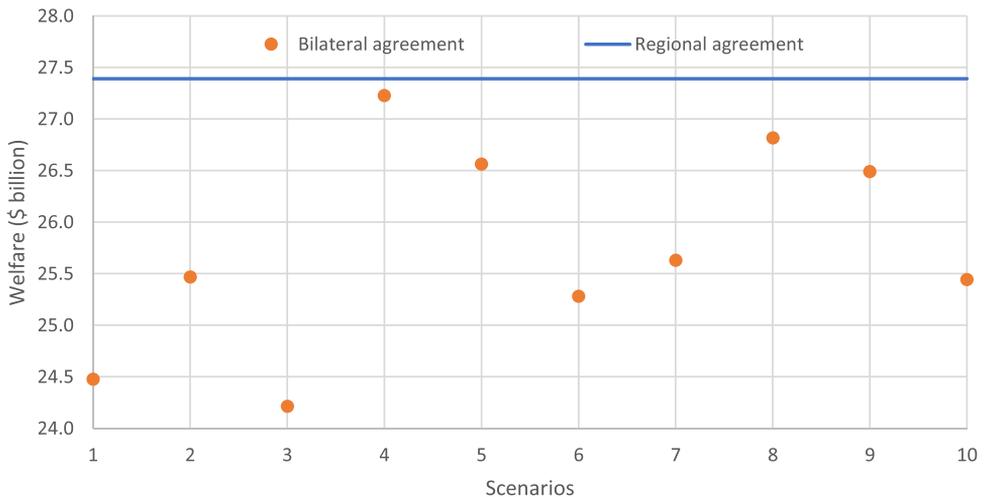


Fig. 2. Welfare results across the bilateral and multilateral scenarios.

their export price. In addition to the larger decrease in welfare from ToT, the USA also has a larger decrease in welfare from investment in the multilateral scenario.

In terms of countries who gain the most from a multilateral agreement, Japan now has the largest welfare increase (as the ToT result is basically flipped). Japan had previously entered into a large number of bilateral agreements (covering more than half of the sectors), but the multilateral agreement that forces reform in almost every sector (except for rice, beef, and

manufacturing) leads to greater welfare gains. The two countries with the next largest welfare under the multilateral agreement have very little change from the bilateral agreements. Canada (\$484 million) and Singapore (\$231 million) are the countries that gain the most in terms of multilateral versus bilateral agreements.

4. The difficulty of reforming sensitive products

Results indicate that there are several agriculture sectors that are often not included in the bilateral agreements, e.g., dairy. To examine the role that ‘sensitive’ sectors play in trade policy, we conduct additional scenarios where we vary the order of countries choosing to be a part of a bilateral agreement. First, we note that no matter the order, welfare from the bilateral agreements never reaches that of the multilateral case. Although presenting the results for all of the possible scenarios is not possible, there are some overall observations that can be gleaned. These largely revolve around what happens to the agricultural sector in the TPP scenario. As mentioned before, agriculture tends to have higher tariffs in place than non-agriculture. In addition, the majority of TRQs in place are on agricultural products, and often feature very high over-quota rates that effectively prohibit imports beyond the quota (Beckman et al., 2021b). Finally, Li and Beghin (2012) note that NTMs tend to be in place on agricultural products more than non-agriculture; and Beckman and Arita (2017) note that NTMs and TRQs often coexist in the most sensitive agricultural sectors, combining to restrict trade. As such, agricultural sectors that are known to be sensitive and highly protected (e.g., beef and dairy) are featured in our model to see if they would be liberalized.

Across 10 simulations that we conducted; the following were the set of bilateral pairs/sectors that were liberalized the least often:

- Dairy from Singapore to Canada (tariff of 46%), never liberalized;
- Cattle/beef from Australia to Japan (tariff of 26%), never liberalized;
- Cattle/beef from Canada to Japan (tariff of 24%), never liberalized;
- Cattle/beef from New Zealand to Japan (tariff of 24%), never liberalized;
- Dairy from USA to Canada (tariff of 30%), liberalized in 40% of the simulations.

4.1. EU trade agreements and the sensitivity of agriculture

Our results indicate that several agricultural sectors remain protected in the potential bilateral agreements, especially those that are noted as typically protected by developed countries (dairy and cattle/beef). To add some more context into the sensitivity of agriculture in trade agreements, table 6 shows those agricultural sectors that the EU has protected in some of their trade agreements.¹⁰ We focus on those sectors that are governed under a TRQ as these are typically where the largest tariff (in ad-valorem equivalent) occurs (in particular, when the quota is filled, and the over-quota rate applies). Jafari et al. (2021) note that these TRQs are crucial for trade negotiations because they are rarely completely liberalized and are often the obstacles in

¹⁰ The EU is used as an example because of the availability of information on their trade agreements. Many of the same arguments made here can apply to other developed countries; although Ajewole et al. (2022) present data that show that Australia, New Zealand, and the U.S. tend to give preferential access through lower tariff rates to those they have a trade agreement with.

Table 6
Products the EU Tends to Protect in Trade Agreements.

	Animal Products	Dairy	Fruits & vegetables	Grains & oilseeds	Sugar & sweeteners	Wine & spirits	Other processed food
South Africa (2000)	Ex	TRQ, Ex	TRQ, Ex	Ex	Ex	TRQ	Ex
Mexico (2000)	Ex	Ex	TRQ, Ex	Ex	TRQ, Ex	Ex	TRQ, Ex
Chile (2003)	TRQ, Ex	TRQ, Ex	TRQ, Ex	TRQ, Ex	Ex	Ex	TRQ, Ex
Colombia/Peru/Ecuador (2012/2017)	TRQ	TRQ	TRQ	TRQ	TRQ	TRQ	TRQ
Canada (2017)	TRQ, Ex	TRQ	TRQ	TRQ	No info	Gis	TRQ
U.S. (2022)*	TRQ	TRQ	TRQ	TRQ	TRQ	None	TRQ

Note: Ex refers to a sector with products excluded from reform, TRQ represents sectors that have a product covered under a TRQ, GIs are those protected by Geographical Indicators, and None refers to those with either no data or that are not explicitly mentioned as being included in the protected sectors. The agreement with Colombia and Peru was in force in 2012, then Ecuador joined in 2017. * the U.S. does not have a trade agreement with the EU, but they are numerous products that have TRQs in place from various trade disputes.

Source: [Rudloff and Simons \(2004\)](#) for the South Africa, Mexico, and Chile agreements. [EC \(2023\)](#) for the Colombia/Peru/Ecuador agreement. [Jafari et al. \(2021\)](#) for the agreement with Canada. [USTR \(2023\)](#) for the U.S. TRQs.

negotiations. One argument related to that is that countries might find it to their advantage to retain these TRQs to have something to negotiate with.

As shown in [table 6](#), the EU tends to protect many agricultural products in their trade agreements. In earlier trade agreements, animal products were often completely excluded, but the EU has offered TRQs in some of these products in more recent agreements. This is the same patterns for many of the other commodities, with some sort of mixture of products excluded from reform and others with an established TRQ within the category. In one of the more recent trade agreements, the EU opened a TRQ for several agricultural commodities for Canada, yet poultry and eggs were excluded. Note that Canada does use similar production techniques as the U.S., many of which face an NTM and are banned from the EU ([Beckman & Arita, 2017](#)). Finally, ([Woolcock, 2007](#)) notes that even in these trade agreements, the EU retains the right to apply several safeguards (the ability to apply extra tariffs) on several sensitive agriculture sectors.

5. Conclusions

The number of global trade agreements continue to increase, and in the absence of a large-scale multilateral agreement in the WTO, these trade agreements have either been bilateral or with more than two countries. Previously, the debate between which path to take for more global trade was between the bilateral approach and WTO multilateral agreements; but the path taken by the U.S. in the Trans-Pacific Partnership (pursuing bilateral agreements rather than the multilateral approach), has led to a debate between the approaches not led by the WTO. Using a Nash in Nash setup in an applied general equilibrium model, our work provides, perhaps, the first definitive proof that a multilateral, regional trade agreement is generally more welfare enhancing for all parties than pursuing a bilateral approach.

But the purpose of our work is to show how bilateral trade agreements get in the way of multilateral agreements. Our results indicate that if countries are left to negotiate their own bilateral agreements, they most frequently stop at some point where they maximize their own welfare, and any further liberalization is not possible (no country benefits from altering its agreements). Each of the simulations shows how far the countries would get with respect to full liberalization. We never observe that they reach a multilateral agreement, and that gap depends on which countries lead the negotiations. Perhaps the biggest reason why the countries in our work never choose to have a bilateral trade agreement with all, and why sectors are excluded is the political economy nature of trade. This is particularly the case with agriculture—with many sectors deemed to be ‘sensitive’ and thus far excluded from tariff reform. As such, there are large tariffs (often in the form of TRQs) that countries do not reform in our scenarios. If these cannot be reformed in bilateral agreements, it’s no wonder that any further large-scale WTO reform has failed. And, we note that the tariffs used in our experiment are already relatively low compared to the global average, and most sectors would be reformed in TPP—but even then, there are some sectors that are not (rice in Japan, for example). But, we also wonder if countries keep TRQs in place in order to have negotiating power in future trade agreements?

The model we build for this work could be used to analyze future trade policy decisions. That is, a country, such as the United States could see that pursuing bilateral agreements might be advantageous at the country level, but they risk being left behind if they do not pursue multilateral agreements that can include many more countries at one time. That is, a country might have a decrease in welfare in a multilateral agreement (or even bilateral agreement). But they would likely lose more if they do not join—as they would completely miss any sort of liberalization and have trade diversion. On the more global level, our results indicate that indeed a collective

multilateral agreement is more welfare enhancing for the world than pursuing bilateral agreements. Perhaps such a result could help motivate future WTO-wide multilateral reform.

Finally, we would like to note that the trade landscape has changed considerable over the last couple of years. The retaliatory tariffs and the Phase One agreement highlight that trade disputes can disrupt global trade systems (Bown, 2021). And the COVID-19 pandemic further disrupted trade flows (Rogoff, 2021; Salvatore, 2021; Stiglitz, 2021); although both issues further highlight the importance of trade policy in keeping trade channels open.

Acknowledgements

This research was supported [in part] by the U.S. Department of Agriculture, Economic Research Service. The authors thank Sabah Cavallo, the editors of JPM, and the reviewers of this paper.

References

- Ajewole, K., Beckman, J., Gerval, A., Johnson, W., Morgan, S., & Sabala, E. (2022). *Do free trade agreements benefit developing countries? An examination of U.S. agreements. economic information bulletin*. United States Department of Agriculture.
- Beckman, J. (2021). Reforming Market Access in Agricultural Trade: Tariff Removal and the Trade Facilitation Agreement. Economic Research Report Number 280, United States Department of Agriculture.
- Beckman, J., & Arita, S. (2017). Modeling the interplay between sanitary and phytosanitary measures and tariff-rate quotas under partial trade liberalization. *American Journal of Agricultural Economics*, 99(4), 1078–1095.
- Beckman, J., Burfisher, M., Mitchell, L., & Arita, S. (2021a). Hidden obstacles to trade: The case of the EU’s ban on beef hormones. *Journal of Policy Modeling*, 43(6), 1332–1343.
- Beckman, J., Dyck, J., & Heerman, K. (2017). *The global landscape of agricultural trade, 1995-2014. Economic information bulletin*. United States Department of Agriculture.
- Beckman, J., Gale, F., & Lee, T. (2021b). *Agricultural market access under tariff-rate quotas. Economic research report*. United States Department of Agriculture.
- Beckman, J., Gopinath, M., & Daugherty, K. (2021). Options for ASEAN Trade Expansion: Within, Plus Three or Six, European Union of the United States? *The World Economy*, 44(5), 1177–1204.
- Bekkers, E. (2019). Challenges to the trade system: The potential impact of changes in future trade policy. *Journal of Policy Modeling*, 41(3), 489–506.
- Bruss, F. (2022). Who wins from a FTA induced revival of world trade? *Journal of Policy Modeling*, 44(3), 653–674.
- Brooks, J. (2019). Why is agricultural trade policy always so difficult to reform? *EuroChoices*, 8, 38–43.
- EC. (2023). EU-Colombia-Peru-Ecuador Trade Agreement. Access2Markets.
- Feedstuffs. (2016). TPP Vote Swayed Both Ways by Dairy.
- Fugazza, M., & Maur, J. (2008). Non-tariff barriers in CGE models: How useful for policy? *Journal of Policy Modeling*, 30(3), 475–490.
- Ghaith, Z., Kulshreshtha, S., Natcher, D., & Cameron, B. (2021). Regional computable general equilibrium models: A review. *Journal of Policy Modeling*, 43, 710–724.
- Gilbert, J., Furusawa, T., & Scollay, R. (2018). The economic impact of the trans-pacific partnership: What have we learned from CGE simulation? *The World Economy*, 41(3), 831–865.
- Griffith, G., Lattimore, R., & Robertson, J. (1993). Domestic dairy policies and international market adjustment in a simplified model of world dairy products trade. *Journal of Policy Modeling*, 15(2), 141–156.
- International Trade Commission. (2021). MAcMap: Market access map. Retrieved from: (<https://www.macmap.org/>).
- Jafari, Y., & Tarr, D. (2017). Estimates of Ad valorem equivalents of barriers against foreign suppliers of services in eleven services sectors and 103 countries. *The World Economy*, 40(3), 544–573.
- Jafari, Y., Britz, W., Guimbard, H., & Beckman, J. (2021). Properly capturing tariff rate quotas for trade policy analysis in computable general equilibrium models. *Economic Modelling*, 104.
- Jean, S., Laborde, D., & Martin, W. (2010). Formulas and flexibility in trade negotiations: Sensitive agricultural products in the world trade organization’s Doha agenda. *The World Bank Economic Review*, 24(3), 500–519.

- Koopman, R., Hancock, J., Piermartini, R., & Bekkers, E. (2020). The value of the WTO. *Journal of Policy Modeling*, 42, 829–849.
- Li, Y., & Beghin, J. (2012). A meta-analysis of estimates of the impact of technical barriers to trade. *Journal of Policy Modeling*, 34(3), 497–511.
- Richter, A. (2014). *Doha development round: Why did it fail?* Anchor Academic Publishing.
- Rogoff, K. (2021). Fiscal sustainability in the aftermath of the great pause. *Journal of Policy Modelling*, 43(4), 783–793.
- Rudloff, B., & Simons, J. (2004). Comparing EU free trade agreements. european centre for development policy management. *In Brief*(No. 6a).
- Salvatore, D. (2019). *International economic*. John Wiley & Sons.
- Salvatore, D. (2021). The U.S. and the world economy after COVID 19. *Journal of Policy Modelling*, 43(4), 728–738.
- Stiglitz, J. (2021). Globalization in the aftermath of the pandemic and trump. *Journal of Policy Modelling*, 43(4), 794–804.
- USTR). (2023). Agreement Between the United States of America and the European Union Pursuant to Article XXVIII of the General Agreement on Tariffs and Trade (GATT) 1994 Relating to the Modification of Concessions on All the Tariff-Rate Quotas Included in the EU Schedule CLXXV as a Consequence of the United Kingdom's Withdrawal from the European Union.
- Wharton. (2017). Bilateral or Multilateral: Which Trade Partnerships Work Best? Available at: <https://knowledge.wharton.upenn.edu/article/bilateral-multilateral-trade-partnerships-work-best/>.
- Williams, B. (2018). Bilateral and regional trade agreements: Issues for congress. *Congressional Research Service*.
- Woolcock, S. (2007). European Union policy towards free trade agreements. *ECIPE Working*(No. 3).
- WTO). (2021a). Regionalism: Friends or Rivals?
- WTO. (2021b). World Tariff Profile.
- WTO. (2023). Regional Trade Agreements.