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Abstract

Before the Trans-Pacific Partnership (TPP) was scheduled to enter into force, the United States withdrew from the trade accord. Eleven other TPP signatories decided to revive the agreement, which led to the implementation of the Comprehensive and Progressive Agreement for TPP (CPTPP). The objectives of this paper are threefold: (i) estimating economic welfare effects under alternative scenarios of the TPP/CPTPP, (ii) evaluating the extent of losses to the US from its withdrawal from TPP and expected gains from rejoining the Trans-Pacific trade accord, and (iii) examining whether the US economy would have to undergo extensive sectoral adjustments from its participation. To examine these issues, we employ a dynamic computable general equilibrium (CGE) model that incorporates agent-specific import preferences. The results suggest that the US loses an opportunity to gain approximately $100 billion per year in its long-run economic welfare by withdrawing from the TPP. However, it could recover most of its projected welfare gains by re-engaging with the CPTPP. Since sectoral output adjustments in the US are relatively small, its adjustment costs from participation in the CPTPP would be limited.

Keywords: TPP, CPTPP, US, GTAP, CGE model

JEL Classification: F13, F14, F15, F17

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1. Introduction

After seven years of negotiations, twelve nations finally agreed on the Trans-Pacific Partnership (TPP) trade accord in October 2015. However, the United States withdrew from the TPP in January 2017 before it went into effect. Eleven other TPP signatories decided to revive the agreement, which led to the Comprehensive and Progressive Agreement for TPP (CPTPP) signing in March 2018. This agreement specified that its provisions are implemented 60 days after ratification by at least six signatories. The CPTPP entered into force in Australia, Canada, Japan, Mexico, New Zealand and Singapore on 30 December 2018, Vietnam on 14 January 2019, Peru on 19 September 2021, and Malaysia on 29 November 2022. The trade agreement will go into effect in Brunei and Chile 60 days after they complete their ratification processes.

The objectives of this paper are threefold. First, we estimate economic welfare effects under alternative scenarios of the TPP/CPTPP. Second, we evaluate the extent of losses to the US from its withdrawal from the TPP and the expected gains from rejoining the CPTPP. Third, we examine whether the US economy would have to undergo considerable sectoral adjustments from its return to the Trans-Pacific trade deal. We employ a dynamic computable general equilibrium (CGE) model with agent-specific import preferences to examine three alternative scenarios of the TPP/CPTPP. In the first scenario, seven of the 11 members start implementing the CPTPP in 2019, Peru in 2021, Malaysia in 2023, and Brunei and Chile in 2024.[1] We assume that Korea and the United Kingdom will join the CPTPP in 2024. In the second scenario, we assume that the US will join the CPTPP in 2026 while retaining other assumptions. The third is a hypothetical scenario in which the TPP, including the US, is implemented from 2018, followed by enlargements. We include this scenario to compare the US welfare and sectoral output results with the first two scenarios.

Many studies have quantified the effects of the TPP/CPTPP using a CGE model (e.g., Ciuriak et al., 2017; Ferrantino et al., 2020; Gilbert et al., 2018; Lee and Itakura, 2018; Li and Whalley, 2021; Petri et al., 2012; Petri and Plummer, 2016; USITC, 2016; World Bank,

[1] Since only 33 days were left in 2022 when the CPTPP came into force in Malaysia, we assumed Malaysia started implementing CPTPP in 2023.

2016). While all TPP/CPTPP members realize welfare and real income gains, the magnitudes of the gains differ significantly across studies, resulting from different model structures and assumptions used in different studies (see **Table 1**). Most recent studies employ a dynamic CGE model rather than a static one because it allows for phasing in the actual tariff commitment schedule rather than counterfactual one-time shock in tariff reductions. Some studies (e.g., Petri and Plummer, 2016; World Bank, 2016) incorporate Melitz's (2003) model structure that recognizes heterogeneity in firms' productivity. Balistreri and Tarr (2020, 2022) show that firm heterogeneity-based CGE models produce more significant welfare changes than conventional CGE models based on Armington (1969). Other features and assumptions that increase welfare changes include reductions in barriers to foreign direct investment (FDI), improved productivity growth, incorporating agent-specific import preferences, and nondiscriminatory reductions in nontariff barriers (NTBs) between members and non-members. Studies on the TPP/CPTPP show that smaller and more open member countries, such as Vietnam and Malaysia, would attain relatively large welfare gains in percentage terms. Most studies estimate US welfare gains from implementing the TPP/CPTPP to be only 0.1-0.5 percent of its real income, casting doubt on the possibility of its rejoining the Trans-Pacific trade agreement.

Several studies have suggested that political motivations are critical in participating in free trade agreements (FTAs). Using a dataset covering 116 countries from 1960-2007, Liu and Ornelas (2014) find that deeper engagement in FTAs increases the durability of democracies and that political instability induces FTA participation. Hinz (2017) suggests that geopolitical considerations play a significant role in the choice of partner countries and the depth of economic integration. Eichengreen et al. (2021) indicate that both economic variables and geopolitical factors are essential for bilateral trade accords. In particular, they show that defense treaties significantly increase the probability of implementing a bilateral trade agreement.

Although the US has defense pacts with three CPTPP members, namely Australia, Canada and Japan, political motives for the US to rejoin the Trans-Pacific trade deal appear to be small. Some industries, such as steel and automobile, might face increasing import competition, influencing voting behavior in several vital states if the US were to join the CPTPP. Instead of joining the CPTPP, in May 2022, the Biden Administration

launched the Indo-Pacific Economic Framework for Prosperity (IPEF) with a total of 14 founding member countries.[2] They will negotiate four pillars to achieve a free and open Indo-Pacific: (i) trade, (ii) supply chains, (iii) clean energy (e.g., decarbonization and infrastructure), and (iv) fair economy (e.g., anti-corruption). However, the IPEF does not cover market access, such as tariff and NTB reductions. Thus, it would provide fewer economic benefits to the US than joining the CPTPP. Nonetheless, the US is unlikely to apply for membership in the Trans-Pacific trade accord, at least before the 2024 US presidential election, owing to domestic political reasons.

The following section gives an overview of the model and data, followed by descriptions of the baseline and policy scenarios in Section 3. Section 4 offers assessments of welfare and sectoral output adjustment effects, and the final section provides concluding remarks.

2. Analytical Framework and Data

2.1 Overview of the dynamic CGE model used in this study

The numerical simulation experiments undertaken for this study are derived from the dynamic GTAP model, described in detail by Ianchovichina and McDougall (2012), with a significant modification. The GTAP database does not disaggregate goods and services imports by sector and country of origin between intermediates and final goods and services. Thus, in most CGE models, the source composition of imported products is the same for producers and consumers.[3] By combining the OECD's inter-country input-output (ICIO) tables with the GTAP database, we obtain the source composition of imported intermediates and that of imported final goods and services that are different in each product category. The ICIO data enable us to incorporate agent-specific import preferences into the model and to estimate imports and exports of intermediate and final goods and services more accurately.

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[2] The founding members of the IPEF are Australia, Brunei, Fiji, India, Indonesia, Japan, Korea, Malaysia, New Zealand, the Philippines, Singapore, Thailand, the US and Vietnam.

[3] The government is contained in consumers since the final demand includes its spending.

Other model structures used in this study are the same as the dynamic GTAP model, which extends the comparative static framework of the standard GTAP model developed by Hertel (1997) to the dynamic framework by incorporating international capital mobility and capital accumulation. The dynamic GTAP model allows international capital mobility and capital accumulation. At the same time, it preserves all the features of the standard GTAP, such as constant returns to production technology, perfectly competitive markets, and product differentiation by countries of origin, known as the Armington assumption (Armington, 1969). Producers and consumers allocate aggregate demand for each product between domestically produced goods and an aggregate import bundle. The latter is then allocated across countries of origin to determine the bilateral trade flows on a sectoral basis. The model enhances the investment theory by incorporating international capital mobility and ownership. This way, it captures crucial trade agreement effects on investment and wealth that a static model misses.

In the dynamic GTAP model, each country/region is endowed with physical capital stock (K) owned by domestic firms. The physical capital stock is accumulated over time with net investment (I) as

$$K = K_0 + \int_{T_0}^{T} I(\tau) d\tau, \tag{1}$$

where K_0 represents the capital stock at some base time (T_0). Totally differentiating (1), we obtain

$$k = 100 \frac{I}{K} t, \tag{2}$$

where k denotes the percentage change in the capital stock, and t is the change in time defined as a continuous variable, not a discrete-time index. A comparative static simulation with $t = 0$ does not change the capital stock. Net investment, sourced from regional household savings, drives the dynamics in capital stock from a change in time.

Firms own the physical capital, whereas households own indirect claims on the physical capital in the form of equity. Since the model assumes that the physical capital is the sole asset, the value of the physical capital is equal to the ownership value of the firms.

$$PK = W = W^H + W^F, \tag{3}$$

where P denotes the price of capital goods, and W is the ownership value of firms that domestic households own W^H and foreign households own W^F. Thus, there are two types of equities: equity in domestic firms and equity in foreign firms. To obtain equity in foreign firms, the representative household must have shares in a portfolio of foreign equities (W^T). The household's equity holdings (H) are defined as

$$H = W^H + W^T. \tag{4}$$

According to the following equations, values of the household's equity holdings evolve over time.

$$W^H = P \int_{T_0}^{T} \omega^H(\tau) d\tau, \tag{5}$$

$$W^T = P^T \int_{T_0}^{T} \omega^T(\tau) d\tau, \tag{6}$$

where ω^H is the quantity of shares in domestic firms, ω^T is the quantity of shares in the portfolio of foreign firms, and P^T is the portfolio price of foreign equities. Substituting them to Equation (4) and totally differentiating, we obtain

$$h = \theta^H p + \theta^T p^T + 100 \frac{S}{H} t, \tag{7}$$

where h, p, and p^T denote percentage change in the household's equity holdings, the price of capital goods, and the portfolio price, respectively. θ^H denotes the share of equity in domestic firms in the household's equity holdings, and θ^T is the share of the portfolio. The dynamics arising from the last term are equal to the household's total investment value at a point in time ($P\omega^H + P^T\omega^T$). Since the household allocates all savings (S) for investment, S in the last term corresponds to the total investment value. Some amount of the household's savings is invested in the portfolio of foreign equities. Aggregating the investment in the portfolio across countries (indexed by r), we obtain the accounting equality for the portfolio and the foreign ownership value of firms as

$$\sum_r W^T = \sum_r W^F. \tag{8}$$

The savings in one country/region are invested directly in domestic firms and indirectly in foreign firms. The dynamics arising from positive savings in one region are related to the dynamics from the net investment in other regions. Overall, it must hold that all the savings are entirely invested in the home and foreign markets in every country/region.

In the short run, an equalization of the rates of return seems unrealistic since well-known empirical observations exist for "home bias" in savings and investment. These observations suggest that capital is not perfectly mobile, causing some divergence in the rates of return across countries/regions. The dynamic GTAP model allows inter-regional differences in the rates of return in the short run, which will eventually be equalized in the very long run. It is assumed that differences in the rates of return are attributed to the errors in investors' expectations about the future rates of return. During the process, these errors are gradually adjusted to the actual rate of return as time elapses and are eventually eliminated, and a unified rate of return across regions could be attained. Income accruing from foreign and domestic assets ownership could then be appropriately incorporated into total regional income.

Participating in a trade agreement could lead to more investment from abroad. Preferential trade liberalization often lowers the prices of goods in a participating country owing to the removal of tariffs, creating an increase in demand for goods. The increased demand expands the production of goods, raising demand for intermediate inputs, labor, capital and other primary factor inputs in member countries. The increased demand for production inputs raises the corresponding prices, wage rate and rental rate. A higher rental rate is translated into a higher rate of return, attracting more investment from domestic and foreign countries.

2.2 Data, aggregation and initial tariffs

In this study, we employ the GTAP database version 10, which distinguishes 141 countries/regions and 65 sectors (Aguiar et al., 2019), the OECD's ICIO tables, and economic forecasts from international organizations. The data have been aggregated into 23 countries/regions and 15 sectors, as shown in **Table 2**. Foreign income data are obtained from the International Monetary Fund's *Balance of Payments Statistics*, which

are used to track international capital mobility and foreign wealth. The values of key parameters, such as demand, supply and CES substitution elasticities, are based on previous empirical estimates. The model calibration primarily consists of calculating share and shift parameters to fit the model specifications to the observed data to reproduce a solution for the base year.

Table 3 summarizes the sectoral tariff rates on 12 product categories and tariff equivalents of nontariff barriers (NTBs) in three services sectors. There are striking differences in the tariff structures across countries/regions. Singapore is duty-free except for alcohol and tobacco. US tariff rates are low, except on textiles and apparel. The tariff rates on textiles and apparel are also relatively high in many other countries/regions, including Japan, Taiwan, Vietnam, India, Canada, Mexico, Peru and the rest of the world. In Japan and Korea, tariff rates on agricultural and food products are substantially higher than on other products. The tariff rate on motor vehicles exceeds 10 percent in China, Taiwan, Thailand, Vietnam, the rest of ASEAN, Australia and India.

Ad valorem tariff equivalents of NTBs in services sectors are computed as unweighted averages of the gravity-model estimates of Wang et al. (2009) and the values employed by the Michigan Model of World Production and Trade (Deardorff and Stern, 2011). There are even more significant variations in tariff equivalents of NTBs in services than in tariff rates on commodities. They are exceptionally high in China, Indonesia, the Philippines, Thailand, Vietnam and India.

3. The Baseline and Policy Scenarios

3.1 The Baseline Scenario

In order to evaluate the effects of the TPP/CPTPP, the baseline scenario is first established, showing the path of 23 economies/regions over the period 2014-2035. The purpose of the baseline scenario is to correctly project the state of the base year to a future situation in the years covered by the model. Its projections contain information on macroeconomic variables and expected policy changes. The macroeconomic variables in the baseline include projections for real GDP, gross investment, capital stocks, population and total labor force. Real GDP projections and gross investment were obtained from

International Monetary Fund (2022). Projections for population are taken from the United Nations (2022), while those for labor force are based on the working-age population (15-64 years old).

The projections for population, investment and labor force obtained for over 150 countries are aggregated to 23 countries/regions, and the growth rates are calculated to obtain the macroeconomic shocks describing the baseline. Changes in capital stocks are not projected but determined endogenously as the accumulation of projected investment. Any changes in real GDP not explained by the changes in endowments are attributed to technological change. These projections are consistent with the equilibrium conditions of the model by making numerous parameters (e.g., shift parameters of the equations) endogenous in the baseline. Then in policy scenarios the parameters become exogenous, which equal to the baseline values.

Policy projections are also introduced into the baseline scenario. Trade accords included in the baseline are those which have already entered into force among the member countries, including all ASEAN+1 FTAs, EU-Korea, Korea-US, China-Korea, EU-Japan and US-Japan trade agreements. It is assumed that tariffs are cut by 80 percent among the member countries of the currently implemented FTAs. Productivity is assumed to increase by 1 percent per year in every sector in all countries/regions.

3.2 Policy Scenarios

The welfare and sectoral output effects of the TPP/CPTPP and their economic implications for the United States will be examined in the next section. We consider the following three scenarios.

Scenario 1: Implementations of CPTPP7 over the period 2019-2035, CPTPP8 from 2021-2035, CPTPP9 from 2023-2035, and CPTPP13 from 2024-2035.[4]

Scenario 2: Same as Scenario 1, except that the United States will become a member of the CPTPP in 2026.

[4] CPTPP7: Australia, Canada, Japan, Mexico, New Zealand, Singapore and Vietnam. CPTPP8: CPTPP7 plus Peru. CPTPP9: CPTPP8 plus Malaysia. CPTPP13: CPTPP9 plus Brunei, Chile, Korea and the UK.

Scenario 3: TPP8 over the period 2018-2035, TPP9 from 2021-2035, TPP10 from 2023-2035, and TPP14 from 2024-2035.[5]

In Scenario 1, seven of the 11 CPTPP members implement the trade accord in 2019, followed by implementations of the CPTPP by Peru, Malaysia, and Brunei and Chile in 2021, 2023 and 2024, respectively. We assume that the United Kingdom, which formally applied to join the CPTPP in 2021, and Korea, which has officially decided to join the CPTPP, will join the club in 2024.

Although both China and Taiwan formally applied to join the CPTPP in September 2021, neither is likely to be admitted. First, China is unlikely to meet the high standards concerning such issues as state-owned enterprises, enforceable labor rights, and transparency and anti-corruption. Second, China has strongly opposed Taiwan's membership, and Taiwan's attempt to join might trigger military action by China. Finally, the accession to the CPTPP must be approved unanimously by all its members, but at least one or two countries oppose either China or Taiwan from joining the partnership.

Scenario 2 is the same as Scenario 1, except that the United States is assumed to rejoin the Trans-Pacific trade accord in 2026. Scenario 3 is a hypothetical scenario in which eight of the 12 TPP signatories, including the US, implement the TPP starting in 2018, followed by Peru in 2021, Malaysia in 2023, and Brunei, Chile, Korea and the UK in 2024. The third scenario is added to compare the differences in the effects between the US participation from the beginning of the TPP implementation and not participating in the CPTPP, as well as those under this scenario and a delay in the US participation.

In all three scenarios, tariff reductions are based on the actual TPP tariff commitment schedules for each commodity in member countries compiled by the International Trade Centre (2016). The tariff reduction timeline differs significantly across commodities. While tariffs are reduced to zero for most commodities within ten years, for several commodities, some tariffs will remain after 2035. Tariff equivalents of NTBs in services are assumed to fall linearly by 25 percent over ten years, starting from the first year of

[5] TPP8: Australia, Canada, Japan, Mexico, New Zealand, Singapore, the United States and Vietnam. TPP9: TPP8 plus Peru. TPP10: TPP9 plus Malaysia. TPP14: TPP10 plus Brunei, Chile, Korea and the UK.

implementation. In addition to reductions in tariffs and NTBs, the time cost of trade – such as shipping delays arising from regulatory procedures and inadequate infrastructure – is to decrease by 25 percent between the member economies.[6]

We also assume that agricultural and manufacturing productivity will gradually increase from 1 percent a year (baseline) to 1.1 percent a year over ten years after a member starts implementing the TPP/CPTPP. Trefler (2004) shows that import liberalization increases productivity through three factors: (i) greater competition in liberalized sectors, (ii) larger imports of technology-intensive intermediate and capital goods, and (iii) increasing the quality and variety of intermediate inputs available to domestic producers. Using a model with firm heterogeneity, Chen et al. (2009) demonstrate that trade openness positively affects productivity and negatively affects markups in the short run. Halpern et al. (2015) find that imports have a significant and large effect on firm productivity and that imported inputs caused one-quarter of the productivity growth in Hungary during 1993-2002. Ahn et al. (2019) suggest that removing remaining tariffs could increase the aggregate productivity of developed countries by around 1 percent on average. While an increase in productivity of 0.1 percentage point is relatively tiny, the TPP/CPTPP is only one of many FTAs. Thus, assuming that a marginal increase in productivity resulting from the TPP/CPTPP is 0.1 percentage point after considering all FTAs included in the baseline would be reasonable.

4. General Equilibrium Results

4.1 US welfare changes during 2019-2035

The welfare effects are assessed in terms of deviation in equivalent variation (EV) from the baseline.[7] In **Figure 1**, we plot US welfare changes relative to the baseline scenario over the 2019-2035 period for the three scenarios. Examining deviation in EV for the whole adjustment period would enable us to provide an overall welfare assessment. However, since our primary focus is the US, we will only provide welfare changes in 2035 for the rest of the

[6] For a detailed analysis of the time cost of trade, see Hummels and Schaur (2013) and Minor (2013).

[7] A representative household's utility is another welfare measure often used.

countries/regions. Instead, we decompose the welfare changes into five categories for all 23 countries/regions in Section 4.2.

When the US never joins the CPTPP (Scenario 1), its trade with the CPTPP members and total trade would decrease in all years. This trade diversion tends to reduce US welfare slightly throughout the period. By contrast, its terms of trade would improve during the entire period, offsetting the welfare loss mainly caused by trade diversion. As a result, under Scenario 1, US welfare would be almost unchanged during 2019-2035.

If the US is assumed to rejoin the Trans-Pacific trade accord in 2026 (Scenario 2), its welfare gains would increase rapidly from 2026 to 2035 and be $95.9 billion (0.4%) relative to the baseline in 2035. While annual welfare gains might be relatively small, the cumulative gains would reach $412.6 billion by 2035 and continue to increase. Reductions in trade barriers decrease the prices of imported intermediates and final goods and services. They would lead to a fall in the cost of intermediate inputs and increases in the final demand, real income and aggregate production. They also boost the rate of return on investment, thereby increasing both foreign and domestic investment and raising the capital stock and total output. In addition, an increase in productivity resulting from greater import competition raises total output and real income. All these factors contribute to welfare gains.

Had the US stayed in the TPP (Scenario 3), its welfare would have been $105 billion greater than its baseline value in 2035. Its cumulated welfare gains to 2035 would amount to $1.18 trillion. The tariff commitment schedules vary greatly across commodities, ranging from tariff elimination in the first year to gradual tariff cuts that continue for more than ten years. Since tariffs on imports from member countries decrease gradually over several years, US welfare increases only slightly in the short run. Meanwhile, as fewer products are subject to tariff cuts in later years, particularly after 2027, the welfare curve for Scenario 3 becomes flatter in later periods. Capital accumulation increases production and real income, causing welfare gains to become greater compared with the case of no capital accumulation. Welfare gains under Scenario 3 are more significant than those under Scenario 2 until 2034. The difference in welfare gains between the two scenarios shrinks to less than $10 billion in 2035 because US tariff cuts under Scenario 2 are almost fully realized by that year. In both Scenarios 2 and 3, a long-run increase in the welfare of approximately $100 billion is a

permanent increase relative to the baseline, which may not be small compared with the investment required to generate this amount every year.

4.2 Decomposition of welfare changes by category

Economic welfare is primarily determined by five factors: allocative efficiency, the terms of trade, productivity growth, the contribution to EV of change in the price of capital goods, and the contribution to EV of change in equity owned by a region (Walmsley et al., 2012). **Table 4** presents welfare changes decomposed into these five categories under each scenario in 2035 for all 23 countries/regions. Under Scenario 1, the economic welfare of every CPTPP member increases, whereas that of nonmembers could either increase or decrease. This result is because nonmembers' allocative efficiency decreases owing to reductions in trade volume, whereas their terms of trade and equity ownership could move in either direction. An increase in allocative efficiency resulting from lower trade barriers and a boost in productivity growth from the increased competition are the two most significant factors of welfare gains for member countries. In terms of percentage changes in total EV, they range from 0.4 percent (Australia) to 2.1 percent (Vietnam).

Under Scenario 2, in which the US is assumed to return to the Trans-Pacific trade agreement in 2026, most of the CPTPP members' welfare gains will increase in 2035. However, since seven members – Japan, Singapore, Australia, Canada, Mexico, Chile and Peru – already have FTAs/trade agreements with the US, their welfare gains are hardly affected. One notable exception is a considerable increase in Vietnam's welfare gains from 2.1 percent to 5.7 percent. The US is Vietnam's largest export destination and fourth largest import source country despite no trade agreements between the two countries. As a result, after the US becomes a member and mutually reduces the trade barriers, Vietnam's exports to and imports from the US rise immensely. The lower trade distortions and more extensive trade significantly increase Vietnam's allocative efficiency.

In the US, four categories of welfare – allocative efficiency, the terms of trade, productivity growth, and the contribution of change in the price of capital goods – increase, whereas the contribution to the welfare of change in equity owned by the US decreases. We have already discussed an increase in allocative efficiency for the CPTPP members.

US terms of trade improve because the relative demand for US products rises, raising the weighted average of the prices of US exports relative to the weighted average of its imports. US productivity of non-service sectors will increase by 0.1 percentage point over 2026-2035. The price of capital goods in the US will increase relative to the baseline in 2035, which will positively affect welfare. Finally, the welfare change resulting from a change in the equity holdings is negative because an increase in US households' foreign income receipts is less than an increase in income payments to foreign investors. In other words, while the value of US holdings of other countries' equity increases, the value of other countries' US equity holdings increases by a larger amount.

Scenario 3 is included primarily to compare the welfare results of the US under the first two scenarios with this counterfactual scenario. As shown in Figure 1, US welfare gains are greater in this scenario than in Scenario 2 during the entire period. However, the difference in US welfare gains between the two scenarios becomes less than $10 billion in 2035. Compared with Scenario 1, which assumes the US never joins the CPTPP, the difference in its welfare changes is projected to become $103 billion in 2035.

4.3 US Sectoral Output Adjustments

Structural adjustments and resource reallocations result from trade agreements. The FTA groupings and differences in the initial tariff rates across sectors and member countries play a critical role in determining the direction of the adjustments in sectoral output. Other factors that affect the magnitude and direction of sectoral output changes include the import-demand and export-output ratios (approximating the extent of trade dependence), the share of imported intermediate inputs in total costs, and the elasticity of substitution between domestic and imported products. **Table 5** presents US sectoral output adjustments in 2035, expressed in percent changes relative to the baseline in that year. In Scenario 1, a lower volume of US trade with the CPTPP countries in almost all commodities relative to the baseline scenario causes the output of a wide range of sectors to fall by small percentages.

In Scenario 2, US exports to and imports from the CPTPP members increase during 2026-2035. Since several CPTPP members' initial tariffs on agricultural and food products

are relatively high and the US is the largest exporter of these products, the output of agriculture and food products increases. The output of petroleum and chemical products increases primarily because the US has a comparative advantage in chemical products, particularly pharmaceutical products. An increase in investment leads to an expansion in the construction sector. Overall, expansions of these sectors are tiny in percentage changes. By contrast, the output of textiles and apparel contracts by a large percentage because the US protects this sector with high initial tariffs (Table 3), significantly increasing its imports after the US joins the CPTPP. Other contracting sectors' output – e.g., metals and electrical equipment – decreases by less than 1 percent.

Had the US not withdrawn from the TPP (Scenario 3), only the textile and apparel sector would be projected to contract in 2035. Compared with Scenario 2, the US would start implementing the TPP/CPTPP eight years earlier, providing additional years for real income gains, higher demand for goods and services, and increased output of most products. US exports and imports would be higher in 2035 under Scenario 3 than in Scenario 2. The output of all sectors other than textiles and apparel would expand slightly. Contrary to popular belief, a significant contraction of output and employment in US manufacturing would not occur.[8] In particular, the output of motor vehicles would not fall mainly because US tariffs on imports of Japanese motor vehicles would not be eliminated for 25-30 years, as agreed during the TPP negotiations. Minor sectoral output adjustments in the US contrast with relatively large sectoral adjustments in small open economies such as Vietnam, Brunei and Malaysia (e.g., Lee and Itakura, 2018).

5. Conclusion

In this paper, we have used a modified dynamic GTAP model to investigate how the TPP/CPTPP might affect the economic welfare of the United States and other Asia-Pacific countries. Under the first scenario in which the CPTPP is first implemented in seven of the 11 CPTPP members starting in 2019, Peru in 2021, Malaysia in 2023, and Brunei, Chile, Korea and the UK in 2024, the welfare gains for the CPTPP countries in 2035 range from

[8] Although not reported in Table 5, percent changes in sectoral employment are similar to those in sectoral output.

0.4 percent (Australia) to 2.1 percent (Vietnam). In the second scenario in which the US is assumed to join the CPTPP in 2026, most members' welfare gains become larger. In particular, Vietnam's welfare gains are projected to increase from 2.1 to 5.7 percent, mainly because it is a small open economy with high trade dependency on the US. The US welfare gain would reach $95.9 billion or 0.4 percent of its real income in 2035. We include the third scenario to compare the welfare effects of the TPP/CPTPP with the other two scenarios. If the United States had never withdrawn from the TPP, its welfare gains would be $105 billion in 2035. However, by re-engaging with the CPTPP (Scenario 2), it would be able to recover most of its projected welfare gains by 2035.

Under Scenario 2, the output of several manufacturing sectors is projected to decline by small percentages in 2035, which is more than offset by output expansion in the primary and tertiary sectors. If the US had stayed in the TPP (Scenario 3), the output of all sectors except textiles and apparel would increase slightly. Since sectoral output adjustments in the US are minor, its adjustment costs from participation in the CPTPP would be limited.

Although not being examined in this paper, US re-engagement with the Trans-Pacific trade deal might be desirable for two additional reasons. First, its return to the CPTPP will likely facilitate a reduction in US dependence on Chinese intermediate products and greater diversification in its supply chains (Laget et al., 2020). Second, after the UK and Korea become members of the CPTPP, five member countries – Australia, Canada, Japan, Korea and the UK – will have defense pacts with the US, which might provide a political incentive for the US to rejoin the trade pact amid escalating tensions with China (Hinz, 2017; Eichengreen et al., 2021). Both issues are beyond the scope of this paper. The reader is referred to the literature for further details.

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Table 1. Comparisons of model structures and assumptions in selected TPP/CPTPP studies

	Ciuriak et al. (2017)	Ferrantino et al. (2020)	Gilbert et al. (2018)	Petri & Plummer (2016)	World Bank (2016)
Static or dynamic model	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Armington or Melitz model	Armington model	Armington model	Armington model	Melitz model	Melitz model
Market structure in manufacturing	Perfect comp	Perfect comp	Monopolistic comp; allows firm hetero.	Monopolistic comp & firm heterogeneity	Monopolistic comp & firm heterogeneity
Incorporate:					
Nontariff barriers (NTBs)	Yes	Yes	No	Yes	Yes
Foreign direct investment	Yes	No	No	Yes	No
Productivity growth	No	Allows produc kicks	No	No	No
Global value chains	No	No	No	No	No
Nondiscriminatory reductions in NTBs	No	Yes	No	Yes	No

Source: Authors' construction based on previous studies.

Table 2. Regional and sectoral aggregation

A. Regional aggregation

	Country/region	Corresponding economies/regions in the GTAP 10 data base
1	United States	United States
2	Japan	Japan
3	China	China, Hong Kong
4	Korea	Korea
5	Taiwan	Taiwan
6	Singapore	Singapore
7	Brunei	Brunei Darussalam
8	Malaysia	Malaysia
9	Indonesia	Indonesia
10	Philippines	Philippines
11	Thailand	Thailand
12	Vietnam	Vietnam
13	Rest of ASEAN	Cambodia, Laos, rest of Southeast Asia
14	Australia	Australia
15	New Zealand	New Zealand
16	India	India
17	Canada	Canada
18	Mexico	Mexico
19	Chile	Chile
20	Peru	Peru
21	UK	United Kingdom
22	EU	27 member states of the European Union
23	Rest of world	All the other economies/regions

B. Sectoral aggregation

	Sector	Corresponding commodities/sectors in the GTAP 10 data base
1	Agriculture	Agriculture; livestock; forestry; fishing; processed rice
2	Mining	Coal, oil, gas; other extraction
3	Food products	Food products; beverages and tobacco products
4	Textiles & apparel	Textiles; wearing apparel; leather products
5	Petro & chemical	Petroleum, coal products; chemical; rubber and plastic products
6	Metals	Ferrous metals; metals nec; metal products
7	Electronic prod.	Computer, electronic and optical products
8	Electrical equip.	Electrical equipment
9	Machinery	Machinery and equipment nec
10	Motor vehicles	Motor vehicles and parts
11	Other transport equip.	Transport equipment nec
12	Other manufac.	Other manufactures
13	Construc & util.	Construction; electricity; gas manufac, distribution; water
14	Trade & transport	Trade; sea transport; air transport; other transport; warehousing
15	Other services	Communication; financial services; other services

Table 3. Tariff rates on merchandise imports and tariff equivalents of nontariff barriers on services, 2014 (%)

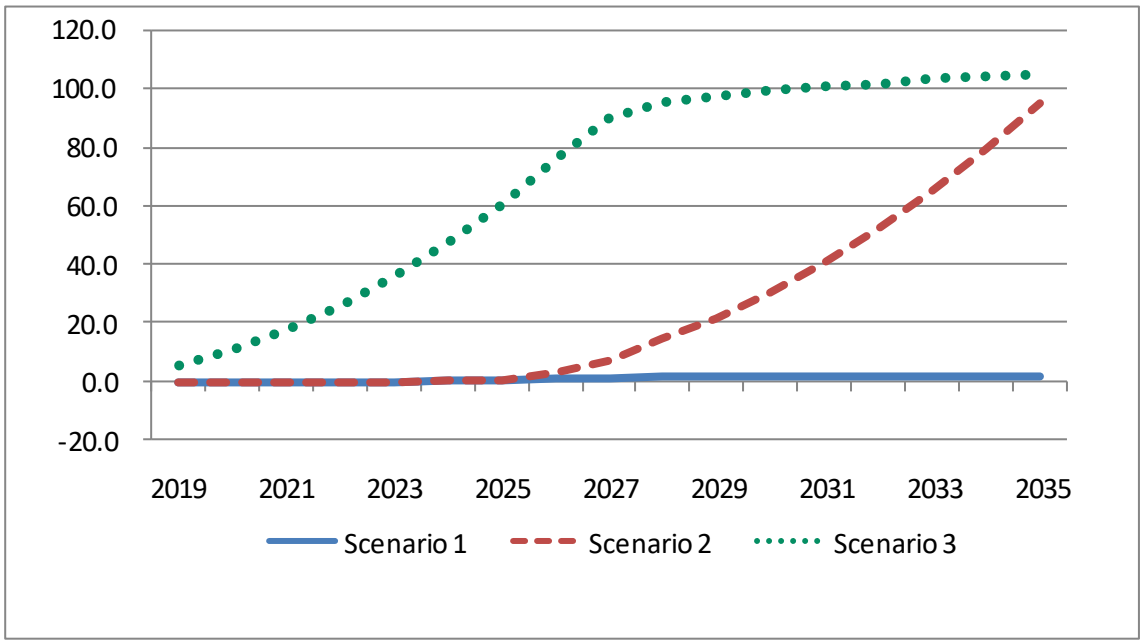
	Sector	US	Japan	China	Korea	Taiwan	Singapore	Brunei	Malaysia	Indonesia	Philippines	Thailand	Vietnam
1	Agriculture	0.2	13.1	2.6	109.7	4.3	0.0	0.0	2.6	2.4	12.6	20.3	4.5
2	Mining	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.9	0.2	0.6	0.0	0.7
3	Food products	1.7	14.5	6.2	21.0	10.7	4.3	0.9	8.1	5.2	4.5	17.7	8.4
4	Textiles & apparel	9.4	7.1	5.9	5.5	7.3	0.0	0.8	0.8	2.8	2.4	4.6	9.7
5	Petro & chemical	1.1	0.8	4.0	3.5	2.0	0.0	0.2	1.3	2.0	1.6	2.4	3.7
6	Metals	0.7	0.4	2.0	1.1	0.7	0.0	0.0	2.2	2.8	1.2	1.7	1.9
7	Electronic prod.	0.3	0.0	1.9	1.1	0.4	0.0	1.4	0.1	0.4	0.4	0.5	0.7
8	Electrical equip.	1.0	0.0	4.5	3.8	3.1	0.0	1.8	1.4	1.9	1.4	3.4	3.9
9	Machinery	0.6	0.0	4.5	2.7	1.4	0.0	0.8	1.3	2.5	0.6	1.3	1.1
10	Motor vehicles	0.6	0.0	18.2	3.0	13.8	0.0	0.5	6.1	7.7	6.6	16.0	11.6
11	Other transp equip.	0.3	0.0	2.8	0.8	1.9	0.0	0.0	0.8	1.9	3.5	3.3	5.3
12	Other manufac.	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.2	2.1	1.7	2.3	0.0
13	Construc & util.	2.3	5.0	25.2	13.0	10.8	0.0	20.6	17.4	64.4	52.6	44.9	53.7
14	Trade & transport	6.8	18.3	85.1	27.7	24.1	1.3	21.4	29.5	89.8	71.9	57.4	74.1
15	Other services	7.5	17.9	80.2	30.1	27.0	1.6	14.3	30.5	91.8	72.3	56.1	75.3

Sources: Sectors 1-12: GTAP database, version 10. Sectors 13-15: unweighted averages of the gravity-model estimates of Wang et al. (2009) and the values employed by the Michigan Model of World Production and Trade.

Table 3 (continued)

	Sector	Rest of ASEAN	Australia	NZ	India	Canada	Mexico	Chile	Peru	UK	EU	Rest of world
1	Agriculture	3.6	0.1	0.1	18.6	0.2	1.3	0.4	1.4	1.5	0.9	6.9
2	Mining	0.5	0.0	0.0	1.9	0.0	0.0	0.5	0.0	0.0	0.0	0.5
3	Food products	3.8	1.0	1.0	48.8	0.8	2.2	0.3	0.8	3.4	1.9	10.7
4	Textiles & apparel	2.3	6.1	2.9	11.4	9.5	8.3	0.7	8.1	4.4	2.9	11.3
5	Petro & chemical	2.5	1.0	0.8	7.0	0.4	0.5	0.2	1.1	0.7	0.6	3.8
6	Metals	1.6	2.2	1.0	8.3	0.3	0.5	0.5	0.4	0.4	0.3	3.6
7	Electronic prod.	4.3	0.5	0.3	2.7	0.2	0.4	0.2	0.7	0.5	0.4	3.3
8	Electrical equip.	2.4	2.7	1.7	8.0	0.8	0.6	0.4	1.7	0.9	0.6	6.3
9	Machinery	2.1	2.2	2.3	6.7	0.0	0.4	0.3	0.3	0.4	0.3	4.0
10	Motor vehicles	10.4	13.1	4.0	13.9	0.9	2.0	0.6	2.3	0.5	0.5	9.2
11	Other transp equip.	3.5	1.3	0.2	6.6	0.7	2.0	0.2	2.0	0.7	0.7	4.6
12	Other manufac.	0.0	0.0	0.0	0.0	1.0	1.5	0.3	2.6	0.0	0.0	0.0
13	Construc & util.	20.6	4.3	1.0	109.7	9.2	40.8	25.8	27.2	5.6	5.6	30.9
14	Trade & transport	24.4	12.9	5.8	139.7	15.7	54.1	27.6	43.5	9.9	9.9	42.5
15	Other services	16.6	15.5	5.0	138.9	18.9	58.5	28.0	44.9	9.9	9.9	44.2

Figure 1. US welfare changes under Scenarios 1-3, 2019-2035
(Changes in EV relative to the baseline, US$ billion in 2014 prices)



Definition of scenarios:

Scenario 1: Implementations of CPTPP7 over the period 2019-2035, CPTPP8 from 2021-2035, CPTPP9 from 2023-2035, and CPTPP13 from 2024-2035.

Scenario 2: Same as Scenario 1 except that the US is assumed to become a member of the CPTPP in 2026.

Scenario 3: TPP8 over the period 2018-2035, TPP9 from 2021-2035, TPP10 from 2023-2035, and TPP14 from 2024-2035.

Source: Model simulations.

Table 4. Decomposition of welfare changes by category, 2035
(Changes in EV relative to the baseline)

Scenario 1

	Allocative efficiency	TOT	Produc. growth	ΔP	Equity by region	Total EV	
	billions of US$ in 2014 prices					US$ bn	% change
United States	-1.2	3.6	0.0	-2.6	1.9	1.6	0.0
Japan	10.5	-1.2	16.8	0.4	8.3	34.7	0.6
China	-9.2	0.2	0.0	-2.2	10.6	-0.6	0.0
Korea	9.1	0.5	13.4	1.1	0.1	24.2	1.0
Taiwan	-0.3	0.0	0.0	0.0	0.7	0.3	0.0
Singapore	3.5	0.0	2.8	0.0	3.9	10.2	1.6
Brunei	0.2	0.0	0.1	0.0	0.1	0.4	0.9
Malaysia	0.0	-0.6	6.2	0.0	3.0	8.6	1.1
Indonesia	-0.1	0.3	0.0	-0.2	0.1	0.0	0.0
Philippines	0.2	0.2	0.0	-0.3	0.0	0.1	0.0
Thailand	-0.2	0.2	0.0	0.0	0.1	0.0	0.0
Vietnam	5.1	-0.3	7.5	0.6	-1.2	11.8	2.1
Rest of ASEAN	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Australia	4.6	0.3	6.2	0.8	0.3	12.2	0.4
New Zealand	0.7	0.4	1.0	0.1	0.1	2.3	0.8
India	-1.2	0.8	0.0	-1.2	0.0	-1.6	-0.02
Canada	4.1	0.7	7.7	1.5	-0.8	13.1	0.5
Mexico	9.0	-3.4	8.8	0.1	-0.3	14.2	1.0
Chile	0.6	0.2	1.7	0.3	-0.4	2.4	0.6
Peru	0.6	0.0	2.5	0.2	-0.2	3.1	0.8
UK	2.4	3.1	9.1	2.0	-6.3	10.4	0.3
EU	-5.6	1.7	0.0	-0.3	1.5	-2.7	-0.01
Rest of world	-3.4	-6.6	0.0	0.0	-1.2	-11.2	-0.03
World total	29.3	0.0	83.9	0.2	20.2	133.6	0.1

Categories of welfare changes: (1) allocative efficiency, (2) the terms of trade (TOT), (3) productivity growth, (4) the contribution to EV of change in the price of capital goods (ΔP), and (5) the contribution to EV of change in equity owned by a region.

Source: Model simulations.

Table 4 (continued)

Scenario 2

	Allocative efficiency	TOT	Produc. growth	ΔP	Equity by region	Total EV	
	billions of US$ in 2014 prices					US$ bn	% change
United States	16.8	15.4	71.3	10.8	-18.5	95.9	0.4
Japan	13.2	-2.0	16.8	0.0	9.1	37.1	0.6
China	-14.8	1.5	0.0	-6.2	15.6	-3.8	-0.01
Korea	12.3	-0.8	13.4	0.7	0.4	25.9	1.1
Taiwan	-0.5	0.0	0.0	-0.1	1.0	0.4	0.0
Singapore	3.4	-0.2	2.8	-0.1	3.9	9.8	1.5
Brunei	0.3	0.0	0.1	0.0	0.1	0.5	1.2
Malaysia	0.6	-0.8	6.2	-0.1	3.5	9.3	1.2
Indonesia	-0.3	0.0	0.0	-0.4	0.0	-0.6	-0.03
Philippines	0.1	0.3	0.0	-0.7	0.1	-0.2	-0.1
Thailand	-0.3	0.3	0.0	0.0	0.0	0.0	0.0
Vietnam	21.1	4.7	7.6	3.0	-4.5	31.8	5.7
Rest of ASEAN	0.1	0.0	0.0	0.0	0.0	0.1	0.0
Australia	4.6	-0.7	6.2	0.4	0.8	11.3	0.4
New Zealand	0.7	0.4	1.0	0.0	0.1	2.3	0.8
India	-1.6	2.4	0.0	-2.0	-0.4	-1.6	-0.03
Canada	7.0	-1.0	7.7	0.8	-0.7	13.9	0.5
Mexico	12.0	-2.6	8.8	0.0	-1.1	17.0	1.1
Chile	1.0	0.1	1.7	0.2	-0.4	2.5	0.7
Peru	0.9	-0.2	2.5	0.1	-0.1	3.1	0.8
UK	3.5	3.8	9.1	2.1	-7.1	11.4	0.3
EU	-10.9	0.1	0.0	-2.2	4.9	-8.1	-0.04
Rest of world	-6.4	-20.7	0.0	-1.3	-3.5	-31.9	-0.1
World total	62.5	-0.1	155.3	5.0	3.4	226.1	0.2

Table 4 (continued)

Scenario 3

	Allocative efficiency	TOT	Produc. growth	ΔP	Equity by region	Total EV	
	billions of US$ in 2014 prices					US$ bn	% change
United States	22.7	9.1	71.5	4.6	-2.9	105.0	0.4
Japan	12.8	-2.0	16.8	0.1	9.1	36.8	0.6
China	-18.2	3.2	0.0	-4.5	13.4	-6.1	-0.02
Korea	11.9	-0.2	13.4	0.8	0.3	26.2	1.1
Taiwan	-0.6	0.2	0.0	-0.1	0.8	0.3	0.0
Singapore	3.1	0.1	2.8	0.0	3.6	9.7	1.5
Brunei	0.3	0.0	0.1	0.0	0.1	0.5	1.2
Malaysia	0.6	-0.9	6.2	-0.1	3.2	9.1	1.2
Indonesia	-0.3	0.2	0.0	-0.3	-0.1	-0.5	-0.02
Philippines	0.1	0.2	0.0	-0.6	0.0	-0.3	-0.1
Thailand	-0.3	0.4	0.0	0.0	0.1	0.1	0.0
Vietnam	23.7	4.8	7.7	2.9	-2.4	36.7	6.6
Rest of ASEAN	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Australia	4.4	-0.5	6.2	0.6	0.2	10.9	0.4
New Zealand	0.7	0.3	1.0	0.0	0.1	2.3	0.8
India	-1.6	2.2	0.0	-1.7	-0.3	-1.5	-0.02
Canada	6.9	-0.5	7.7	0.5	-0.6	14.1	0.5
Mexico	13.3	-4.4	8.8	-0.3	0.5	18.0	1.2
Chile	0.9	0.1	1.7	0.2	-0.5	2.5	0.7
Peru	0.8	-0.2	2.5	0.1	-0.2	3.1	0.8
UK	3.2	4.0	9.1	2.4	-6.3	12.5	0.4
EU	-13.7	3.2	0.0	-0.7	0.3	-11.0	-0.05
Rest of world	-9.6	-19.5	0.0	-1.1	-12.5	-42.8	-0.1
World total	61.3	-0.1	155.6	2.8	6.0	225.6	0.2

Table 5. US sectoral output adjustments in 2035
(Percent changes relative to the baseline)

Sector	Scenario 1	Scenario 2	Scenario 3
Agriculture	0.0	0.5	0.6
Mining	0.0	0.4	0.5
Food products	-0.1	0.8	0.8
Textiles & apparel	-0.7	-7.5	-8.8
Petro & chemical prod.	-0.2	0.6	1.0
Metals	-0.5	-0.8	0.1
Electronic products	-0.5	-0.2	1.2
Electrical equipment	-0.3	-0.3	1.1
Machinery	-0.1	0.2	1.0
Motor vehicles	-0.7	0.1	0.4
Other transport equip.	-0.1	-0.3	0.6
Other manufactures	-0.1	0.1	0.6
Construction & utilities	-0.2	0.8	0.7
Trade & transport	0.0	0.1	0.3
Other services	0.0	0.1	0.2

Source: Model simulations.