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The Implications of the Trans-Pacific Partnership for Japan: Agricultural Policy Reforms and Productivity Gains*

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Abstract

In October 2015 twelve nations reached final agreement on the largest regional trade accord in history, accounting for 40 percent of the world GDP. While the implementation of the Trans-Pacific Partnership (TPP) agreement is expected to bring about economic welfare gains for all member countries, some sectors, such as several agricultural sectors in Japan, are expected to contract if no policy reform is carried out. The objectives of this paper are twofold. First, by using a dynamic applied general equilibrium model with plausible sequences of TPP enlargements, we offer results that are highly policy relevant. Second, we examine additional effects of the TPP, namely trade-induced agricultural policy reforms in Japan and the positive impact on productivity. The results suggest that when Japan's agricultural policy reforms would result in an increase in productivity of its agricultural sectors, the extent of output contraction of agricultural and processed food sectors in the country would be reduced significantly except for dairy products. In addition, when import and export penetrations are assumed to exert a positive effect on productivity, the magnitudes of welfare gains for all the member countries increase considerably.

JEL Classification Codes: F15, F17

Keywords: TPP, agricultural policy reform, productivity growth, Japan

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1. Introduction

After more than five years of negotiations, twelve nations reached final agreement in October 2015 on the largest regional trade accord in history, accounting for 40 percent of the world GDP. While the implementation of the Trans-Pacific Partnership (TPP) agreement is expected to bring about economic welfare gains for all member countries, some sectors, such as several agricultural sectors in Japan, are expected to contract if no policy reform is carried out. As a result, Japan Agricultural Cooperatives (JA) and most farmers in Japan have strongly resisted the trade accord. The objectives of this paper are twofold. First, by providing plausible sequences of TPP enlargements and using a global dynamic applied general equilibrium model to evaluate the welfare and sectoral output effects, we offer results that are highly policy relevant. Second, we examine additional effects of the TPP, namely TPP-induced agricultural policy reforms in Japan and the positive impact of increased competition on productivity.

A number of studies have quantified the effects of various FTAs in the Asia-Pacific region using a CGE model (e.g., Cheong, 2013; Itakura and Lee, 2012; Kawai and Wignaraja, 2009; Lee et al., 2009; Li and Whalley, 2014; Petri, Plummer and Zhai, 2012, 2014). Petri et al. (2014) assume that the TPP initially expands from 12 to 17 members to include China, Indonesia, Korea, the Philippines and Thailand. However, it is more reasonable to assume that China's participation in the TPP comes after the other countries' accession because it is expected to take longer to meet the high standards of the TPP, including competition policy, government procurement and intellectual property rights. One of our aims is to construct TPP enlargement sequences that are reasonable estimates.

Using an 11-country numerical general equilibrium model, Li and Whalley (2014) investigate how China's participation in the TPP would affect China and other countries. While their study is policy-relevant and the results are intuitive, they exclude sectoral results. Nevertheless, a significant share of TPP negotiations has been devoted to sectoral issues, such as agriculture, automobiles, insurance and other services. Their model has only two sectors, and the tradable sector includes extremely heterogeneous sectors, such as agriculture, textiles and apparel, electronics products and automobiles. However, there are large differences in tariff rates, relative factor endowments and technology among these

sectors. By constructing a 22-region, 29-sector model, this study attempts to overcome the aggregation bias inherent in highly aggregated models.

An overview of the model and data is given in the next section, followed by descriptions of the baseline and policy scenarios in Section 3. In Section 4 assessments of welfare and sectoral output effects under each policy scenario are offered. Concluding remarks are provided in the final section.

2. Analytical Framework and Data

2.1 Overview of the Dynamic GTAP Model

The numerical simulations undertaken for this study are derived from the dynamic GTAP model, described in detail by Ianchovichina and McDougall (2001) and Ianchovichina and Walmsley (2012). This model 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, while 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, in keeping with the so-called Armington assumption.[1] At the same time, it enhances the investment theory by incorporating international capital mobility and ownership. In this way it captures important FTA effects on investment and wealth that are missed by a static model.

In the dynamic GTAP model, each of the regions is endowed with fixed physical capital stock owned by domestic firms. The physical capital is accumulated over time with new investment. This dynamics are driven by net investment, which is sourced from regional households' savings. The savings in one region are invested directly in domestic firms and indirectly in foreign firms, which are in turn reinvested in all regions. The

[1] See Armington (1969). The model uses a nested CES structure, where at the top nested level, each agent chooses to allocate aggregate demand between domestically produced goods and an aggregate import bundle, while minimizing the overall cost of the aggregate demand bundle. At the second level, aggregate import demand is allocated across different trading partners, again using a CES specification, wherein the aggregate costs of imports are minimized.

dynamics arising from positive savings in one region is related to the dynamics from the net investment in other regions. Overall, at the global level, it must hold that all the savings across regions are completely invested in home and overseas markets.

In the short run, an equalization of the rates of return seems unrealistic, and there exist well-known empirical observations 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 regions. The dynamic GTAP model allows inter-regional differences in the rates of return in the short run, which will be eventually 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 eventually they are eliminated and a unified rate of return across regions can be attained. Income accruing from the ownership of the foreign and domestic assets can then be appropriately incorporated into total regional income.

Participating in an FTA could lead to more investment from abroad. Trade liberalization often makes prices of goods in a participating country lower due to removal of tariffs, creating an increase in demand for the goods. Responding to the increased demand, production of the goods expands in the member country. The expansion of production is attained by using more intermediate inputs, labor, capital, and other primary factor inputs. These increased demands for production inputs raise the corresponding prices, wage rates, and rental rates. Higher rental rates are translated into higher rates of return, attracting more investment from both home and foreign countries.

2.2 Data, aggregation and initial tariffs

In this study we employ the GTAP database version 8.1, which has a 2007 base year and distinguishes 129 countries/regions and 57 sectors (Narayanan et al., 2012). For the purposes of the present study, the data has been aggregated to 22 countries/regions and 29 sectors, as shown in Table 1. Foreign income data are obtained from the International Monetary Fund (IMF)'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 upon previous empirical estimates. The model calibration primarily consists of calculating share and shift parameters to fit the model specifications to the observed data, so as to be able to reproduce a solution for the base year.

The sectoral tariff rates for the 22 countries/regions in 2007 are summarized in Table 2. There are striking differences in the tariff structures across the countries/regions. Singapore is duty free with the exception of alcohol and tobacco. The exceptionally high tariff rate on rice in Japan stands out. The tariff rates in a number of other agricultural and food products in Japan are also high, as well as in Korea and India. With the exception of Australia, New Zealand and Chile, the tariff rates on some agricultural and food products are also relatively high in other regions, such as sugar in the United States, Russia and the EU, dairy products and meats in Canada, and rice in the Philippines. In manufacturing the tariff rates on textiles and apparel are relatively high in all regions except China, Singapore, Chile and the EU. The tariff rate on motor vehicles exceeds 20% in Thailand, Vietnam and India.

Ad valorem tariff equivalents of nontariff barriers (NTBs) in nine 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 (e.g. Brown, Kiyota and Stern, 2010). There are even greater variations in tariff equivalents of NTBs in services than in commodities.

3. The Baseline and Policy Scenarios

3.1 The Baseline Scenario

In order to evaluate the effects of region-wide FTAs in the Asia-Pacific, the baseline scenario is first established, showing the path of each of the 22 economies/regions over the period 2007-2030. The baseline contains information on macroeconomic variables as well as expected policy changes. The macroeconomic variables in the baseline include projections for real GDP, gross investment, capital stocks, population, and total labor. Real GDP projections and gross investment were obtained from International Monetary Fund's *World Economic Outlook Database* (2015). Projections for population were taken from the

United Nations' *World Population Prospects Database* (2015), while those for labor were based on the working-age population (14-65 year old).

The projections for population, investment, and labor obtained for over 150 countries were aggregated, and the growth rates were calculated to obtain the macroeconomic shocks describing the baseline. Changes in the capital stocks were not imposed exogenously, but were 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.

In addition, policy projections are also introduced into the baseline. Trade accords included in the baseline are those which are already agreed among the member countries, including the ASEAN Free Trade Area (AFTA), the ASEAN-China, ASEAN-Korea, ASEAN-Japan, ASEAN-Australia-New Zealand, ASEAN-India, EU-Korea, Korea-US, Australia-Japan, Australia-Korea, Australia-China and China-Korea FTAs. It is assumed that tariffs are cut by 80% among the member countries of the FTAs that are being implemented. Rice is excluded from tariff liberalization in FTAs that include Japan or Korea as a member country.

3.2 Policy Scenarios

Welfare and sectoral output effects of the TPP and their implications for Japan and other Asia-Pacific countries are to be evaluated in this study. The following four scenarios are designed and summarized in Table 3.

***Scenario 1** (TPP)*: Implementations of TPP-12 over the period 2016-2025, TPP-13 from 2018-2027 and TPP-16 from 2021-2030.

***Scenario 2** (Enlarged TPP)*: Implementations of TPP-12 from 2016-2025, TPP-13 from 2018-2027, TPP-16 from 2021-2030 and TPP-19 from 2024. 70% of TPP-19 is assumed to be implemented in 2030.

***Scenario 3** (Enlarged TPP with agricultural reform in Japan)*: Same as Scenario 2, except that efficiency on overall output for Japan's agricultural sectors is assumed to increase gradually from 1% a year in 2018 to 1.5% a year in 2030, as depicted in Figure 1.

Scenario 4 *(Enlarged TPP with agricultural reform in Japan and productivity gain)*: Same as Scenario 3, except that efficiency on overall output for manufacturing sectors is assumed to increase from 1% a year to 1.1% a year in the TPP-12, TPP-13, TPP-16 and TPP-19 countries during 2016-17, 2018-20, 2021-23 and 2024-30, respectively.

In Scenario 1, we assume that the TPP agreement is implemented over the 2016-2025 period. Since the TPP is open to new members, additional countries are expected to be admitted to the TPP in later years. Korea is likely to be the first country to join the 12-member bloc, as it has expressed an interest in becoming a member and is currently evaluating the schedule and potential impact. We assume that Korea will be admitted to the TPP in 2018 and complete preferential liberalization with the TPP-12 countries in 2027 (TPP-13). Indonesia, the Philippines and Thailand have also expressed an interest in joining the Trans-Pacific trade accord (Petri et al., 2014), and it is hypothesized that these three countries will be admitted in 2021 and implement preferential liberalization with the TPP-13 countries from 2021-2030 (TPP-16).

In Scenario 2, we assume that China, India and Taiwan will be admitted to the TPP in 2024. While it might take a long time for China and India to meet the high standards of the TPP, including competition policy and intellectual property rights, the TPP's growing market size creates pressures for these countries to undertake economic reforms and negotiate for their admissions in the TPP. Taiwan is likely to meet necessary conditions for a membership much earlier, but it is delayed because of political considerations. It is assumed that 70% of the three new members' preferential liberalization with TPP-16 will be effectuated in 2030.

Scenarios 3 and 4 assume the same TPP enlargement sequencing as Scenario 2, but include additional assumptions. Scenario 3 adds an assumption that productivity of Japan's agricultural sectors increases gradually from 1% a year in 2018 to 1.5% a year in 2030, resulting from its policy reforms.[2] The following is a list of possible agricultural policy reforms that are expected to increase productivity of the agricultural sectors in Japan:

[2] Mercurio (2014) suggests that the TPP may become the catalyst needed for the structural reform agenda of the Japanese government.

1. Consolidation of farmland by removing regulations that hinder agricultural land consolidation.
2. Reforming Japan Agricultural Cooperatives (JA), which is expected to reduce inefficiency of the distribution system of agricultural inputs and final products.
3. Abolishing subsidies to part-time farmers and provide direct payments to full-time farmers to help strengthen the farm sector's competitiveness.
4. Encouraging new entrants by promoting the withdrawal of retired farmers and absentee owners.
5. Promoting corporations to engage in agricultural production and apply their managerial skills.

In December 2013 the Japanese Diet enacted a bill to consolidate small plots of agricultural land.[3] The Japanese government has also designed a plan to reform the JA. However, to what extent it will pursue other policy reforms is unknown at this time.

Scenario 4 adds an assumption that productivity, measured by efficiency on overall output, for manufacturing sectors is assumed to increase from 1% a year to 1.1% a year in the TPP-12, TPP-13, TPP-16 and TPP-19 countries during 2016-17, 2018-20, 2021-23 and 2024-30, respectively. Previous studies (e.g., Coe and Helpman, 1995; Coe et al., 2009; Trefler, 2004; Lileeva, 2008; Chen et al., 2009; Wolszczak-Derlacz, 2014) have shown that import and export penetrations result in an increase in productivity.[4] Since manufacturing firms are much more exposed than non-manufacturing firms to foreign competition in both domestic and export markets, we assume that additional productivity growth occurs only in manufacturing sectors.

[3] Honma (2010) states that agricultural land per farm in Japan is about 1/120 of that in the United States and between 1/45 and 1/20 of that in European countries.

[4] Coe and Helpman (1995) and Coe et al. (2009) show that imports of technology-embodied products accelerate productivity growth in the recipient country. Trefler (2004) finds that the Canada-U.S. FTA resulted in large increases in labor productivity in industries with steep tariff cuts, whereas Lileeva (2008) finds that Canada's tariff cuts raised industry-level productivity by increasing the market shares of highly productive plants. Using a trade model with firm heterogeneity, Chen et al. (2009) show that trade openness exerts a positive effect on productivity and a negative effect on markups in the short run. Wolszczak-Derlacz (2014) finds that both import and export penetrations are positively associated with an increase in total factor productivity (TFP).

In all scenarios rice is excluded from tariff liberalization.[5] It is assumed that tariff rates on commodities other than rice decline linearly to zero and tariff equivalents of NTBs in services are reduced by 20 percent during the periods in consideration among the member countries. In addition, time cost of trade – e.g. shipping delays arising from regulatory procedures and inadequate infrastructure – is assumed to fall by 20 percent among them.[6]

Two caveats should be borne in mind when interpreting the results presented in the next section. First, investment liberalization among the member countries is not considered because it requires data on foreign direct investment (FDI) flows by source and host countries and industry, which are unavailable. A challenging extension of the paper would be to endogenize FDI flows to consider attraction of these flows to developing member countries, which may have a significant impact, as were the cases for Mexico joining NAFTA in 1994 and Spain and Portugal joining the EU in 1986. Second, NTBs in manufacturing are not incorporated in this study due to a lack of reliable empirical estimates. NTBs also exist in a number of manufacturing sectors, including automobiles, pharmaceutical products, and some food products. In these products regulatory and other barriers, such as stringent standards and testing and certification procedures, exist. Thus, reductions of NTBs in manufacturing are expected to enlarge the benefits of the TPP. These issues are left for future research.

4. Empirical Findings

4.1 Welfare Effects

Economic welfare is largely determined by four factors: (1) allocative efficiency, (2) the terms of trade, (3) the contribution to equivalent variation (EV) of change in the price of capital investment goods, and (4) the contribution to EV of change in equity owned by a region. The fourth factor is determined by the change in equity income from

[5] While tariffs on a wide range of agricultural commodities will be removed or phased out, those on some agricultural products other than rice, such as wheat, beef, dairy products and sugar, will not be eliminated in Japan. We will attempt to incorporate the specific tariff cuts agreed by the TPP for each product in a revised version.

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

ownership of capital endowments, and it can be further decomposed into three parts: a change in the domestic capital stock, a change in household income earned on capital abroad, and a change in the domestic capital owned by foreigners.

With respect to these four factors, the direction of a welfare change may be summarized as follows. The allocative efficiency effect is generally positive for members of region-wide FTAs. This effect is particularly large for a country with high average initial tariffs. However, it may become negative when the extent of trade diversion is considerably large in FTAs with relatively low intraregional trade. The terms-of-trade effect is usually positive for the members with low average initial tariffs and negative for those with high initial tariffs. An increase in the price of capital investment goods generally raises welfare. A welfare change resulting from a change in the equity holdings is positive if the sum of the region's foreign income receipts and an increase in the domestic capital stock is greater than the foreign income payment, and vice versa.

The welfare results for the four policy scenarios, as percentage deviations in equivalent variation from the baseline for the years 2020, 2025 and 2030, are summarized in Table 4. Under Scenario 1, economic welfare of envisaged TPP-16 members increases during 2025-2030. The welfare gains in 2030 for the TPP-16 countries range from 0.1% (United States) to 1.9% (Singapore). The economic welfare of nonmember regions generally decrease slightly – e.g. reductions of 0.1-0.2% for China, Taiwan and India in 2030 and less than 0.1% for EU-28 and the rest of the world. In Scenario 2, China, India and Taiwan are assumed to join the TPP, which will consist of 19 members (TPP-19) by 2024. The welfare effects of the acceding economies change from negative under the first scenario to positive under the second scenario in 2025-2030, while welfare gains of most of the TPP-16 countries are predicted to increase following the three economies' accession to the TPP.

In Scenario 3, the assumption of gradual increases in productivity of Japan's agricultural sectors from 1% a year in 2018 to 1.5% a year in 2030 is added. If the Japanese government is successful in accomplishing reforms and improving productivity of its agricultural sectors, then Japan's welfare gains in 2030 are projected to increase by 0.2 percentage point (from 0.7% to 0.9%) compared with the case of no reforms. Other

countries' economic welfare is virtually unchanged. Considering that agriculture accounted for only 1.1% of Japan's GDP in 2014, an increase of 0.2 percentage point in welfare is large. Lower prices of agricultural products would reduce intermediate input cost of processed food sectors and some services sectors.

When the TPP is assumed to induce productivity growth in manufacturing sectors in Scenario 4, the magnitudes of welfare gains for the TPP members are amplified considerably.[7] The welfare gain for the United States increases to 0.5%, compared with 0.1% when productivity growth is assumed to be fixed. Thus, for some countries economic impacts resulting from productivity gain through a competitive effect could become larger than those resulting from tariff cuts and reductions in NTBs.

4.2 Sectoral Output Adjustments

Structural adjustments and resource reallocations result from trade accords. 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 output adjustments for each product category include the import-demand ratio, the export-output ratio, the share of each imported intermediate input in total costs, and the elasticity of substitution between domestic and imported products.[8]

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[7] Using the plant-level data in manufacturing sectors, Trefler (2004) finds that labor productivity in industries that experienced the deepest Canadian and U.S. tariff cuts from the Canada-U.S. FTA increased 14-15 percent. Thus, additional productivity growth of 0.1 percentage point per year in this study might be rather conservative, particularly in sectors with relatively high initial tariffs.

[8] A sector with a larger import-demand ratio generally suffers from proportionately larger output contraction through greater import penetration when initial tariff levels are relatively high. In contrast, a sector with a higher export-output ratio typically experiences a larger extent of output expansion, as a result of the removal of tariffs in the member countries. The share of imported intermediate inputs in the total cost of a downstream industry (e.g., the share of imported textiles in the cost of the apparel industry) would evidently affect the magnitude and direction of output adjustments in the latter sector. Finally, the greater the values of substitution elasticities between domestic and imported products, the greater the sensitivity of the import-domestic demand ratio to changes in the relative price of imports, thereby magnifying the effects of FTAs.

Tables 5 presents the sectoral output adjustments for Japan, expressed in percent deviations from the baseline in 2030.[9] The change in rice output is rather small under all scenarios because the tariff rate on this commodity is assumed to be fixed. Output of dairy products contracts by more than 10% under all scenarios, while that of other grains and meats decreases by 8-9% under Scenarios 1 and 2. Output of sugar and livestock contracts 2-5% in the first two scenarios. Output of other crops (consisting mostly of vegetables, fruits and oil seeds) and other food products expand slightly under all scenarios.

When agricultural productivity in Japan is assumed to increase gradually from 1% a year in 2018 to 1.5% a year in 2030 under Scenario 3, the extent of contraction would be reduced significantly in other grains, sugar and meats, but not in dairy products. In livestock output changes become positive, whereas in other crops and other food products output expands by 3-4%. These results suggest that appropriate policy reforms would sufficiently strengthen the competitiveness of Japan's agricultural and processed food sectors other than daily products.

Under most of the scenarios, the manufacturing and services sectors in Japan increase with the exception of apparel, machinery, electronic equipment and other transport equipment. The contraction of the apparel sector results from the removal of relatively high tariffs and sharp increase in imports from China, except under Scenario 1 in which China remains nonmember of the TPP. The reduction in output of electronic equipment in Japan is also reported by Petri et al. (2015) and might result from a large percentage of this product being produced overseas, particularly in ASEAN countries, by Japanese multinational corporations. According to JBIC (2013, p. 62), the percentage of electrical equipment and electronics produced overseas by Japanese firms during the 2010 Fiscal Year was 48.2 percent. In addition, production of many electronics products has become highly fragmented, increasing imports of both parts and components and assembled products from emerging Asia and reducing output produced in Japan. For similar reasons, output of machinery contracts in Japan.

[9] The sectoral output effects for other regions in the model are available upon request from the corresponding author.

5. Conclusion

In this paper, we have used the dynamic GTAP model to investigate how the TPP and its enlargements might affect economic welfare in the member and nonmember economies and sectoral output adjustments in Japan. In the absence of productivity change, welfare gains of the member countries range from 0.1% to 1.9% in 2030. The economic welfare of most of the nonmember regions decreases slightly. If China, India and Taiwan are assumed to join the TPP, welfare gains of most of the TPP member economies are predicted to become greater. When Japan's agricultural policy reforms would result in a gradual increase in productivity of its agricultural sectors from 1% a year in 2018 to 1.5% a year in 2030, its overall welfare gains are expected to increase by 0.2 percentage point in 2030. Finally, when the TPP is assumed to induce productivity growth in manufacturing sectors, the magnitudes of welfare gains for the member economies increase significantly.

In Japan, output of dairy products contracts by more than 10%, that of other grains and meats decreases by 8-9%, and that of sugar and livestock contracts 2-5% under the first two scenarios. When Japan's agricultural policy reforms lead to gradual increases in its productivity under the third scenario, the extent of output contraction of agricultural and processed food sectors in the country would be reduced significantly except for dairy products. Output changes in the livestock sector are predicted to become positive, while those in other crops and other food products show greater positive changes. These predicted changes suggest the beneficial effects of agricultural policy reforms in Japan. When the TPP is assumed to induce productivity growth in manufacturing sectors under the fourth scenario, not only output of manufacturing sectors, but also that of services sectors expands through increases in demand for intermediate services.

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Table 1: Regional and sectoral aggregation

A. Regional aggregation

	Country/region	Corresponding economies/regions in the GTAP 8 database
1	Japan	Japan
2	China	China, Hong Kong
3	Korea	Korea
4	Taiwan	Taiwan
5	Singapore	Singapore
6	Indonesia	Indonesia
7	Malaysia	Malaysia
8	Philippines	Philippines
9	Thailand	Thailand
10	Vietnam	Vietnam
11	Rest of ASEAN	Cambodia, Lao People's Democratic Republic, Myanmar, rest of Southeast Asia
12	India	India
13	Australia	Australia
14	New Zealand	New Zealand
15	United States	United States
16	Canada	Canada
17	Mexico	Mexico
18	Chile	Chile
19	Peru	Peru
20	Russia	Russian Federation
21	EU-28	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom
22	Rest of world	All the other economies/regions

Table 1 (continued)

B. Sectoral aggregation

	Sector	Corresponding commodities/sectors in the GTAP 8 database
1	Rice	Paddy rice, processed rice
2	Other grains	Wheat, cereal grains nec
3	Sugar	Sugar, sugar cane and sugar beet
4	Other crops	Vegetables and fruits, oil seeds, plant-based fibers, crops nec
5	Livestock	Cattle, sheep and goats, animal products nec, raw milk, wool
6	Fossil fuels	Coal, oil, gas
7	Natural resources	Forestry, fishing, minerals nec
8	Meats	Cattle, sheep, goat, and horse meat products, meat products nec
9	Dairy products	Dairy products
10	Other food products	Vegetable oils, food products nec, beverages and tobacco products
11	Textiles	Textiles
12	Apparel	Wearing apparel, leather products
13	Petroleum products	Petroleum, coal products
14	Chemical products	Chemical, rubber, plastic products
15	Steel	Iron and steel
16	Nonferrous metal	Nonferrous metal
17	Metal products	Fabricated metal products
18	Machinery	Machinery and equipment
19	Electronic equipment	Electronic equipment
20	Motor vehicles	Motor vehicles and parts
21	Other transport equip.	Transport equipment nec
22	Other manufactures	Wood products; paper products, publishing, mineral products nec, manufactures nec
23	Construction and utilities	Construction, electricity, gas manufacture and distribution, water
24	Trade	Trade
25	Transport	Sea transport, air transport, other transport
26	Communication	Communication
27	Financial services	Insurance, financial services nec
28	Other private services	Business services, recreation and other services
29	Government services	Public administration and defense, education, health services

Source: GTAP database, version 8.1.

Note: nec = not elsewhere classified.

Table 2: Tariff rates on merchandise imports and tariff equivalents of nontariff barriers on services, 2007 (%)

	Sector	Japan	China	Korea	Taiwan	Singapore	Indonesia	Malaysia	Philippines	Thailand	Vietnam	Rest of ASEAN
1	Rice	421.7	1.4	4.7	0.2	0.0	8.6	39.7	49.9	5.8	13.5	2.6
2	Other grains	27.4	1.7	5.2	2.9	0.0	2.6	0.0	5.1	2.5	4.2	1.5
3	Sugar	39.4	0.1	3.6	10.4	0.0	20.4	0.0	21.7	12.1	16.5	6.2
4	Other crops	4.6	2.8	51.2	8.2	0.0	2.2	10.6	6.7	13.1	13.0	8.0
5	Livestock	5.7	15.7	6.5	5.2	0.0	3.0	0.1	5.9	4.7	1.3	3.3
6	Fossil fuels	0.0	0.1	2.7	1.0	0.0	0.0	2.2	3.0	0.0	1.1	1.1
7	Natural resources	0.2	0.3	1.1	1.5	0.0	1.0	0.2	2.9	1.5	2.1	2.9
8	Meats	24.1	4.7	29.3	16.3	0.0	3.6	0.3	15.8	15.5	18.8	4.7
9	Dairy products	53.3	6.4	45.0	11.2	0.0	4.3	0.8	1.8	9.1	17.3	7.1
10	Other food products	9.9	4.7	30.6	14.3	0.6	7.0	10.6	5.6	14.6	16.3	10.9
11	Textiles	6.3	5.3	8.4	7.6	0.0	7.5	7.1	7.2	6.6	28.8	7.7
12	Apparel	9.6	4.0	8.9	8.1	0.0	7.5	7.9	9.1	20.2	19.1	11.6
13	Petroleum products	0.3	4.5	4.4	2.6	0.0	0.7	0.4	2.4	9.2	14.7	8.4
14	Chemical products	1.0	6.1	4.8	3.0	0.0	3.7	3.8	4.0	7.0	4.5	3.8
15	Steel	0.9	3.9	0.3	0.4	0.0	4.1	17.4	2.9	4.1	3.9	2.2
16	Nonferrous metal	0.4	2.8	2.4	1.0	0.0	2.8	3.4	2.0	1.5	0.9	3.6
17	Metal products	0.4	8.2	5.3	6.1	0.0	6.0	8.4	6.5	11.2	10.9	4.1
18	Machinery	0.1	6.1	5.3	3.1	0.0	2.7	2.2	2.4	5.1	4.4	4.5
19	Electronic equipment	0.0	1.2	1.2	1.9	0.0	0.6	0.1	0.5	1.5	4.7	6.2
20	Motor vehicles	0.0	14.6	7.2	12.1	0.0	11.9	14.0	11.6	23.6	23.2	19.1
21	Other transport equip.	0.0	2.8	1.2	3.9	0.0	1.8	2.0	3.9	3.8	12.2	7.2
22	Other manufactures	0.9	3.5	4.2	3.0	0.0	4.3	5.4	5.1	7.3	10.5	5.8
23	Construction and utilities	5.0	25.2	13.0	10.8	0.0	64.4	17.4	52.6	44.9	53.7	20.6
24	Trade	22.7	109.6	33.0	28.8	1.3	98.5	36.0	80.2	63.5	82.7	32.5
25	Transport	15.8	52.4	25.1	21.4	1.3	84.2	27.6	68.0	53.0	69.7	16.6
26	Communication	17.8	48.1	27.4	23.6	1.3	88.4	30.0	71.5	56.1	73.5	32.8
27	Financial services	17.1	83.3	30.4	27.5	1.5	92.5	30.2	72.6	58.1	74.7	20.0
28	Other private services	16.6	81.2	29.2	26.7	1.5	91.1	29.8	70.8	54.9	73.7	7.3
29	Government services	25.9	84.1	34.3	29.1	2.8	97.8	36.5	76.9	61.5	84.2	24.1

Table 2 (continued)

	Sector	India	Australia	New Zealand	United States	Canada	Mexico	Chile	Peru	Russia	EU-28	Rest of world
1	Rice	39.0	0.0	0.0	1.9	0.0	0.2	5.8	17.7	9.3	8.8	16.0
2	Other grains	98.9	0.0	0.0	0.0	0.0	12.2	0.5	8.0	2.4	1.3	9.9
3	Sugar	91.7	0.0	0.0	24.2	0.4	5.1	2.6	2.5	50.1	25.8	14.8
4	Other crops	34.1	0.4	0.0	2.1	0.2	1.3	1.1	8.0	5.7	1.5	8.5
5	Livestock	11.9	0.1	0.0	0.3	16.3	0.5	0.3	6.7	4.3	0.5	3.5
6	Fossil fuels	11.1	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.1	0.0	1.4
7	Natural resources	9.6	0.1	0.0	0.1	0.0	1.6	0.1	6.9	2.6	0.1	1.5
8	Meats	21.7	0.2	0.8	2.4	31.0	0.7	3.4	10.8	23.8	5.2	19.7
9	Dairy products	31.9	2.1	1.3	15.0	146.0	6.1	0.9	16.3	7.4	1.5	14.0
10	Other food products	79.8	1.6	1.0	2.1	10.9	2.5	1.1	4.0	12.9	1.5	13.2
11	Textiles	15.9	9.1	6.0	7.0	6.5	4.6	3.3	13.5	12.4	2.1	9.7
12	Apparel	13.2	11.7	11.5	9.8	11.7	16.7	3.8	16.3	16.5	3.4	10.1
13	Petroleum products	13.9	0.0	0.1	0.7	0.3	0.8	1.7	2.5	4.0	0.2	4.5
14	Chemical products	13.8	1.9	1.5	1.1	0.6	1.3	0.8	6.1	8.7	0.4	4.1
15	Steel	19.0	3.4	1.6	0.2	0.1	2.4	1.2	6.0	3.0	0.1	4.8
16	Nonferrous metal	14.9	0.6	0.9	0.6	0.0	0.6	0.8	4.4	3.9	0.4	1.3
17	Metal products	14.9	4.3	3.0	1.4	1.0	2.8	1.1	7.1	12.1	0.4	6.9
18	Machinery	14.0	2.3	2.5	0.7	0.4	2.8	0.8	5.4	4.4	0.4	4.9
19	Electronic equipment	2.4	0.9	0.9	0.3	0.2	1.4	0.6	5.1	6.0	0.7	3.6
20	Motor vehicles	24.7	12.4	7.2	0.6	1.0	3.5	3.1	7.2	10.6	0.9	9.8
21	Other transport equip.	6.5	0.8	0.6	0.4	0.7	1.6	0.2	8.9	9.3	0.7	4.8
22	Other manufactures	14.2	2.9	1.8	0.7	0.8	2.3	1.0	7.0	11.8	0.3	5.8
23	Construction and utilities	109.7	4.3	1.0	2.3	9.2	40.8	25.8	27.2	52.9	5.6	26.7
24	Trade	153.3	18.2	8.2	6.8	20.7	61.8	33.8	51.0	73.5	12.0	48.2
25	Transport	133.3	11.4	5.1	6.8	14.0	51.2	26.0	41.7	61.9	8.9	37.1
26	Communication	139.2	13.4	4.3	6.8	15.9	54.3	28.3	44.4	65.3	9.3	36.6
27	Financial services	139.5	13.5	4.3	7.8	19.8	57.6	27.5	46.4	65.9	8.7	43.3
28	Other private services	137.1	13.5	3.7	7.8	19.2	58.2	26.5	43.8	65.1	9.7	40.5
29	Government services	154.8	23.5	10.2	6.3	17.5	60.3	33.0	47.3	69.7	14.2	45.8

Sources: Sectors 1-22 GTAP database, version 8.1. Sectors 23-29: 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: Policy scenarios and assumptions

	2016-17	2018	2019-20	2021	2022-23	2024	2025	2026-27	2028-30
Scenario 1: TPP	TPP-12 (2016-2025)								
		TPP-13 (2018-2027)							
				TPP-16 (2021-2030)					
	Assumptions: 1) NTBs on services and logistic time in merchandise trade are cut by 20%. 2) Rice is excluded from trade liberalization.								
Scenario 2: Enlarged TPP	TPP-12 (2016-2025)								
		TPP-13 (2018-2027)							
				TPP-16 (2021-2030)					
						TPP-19 (2024-2030) 70% implemented			
	Same assumptions as in Scenario 1.								
Scenario 3: Enlarged TPP with agricult reform in Japan	Same TPP enlargement sequencing as in Scenario 2								
	Assumptions: 1) - 2) are same as in Scenario 1. 3) Efficiency on overall output for agricultural sectors 1-5 in Japan increases gradually from 1% a year in 2018 to 1.5% a year in 2030, resulting from Japan's agricultural policy reform (see Figure 1).								
Scenario 4: Enlarged TPP with agricult reform in Japan and productivity gain	Same TPP enlargement sequencing as in Scenario 2								
	Assumptions: 1) - 3) are same as in Scenario 3. 4) Efficiency on overall output for manufacturing sectors 8-22 increases from 1% a year to 1.1% a year in TPP-12 members during 2016-17, in TPP-13 countries during 2018-20, in TPP-16 countries during 2019-21, and in TPP-19 countries during 2024-30.								

Note: TPP-12: Australia, Canada, Brunei, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, United States, and Vietnam. TPP-13: TPP-12 plus Korea. TPP-16: TPP-13 plus Indonesia, Philippines and Thailand. TPP-19: TPP-16 plus China, India and Taiwan.

Figure 1: Agricultural productivity level in Japan (2015 = 100.0)

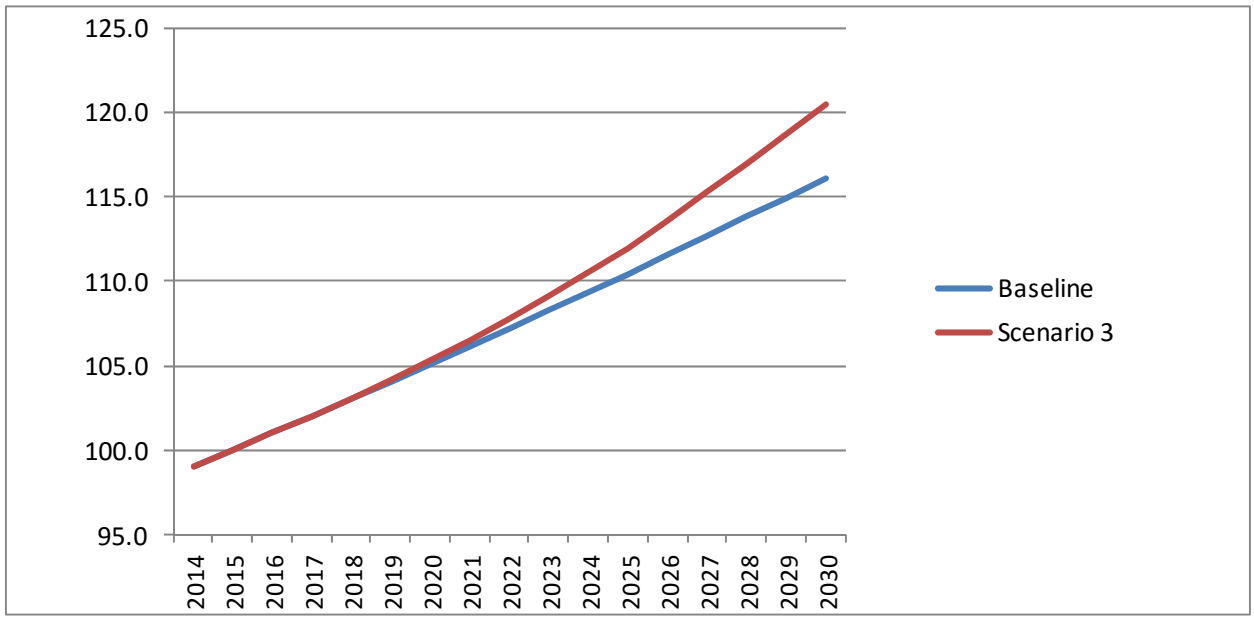

Table 4: The welfare effects of the TPP
(Percentage deviations in utility from the baseline)

	Scenario 1 (TPP)			Scenario 2 (Enlarged TPP)			Scenario 3 (Enlarged TPP with agric reform in Japan			Scenario 4 (Enlarged TPP with agric reform in Japan and productivity gain		
	2020	2025	2030	2020	2025	2030	2020	2025	2030	2020	2025	2030
Japan	0.16	0.46	0.59	0.16	0.50	0.70	0.16	0.56	0.92	0.72	1.74	2.62
China	-0.04	-0.12	-0.17	-0.04	0.07	0.30	-0.04	0.06	0.30	0.06	0.61	1.63
Korea	0.22	0.90	1.46	0.22	0.99	1.81	0.22	0.99	1.80	0.98	3.06	4.94
Taiwan	-0.03	-0.13	-0.25	-0.03	0.47	2.15	-0.03	0.48	2.17	0.15	1.11	3.54
Singapore	0.33	1.23	1.89	0.33	1.24	1.85	0.33	1.24	1.85	1.19	3.25	4.85
Indonesia	-0.03	0.29	0.65	-0.03	0.38	1.00	-0.03	0.38	1.01	-0.05	0.85	1.96
Malaysia	0.34	0.76	0.77	0.34	0.76	0.64	0.34	0.76	0.65	1.15	2.53	3.18
Philippines	-0.04	0.70	1.87	-0.04	0.65	1.31	-0.04	0.66	1.32	0.07	1.71	3.01
Thailand	-0.08	0.59	1.38	-0.08	0.62	1.10	-0.08	0.62	1.11	0.08	1.97	3.19
Vietnam	0.91	1.64	1.41	0.91	1.73	1.90	0.90	1.72	1.90	1.19	2.40	3.06
Rest of ASEAN	-0.03	-0.04	0.04	-0.03	-0.08	0.07	-0.03	-0.05	0.13	-0.16	-0.17	0.24
India	-0.03	-0.17	-0.26	-0.03	0.37	0.98	-0.03	0.36	0.95	0.06	0.81	2.01
Australia	0.04	0.10	0.14	0.04	0.28	1.36	0.03	0.28	1.35	0.13	0.50	1.87
New Zealand	0.24	0.68	0.70	0.24	0.69	0.72	0.24	0.68	0.68	0.62	1.57	2.07
United States	0.04	0.10	0.11	0.04	0.10	0.14	0.04	0.09	0.13	0.33	0.69	1.04
Canada	0.20	0.34	0.32	0.20	0.35	0.44	0.20	0.35	0.43	0.35	0.72	1.19
Mexico	0.25	0.43	0.35	0.25	0.45	0.34	0.25	0.46	0.35	0.73	1.39	1.65
Chile	0.27	0.71	0.62	0.27	0.89	1.63	0.27	0.89	1.61	0.66	1.86	3.08
Peru	0.10	0.15	0.08	0.10	0.21	0.37	0.10	0.21	0.37	0.46	0.98	1.66
Russia	-0.01	0.00	0.04	-0.01	-0.02	0.05	-0.01	-0.02	0.07	-0.07	-0.07	0.19
EU-28	-0.01	-0.04	-0.10	-0.01	-0.06	-0.22	-0.01	-0.07	-0.22	0.02	-0.08	-0.39
Rest of world	-0.02	-0.05	-0.03	-0.02	-0.08	-0.04	-0.02	-0.08	-0.03	-0.14	-0.26	-0.12

Definitions of scenarios:

Scenario 1: TPP-12 over the period 2016-2025, TPP-13 from 2018-2027 and TPP-16 from 2021-2030. Scenario 2: TPP-12 from 2016-2025, TPP-13 from 2018-2027, TPP-16 from 2021-2030 and TPP-19 from 2024. 70% of TPP-19 is assumed to be implemented in 2030. Scenario 3: Same as Scenario 2, except that efficiency on overall output for Japan's agricultural sectors is assumed to increase gradually from 1% a year in 2018 to 1.5% a year in 2030. Scenario 4: Same as Scenario 3, except that efficiency on overall output for manufacturing sectors is assumed to increase from 1% a year to 1.1% a year in the TPP-12, TPP-13, TPP-16 and TPP-19 countries during 2016-17, 2018-20, 2021-23 and 2024-30, respectively.

Table 5: Japan's sectoral output adjustments for the year 2030
(Percentage deviation from the baseline)

	Scenarios			
Sector	1	2	3	4
Rice	0.3	0.2	1.3	1.1
Other grains	-7.6	-7.9	-1.7	-2.9
Sugar	-2.5	-2.3	-0.4	0.2
Other crops	0.5	0.4	3.5	3.3
Livestock	-4.6	-4.4	1.1	1.2
Fossil fuels	-2.5	-3.3	-3.7	-6.0
Natural resources	0.4	0.5	0.6	0.8
Meats	-8.7	-8.7	-1.8	-1.3
Dairy products	-14.3	-13.9	-11.4	-9.9
Other food products	1.6	1.8	2.5	4.5
Textiles	7.0	11.2	10.0	10.0
Apparel	1.0	-2.3	-2.4	-0.9
Petroleum products	1.4	2.8	2.8	5.1
Chemical products	2.0	3.4	3.0	5.1
Steel	1.2	2.5	2.0	3.7
Nonferrous metal	2.6	1.0	0.6	2.0
Metal products	0.7	0.8	0.7	2.3
Machinery	-0.5	-0.3	-1.1	-1.5
Electronic equipment	-1.5	-2.3	-2.8	-2.9
Motor vehicles	1.1	0.2	-0.5	0.8
Other transport equip.	-1.0	-4.1	-4.9	-3.3
Other manufactures	1.2	1.4	1.3	2.9
Construction and utilities	1.9	2.2	2.7	7.1
Trade	0.7	0.7	0.9	2.4
Transport	0.4	0.5	0.5	1.4
Communication	0.4	0.4	0.5	1.7
Financial services	0.3	0.3	0.3	1.3
Other private services	0.5	0.5	0.6	2.1
Government services	0.1	0.1	0.2	0.9

Definitions of scenarios: See notes on Table 4.

Source: Model simulations.