Economic Impact of the United States withdrawal from Trans-Pacific Partnership on Canada: A Computable General Equilibrium Based Analysis

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## Abstract

Canada has recently concluded negotiations on Trans-Pacific Partnership (TPP) with 11 major Pacific Rim countries. The TPP's provisions for market access include elimination of barriers to trade and investment among various member countries. The TPP would have a potential economic impact on its member countries (including Canada). The United States (U.S.) is the largest trade partner for Canada, as it represents more than 80 and 90 percent of Canadian imports and exports, respectively, from and to the TPP region. Thus, in spite of the United States (U.S.) withdrawal from the TPP region, one may expect the agreement to still have an impact on the Canadian economy through changing trade dynamics with currently closed and large trading partners, such as Japan. In this study, we built a Computable General Equilibrium (CGE) model based on the Global Trade Analysis Project (GTAP) model and database to assess the economic impact of the U.S. withdrawal from TPP agreement on the Canadian economy. Our model included 13 regions, 15 sectors, and three factors of production. Three scenarios were simulated to capture the economic impact of the U.S. withdrawal from TPP on Canada:

One, Baseline scenario, where we developed a growth projection model to simulate the economic and trade growth among the TPP member countries and the rest of the world in 2030 without the TPP. In this scenario, we accounted for the natural growth for all the regions based on past performance in terms of population, labour force, and capital. We also accounted for other Free Trade Agreements (FTAs) between TPP members, which may be implemented over the coming decade.

Two, In the second scenario, TPP12 scenario, we assumed that the TPP would be fully implemented by 2030 assuming that the U.S. is a part of the agreement. We eliminated all the remaining tariffs on the agricultural and non-agricultural sectors between the TPP member countries to capture the actual impact of TPP on Canadian economy.

Three, In the third scenario, TPP11, we assumed that U.S. had withdrawn from the TPP and the other 11 country members (including Canada) do business in spite of it.

The study showed that both TPP12 and TPP11 will generate long-term economic gains for Canada. If the TPP is fully implemented in the absence of the U.S. (Scenario TPP11), the impact on Canada will be similar to TPP12 scenario, although it will generate major trade diversion from the U.S. toward other TPP member countries. Total Canadian imports and exports are projected to decrease by 0.26 (1.6 billion USD) and 0.35 (2.7 billion USD) percent, respectively. This net change is a combination of trade creation with TPP11 region and Rest of World (RoW) and diversion of trade flows from the U.S. On the agricultural side, Canada total agricultural imports from TPP11 and RoW will increase by 20.75 (834 million USD) and 25.34 (2.6 billion USD) percent, respectively, while it will decrease by 18 percent (6.4 billion USD) from the U.S. leaving Canada with 6.11 percent (nearly 3 billion) decrease in its net total agricultural imports. Canada agricultural exports, will experience increases to TPP11 region by 8.57 percent (1.6 billion USD) and decrease to the U.S. and RoW by 3.86 (1.4 billion USD) and 1.61 (523 million USD) percent, respectively relative to TPP12 scenarios.



*Key words: Computable General Equilibrium (CGE), GTAP, Transpacific Partnership (TPP), Canada, U.S. withdrawal from the TPP*

## 1. Introduction

Canada has concluded negotiations on the Trans-Pacific Partnership agreement (TPP) (Government of Canada, GA, 2016). This agreement is an expansion of the Trans-Pacific Strategic Economic Partnership Agreement that was signed in 2005 by Brunei Darussalam, Chile, New Zealand, and Singapore. In 2010, Australia, Peru, the United States (U.S.), Vietnam and Malaysia, joined the negotiations. This was followed by the entry of Canada and Mexico in 2012, and finally Japan in 2013. With its ratification, the TPP agreement became one of the largest and most ambitious free trade agreements in history. The key goals of the TPP are to create new market-oriented rules in a rapidly changing international commercial environment, fostering economic growth, developing investment among members and reducing trade barriers among TPP countries (Petri & Plummer, 2016).

TPP member countries' economies collaboratively contribute almost half of global economic output and over 40 percent of world trade. The combined Gross Domestic Product (GDP) of the twelve-member countries exceeds 28.5 trillion dollars or 36 percent of world GDP and is expected to grow over the coming decades (World Bank, 2016). Canada considers TPP an opportunity to increase its access to the fast-growing Asia-Pacific region's markets and to benefit from eliminating tariffs between agreement partners (Government of Canada, GA, 2016). Once the TPP comes into force, Canada would be the only G-7 nation with free trade access to the U.S (through North American Free Trade Agreement -- NAFTA), European Union (EU), and the Asia-Pacific markets. Hence, with the TPP and other trade agreements, Canada will have trade access to over 60 percent of the entire world's economy. In 2016, Canada trade with TPP region (including the U.S.) represented more than 64 and 81 percent of its total merchandise imports and exports respectively (Government of Canada, AAFC, 2017). Table 1 provides a snapshot of Canada trade with the TPP member countries. Merchandise trade flow between Canada and other TPP countries is concentrated with three major trade partners: the U.S., Mexico, and Japan. The trade with these countries together represents the majority of Canada's total trade with the TPP region. Although the high level of trade exchange between Canada and with both the U.S. and Mexico can be attributed to NAFTA, the TPP may further facilitate trade flows.

Table 1. Canada trade with the TPP member countries as percent of total Canadian trade, 2016

| Trade partner | **Imports (%)** | **Exports (%)** |
|---|---|---|
| Australia | 0.38 | 0.38 |
| Brunei Darussalam | n/a | n/a |
| Chile | 0.32 | 0.14 |
| Japan | 2.96 | 2.07 |
| Malaysia | 0.49 | 0.14 |
| Mexico | 6.22 | 1.48 |
| New Zealand | 0.12 | 0.09 |
| Peru | 0.46 | 0.15 |
| Singapore | 0.18 | 0.26 |
| United States | 52.18 | 76.28 |
| Vietnam | 0.93 | 0.10 |
| Total | **64.24** | **81.09** |

Source: Government of Canada, International trade data and market intelligence, Trade Data Online (2016).

The U.S. is the largest trade partner for Canada as it represents more than 80, and 90 percent of Canada imports and exports, respectively, from and to the TPP region. One may hypothesize that Canada may experience some important changes in its trade as a result of withdrawal. These changes may arise through diverting trade flow from the U.S. to other TPP member countries. The goal of this study thus to assess the economic impact on Canada as the U.S. withdraw from the TPP agreement[1].

## 2. Literature review

The applied economic literature has a long list of studies that capture the economic impact of trade policy, using a variety of methodological approaches, including econometrics techniques (e.g., Binh et al., 2011; Martinez-Zarzoso, 2003), case studies (e.g., Canning & Tsigas, 2000), partial and Computable General Equilibrium (CGE) approaches (e.g., Berck et al.,1991; Burfisher et al., 2014). Analysing the effects of trade policy can be grouped by geo-graphical area, level, depth, and time of the analysis. A very broad category can be considered which include *ex ante* and *ex post* analysis (literally meaning 'before and after the trade agreement'). The *ex post* type of studies utilizes historical data to analyse the effect of historical trade policies. In other words, these studies explain the effect of the trade policy after it has already been implemented. This analysis deploys mostly of known econometric models. Such results are highly useful when policy makers want to assess the implications of any future trade policy. The *ex post* approach studies suffer from one major limitation – they cannot answer "what if" or hypothetical questions. The *ex ante* approach on the other hand involves projection of the possible future effect of change in a policy and provides a tool to examine its possible impacts before implementation. This approach can simulate the impacts of a proposed policy changes, and can answer "what if" type questions. The *ex ante* approach provides a framework for projecting the impact of policy changes. For this reason, an *ex ante* approach was employed in this analysis.

The wide interest of using CGE modelling to analyse the impact of trade policy can be explained by six principle factors (Piermartini & Teh, 2005; Borges, 1986; Kehoe & Kehoe, 1994). (i) it can capture the direct and indirect impacts associated with shocks of implementation of trade policy reform. (ii) it is theoretically consistent: CGE models are based on the economic theory and have a microeconomic foundation whereby the production and demand functions for all agents in the economy are explicitly calculated and taken into account, thus ensuring that the analysis is based on a correct theoretical understanding of how economies work. (iii) CGE models are built on equilibrium system where income and expenditures have to match, therefore any shock (e.g. trade policy changes) can be quantitatively measured. (iv) it can measure changes in aggregate sectorial welfare. This is particularly important when policy makers are concerned about understanding the impact of a policy on a specific sector. As a result, this framework can help to answer questions such as "who are the winners and losers?" brought about by changes in trade policy. (v) CGE models are not restricted to perfect competition markets; imperfect or other market structure can be factored into the analysis, and (vi) the CGE models can static and dynamic, the static model provides a before and after shock, on the other hand, dynamic CGE models capture the adjustment throughout the shock, not only the final outcomes of the policy change.

[1] This change might also have impact on the trade flow between TPP member countries, as the U.S. represents the largest economy in the TPP region.

The CGE models built to examine the effect of the TPP on member countries not very rich. This is due to the fact that the agreement has been recently signed, the difficulties of using CGE models to analysis the NTBs impact, and the expectations that the TPP will have relatively small effect on most members' GDP or welfare (Burfisher et al., 2014). Deeper investigation showed that there is no literature to date on the potential impact as the U.S. announced withdrawing from the agreement. Most of the currently CGE-based analysis of economic impact of the TPP is based on the Global Trade Analysis Project (GTAP) model. The features of GTAP which describes the countries' supply, demand, and trade flow, and bilateral tariff rates makes it one of the preferred CGE models in analyzing the trade shocks. The available studies are differing in their assumption about the timeframe (dynamic vs. static), the degree of liberalization, and the base line scenarios.

Burfisher et al. (2014) utilized the static GTAP model using Version 8 (V8 GTAP) database to analyse the impact of TPP on the U.S. and other TPP members. The model used in this study was agriculturally focused where the food and agriculture compromised 25 of a total 29 sectors. In their study, they ran two simulations to quantify the economic effect of TPP on agriculture. In the baseline scenario, the authors simulated the trade and production trends between the TPP members over 2014-25 without the TPP. The goal of this simulation was to simulate the natural growth of trade and production among the members of the agreement based on the natural growth of population, consumptions, and preferences. Under the hypothetical scenario, Burfisher et al. (2014) eliminated all the intra-TPP countries' agricultural and non-agricultural tariffs and TRQs and compared the results with the baseline scenario. The results showed that the TPP will have a minimal impact on the members real GDP with zero or small positive effect, except for Vietnam, Japan, New Zealand, and Mexico, where their real GDP was projected to increase by 0.1, 0.02, 0.01, and 0.01 percent respectively relative to the baseline scenario. While the impact on real GDP was minimal, the study showed that the TPP will have important implications for agricultural trade among the agreement members. Kawasaki (2014) traced out the potential macroeconomic implications of the TPP on the member and non-members by utilizing the GTAP model and comparing the results with the baseline scenario which includes pre-trade existing agreements among member countries. The author found that the TPP has the potential to increase the GDP of member countries by 0.4-10 percent and to expand their trade by 11 percent by 2030. Furthermore, it would have limited positive spillover benefits for non-member countries. Petri and Plummer (2016) updated the results reported in Petri et al. (2012) on the economic effects of the TPP using the GTAP V8 database. Unlike other studies, this study simulated a partial cut of tariffs and NTBs. This U.S.-focused study showed that the U.S. will be one of the largest beneficiary from the TPP. The simulation suggested that TPP will increase annual real income in the U.S. and Canada by 0.5 and 1.3 percent, respectively, of the GDP, and annual exports by 9.1 and 7 percent, respectively, by 2030. The estimates in this study were higher than the one reported in Petri et al. (2012). The reason behind this difference was that the NTBs used in this study were higher, and this study took into account the effect on non-preferential provision of the TPP.

Unlike the aforementioned studies, Cheong (2013) and Lee and Itakura (2014) used a dynamic GTAP CGE solved over 2013-27 and 2014-30, respectively, using GTAP model to trace the TPP's economic impacts. Cheong (2013) found that TPP will have a limited impact on the real GDP of the members of the agreement; however, this impact would be positive on most of the agreement members. Lee and Itakura (2014) used GTAP model to estimate TP impact on Japan, they found that the TPP reform would result in an increase of productivity of agricultural sector by 1 percent, and Japan's overall welfare gains were expected to increase by 0.4 percent.

The limited number of the available studies of CGE-based analysis of the TPP showed that the agreement would have a positive economic impact on the member countries in terms of real GDP, welfare, trade, and production. However, there is a general agreement among all of these studies that the economic impact will be limited. No study addressed the potential economic impact of TPP on Canada's economy as the U.S. announced its withdrawal from the agreement, thus this study fills the gap in the literature by evaluating this impact.

## 3. Methodology

The standard GTAP model was utilized in this study. This model is a comparative static, global general equilibrium model, based on Input-Output (I-O) accounting framework. It has been used alongside its database for a wide range of policy analysis, as it can be extended and modified to support particular types of policy analysis. It is implemented using General Equilibrium Modeling Package (GEMPACK) or General Algebraic Modeling Software (GAMS) to operationalize a large and complicated structure of equations.

### *3.1. Database*

In this study, the GTAP database version nine (GTAP V. 9) was used. It represents the world economy and consists of different country level databases to simulate trade flow quantitatively. It consists of different accounts to measure the value of annual flows of goods and services and includes data on bilateral trade goods and services, intermediate inputs among sectors, and taxes and subsidies for different countries. Its comprehensiveness and flexibility can be aggregated or disaggregated based on research needs and objectives, which has made it one of the most popular databases in CGE analysis (Aguiar et al., 2016; Hertel et al., 2013).

The GTAP database version includes 140 regions and 57 sectors representing the world economy for three benchmark years: 2004, 2007, and 2011. The method and data sources of these three benchmark years are consistent to allow for meaningful comparison of development overtime if needed by researchers. The database classifies economic activities into 57 sectors (products and services) based on United Nations Central Product Classification and International Standard Industrial Classification (Agular et al., 2016). The sectoral classification consists of 26 agricultural and food sectors, 16 manufacturing sectors, and 15 service and other sectors. It includes three factors endowments: capital, land, and natural resources, and five labour categories: officials and managers, technicians, clerks, service/shop workers, and agricultural and unskilled workers. On the technical side, the database contains five files: sets, parameters, core data, energy data, and CO2 emission data. The arrays in the sets files are designed to allow the database to parameterize the standard GTAP model with any level of aggregation. The behavioral parameters include the Armington elasticities (Armington, 1969), factor substitution elasticities, factor transformation elasticities, and demand elasticities. The main data files include data on the input-output flows for each region and bilateral international trade. In addition, these files include protection data on both the exports and imports duties and subsidies, which is presented both implicitly and explicitly. In addition to aforementioned data, the database files include income tax, capital stock, depreciation, population, energy volume, and CO2 emission (Harrison & Pearson, 1998).

### *3.2. Study model description*

In the study model, Canada has 11 trade partners that includes the TPP countries, and the RoW. The model is agricultural-focused model where agricultural products are disaggregated into many sub-sectors. Factors of production were disaggregated into three categories: land, labour, and capital. In addition, small country assumption was imposed on the model. Table 2 summarizes the main components of the national CGE models.

Table 2 Study Model elements

| Element | Description |
|---|---|
| Regional aggregation | 13 regions: Canada, Australia, Brunei-Darussalam, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, U.S., Vietnam, and RoW. |
| Production factors | Labour, land, and capital |
| Sectors | 15: Rice, Wheat, Other grains, Fruits/vegetables, Other oilseeds Other crops, Livestock, Extractions, Meat products, Processed food, Raw milk, Dairy products, Labour-intensive manufacturing, Capital-intensive manufacturing, Services |
| Agents | Household, producer, government, and regional household |
| Exogenous variables | World price index for primary factors, Endowments distribution parameters for savings, government and private consumption and population, Slack variables for consumer goods, endowments, income, profits, savings price and tradable' market clearing |
| Endogenous variables | Quantities of all domestic goods, Prices of all domestic goods, Quantities of all imports, Prices of all imported goods. |

The model accounted for two types of trade: TPP, and RoW. This structure of the model allows for better understanding of the TPP agreement impact. For each trading partner, the database contains trade flow among regions. The model was designed to capture impacts of the TPP agreement on all TPP member countries, however it is a Canada-oriented model. The regional disaggregation included the twelve TPP countries individually plus the RoW which included all other trading nations. Regions in the model are linked through bilateral trade flows. Trading flow in the model explicitly account for transportation and marketing cost. The study model is an agricultural-focused model. To highlight this aspect of the model, the agricultural and food sector were disaggregated into 11 sectors. The disaggregation meant to reduce the aggregation bias in estimating trade impact basically on agricultural and food commodities. The non-agricultural and non-resources sectors were disaggregated into Extractions, labor-intensive manufacturing (which included textile, wearing apparel, transports, and machinery equipment), capital-intensive manufacturing (which included chemical, rubber, plastic products, mineral, and other products), and services sector (which included water, construction, trade, transport, sea and air transport, communication, financial services, insurance, business services, recreation and other services.

### *3.3. Analysis scenarios*

To fulfil the objectives of this study, three scenarios were developed. (i) Baseline scenario, where TPP was not incorporated in the analysis. The natural growth and other FTAs among TPP members which will take place over 2017 to 2030 were included in this analysis. (ii) TPP12 trade barriers elimination scenario, where all trade barriers between the TPP member countries were eliminated to capture TPP impact on Canada by the expected date of full implementation of TPP (i.e., 2030), and (iii) TPP11 scenario, where the simulation is done in absence of the U.S. as a member of the agreement.

Figure 1 below describes the study policy simulation scenarios.

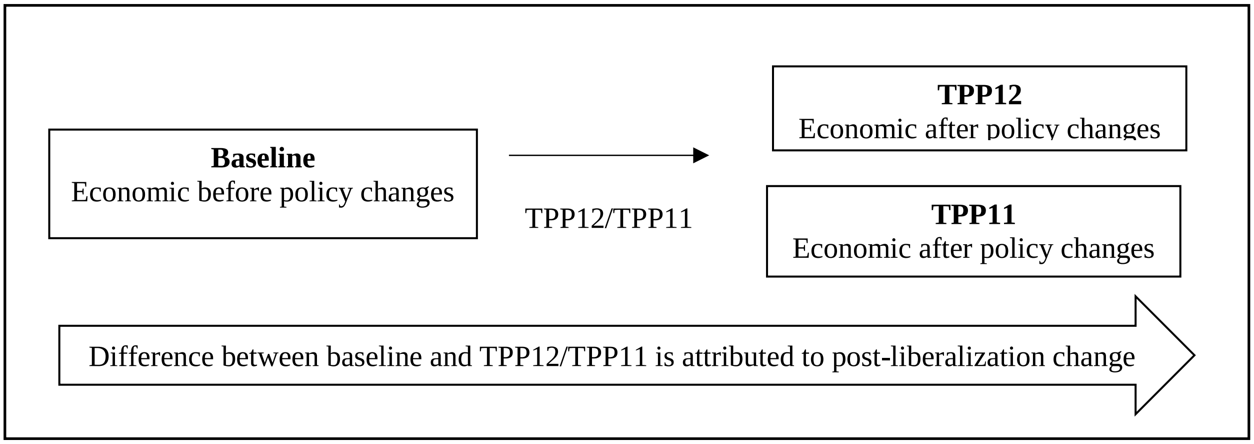


Fig. 1. study policy simulation scenarios

### *3.3.1. Baseline scenario*

The baseline scenario simulates the projected growth among TPP countries without the TPP agreement being in place. The projection takes into account capital accumulation, labour and population growth among TPP countries. The natural growth of population and economic activities in the TPP region is expected to be positive for most countries, with an average growth rate in the GDP varies from 0.79 to 6.15, and average population growth rate varies between -0.34 to 1.60 in 2011-2030 (Table 3). The demand for particular types of food among TPP's countries is also projected to grow over the coming years as a natural response to the economic and population growth, however the total quantity of consumption per capita in TPP countries will not increase dramatically.

Table 3. Projected economic and population growth in TPP member countries, 2011-30

| TPP country | Avg. GDP growth (%) | Avg. pop. growth rate (%) |
|---|---|---|
| Australia | 2.54 | 0.89 |
| Brunei Darussalam | 2.35 | 1.41 |
| Canada | 2.06 | 0.62 |
| Chile | 3.26 | 0.60 |
| Japan | 0.79 | -0.34 |
| Malaysia | 4.60 | 1.20 |
| Mexico | 2.93 | 0.92 |
| New Zealand | 2.32 | 0.67 |
| Peru | 3.75 | 0.81 |
| Singapore | 2.92 | 1.60 |
| United States | 2.12 | 0.72 |
| Vietnam | 6.15 | 0.73 |

Source: United States Census Bureau, International Data Base, (2017).

This simulation included the project effect of other FTAs that the TPP countries are currently engaged in, as these would be implemented over the upcoming years[2]. To capture the impact of other trade agreements that will be implemented over 2017 to 2030 between the TPP countries, we incorporated all the tariff cuts of these agreements in the baseline scenario of the analysis. Data of these variables was collected from WTO Regional Trade Agreements Database. This is done to separate the potential impact of other trade agreement from the impact of the TPP. To deal with other bilateral or regional trade agreements tariff, the study uses simple average to aggregate the tariff data from tariff lines to the sectors defined in the study model. The average tariff cuts between 2017 and 2030 were calculated and applied in all analysis scenarios.

*3.3.2. TPP12 scenario*

Many tariff cuts which are planned by other trade agreement between some of the TPP member countries may improve the market access between these countries over the coming decade. Under TPP12 scenario, the remaining tariffs among TPP member countries is eliminated to capture the impact of TPP agreement. All the intra-TPP tariffs, including the U.S. and RoW on agricultural and non-agricultural products were eliminated to allow for a comparison with the results of the baseline scenario and after with TPP11 scenario, where the U.S. is no longer part of the agreement.

*3.3.3. TPP11 scenario*

Canadian exports to the U.S. represent 94.6 percent of its total trade with TPP region. Although, Canada trade with the U.S. is already free under NAFTA, the U.S. being part of the TPP or abandon it may have impact on Canada through at least the diverge of trade flow between the U.S. and other TPP member countries. The goal of this simulation was to assess the economic impact on Canada as the U.S. had withdrawn from the TPP agreement. This change might also have impact on the trade flow with all TPP member countries, as the U.S. represents the largest economy in the TPP region. The comparison with TPP12 scenario will allow to capture the actual impact of the change in TPP region on Canada economy and trade.

## 4. Simulation procedure

Under baseline scenario, several assumptions were imposed to simulate the growth and trade in TPP region assuming no implementation of TPP agreement: (i) we simulated reduction in tariffs due to non-TPP bilateral and regional trade agreements among TPP countries which will take place over the coming decade based. (ii) the simulation did not include any reductions/changes in non-tariff barriers. (iii) we applied comparative static GTAP, where we assumed: the time had no explicit treatment, assuming constant returns to scale production technology, and perfect competitive markets. (iv) land assumed to be in fixed supply, while we incorporated capital and labour growth in the simulation. (v) primary factors were not allowed to move across borders, but goods and services were allowed, and (vi) we assumed that the TPP would not be in place over the coming decade.

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[2] Most of the bilateral and regional FTAs between TPP countries already implemented in 2014, however there are still some agreements to be implemented over the coming years.

Before running the baseline experiment, the database was updated to reflect the *status quo* of 2017, hence this is necessary as the reference year of the GTAP database is 2011. Specifically, the GTAP database version nine was reproduced and updated to reflect the growth in the world economy after 2011 (i.e., 2011 and 2017 and then 2017 until 2030). To this end, the methodology highlighted in Gehlhar (1997)[3] was followed. Regions in the study model have grown at different rates, hence the growth level is different from one country to another. Three variables were updated: population, labour, and physical capital[4]. The data on these variables were collected from external sources including the UN, International Monetary Fund (IMF), International Labour Organization (ILO), The Federal Reserve Bank of St. Louis Economic Data (FRED), and OECD. These variables were updated for all regions in the model by their corresponding endowment changes. It worth to note that the tariffs levels between the regions in the model was left unchanged in the first update (i.e., 2011 -2017) as there were no significant over this period, but tariffs were updated for the period between 2017-2030. Except for the population, the projections of other variables i.e. physical capital, and labour force is not available for the upcoming decade, thus this study utilized Autoregressive and Moving Average time series analysis to forecast the capital and labour force in each region in the model until 2030. The period chosen for both time series models extends from 1970 to 2014. The date used in this analysis is annual data obtained from the aforementioned sources. The database was updated twice: first to reflect 2017, and then the growth over the period 2017-30. All the bilateral and regional trade agreements that will be implemented over the coming decade were included.

The TPP12 experiment on the other hand involved complete removal of all the remaining tariffs on imports from any of the TPP countries. The TPP experiment was conducted based on the post baseline scenario experiment. In addition to the baseline scenario assumptions listed above, two other assumptions were imposed to fulfil the purposes of this simulation: (i) this scenario assumed that the TPP will be fully implemented by 2030, and (ii) the U.S. was assumed to be a member of TPP agreement.

The final experiment, TPP11 involved keeping non-TPP U.S. trade commitments with all members of the TPP, and eliminating the TPP commitments. Similar baseline and TPP12 scenarios, several assumptions were imposed to achieve the purposes of this simulation. In addition to the baseline scenario assumptions, two other assumptions were imposed to fulfil the purposes of this simulation: (i) the U.S. was assumed to be out of the TPP region, and (ii) the U.S. is assumed to keep all of its trade agreements with TPP member countries including NAFTA.

## 5. Results and discussion

The baseline growth scenario showed that Canada economy will grow over the simulation period. Canada's total trade is expected to grow at a moderate level. Canada's total agricultural imports and exports will increase by 6.4 (2.8 billion USD) and 30 percent (19.4 billion USD) percent, respectively; the agricultural imports and exports to TPP regions will increase by 10.7 (3.2 billion USD) and 30.8 percent (12.2 billion), respectively, and by 3.1 percent (412 million USD) and 28.7 (7.2 billion USD), respectively, to the RoW. The U.S. will continue to be the largest

[3] In the study model, we treat the GDP as an endogenous variable to be affected by other shocks, however there are some studies in the field (see Burfisher et al., 2014) treat the GDP as an exogenous variable.

[4] Physical capital in this study refers to goods that are fixed, tangible, and reproducible.

imports and exports source for Canadian. The agricultural sectors will be affected differently in terms of trade; all Canadian agricultural sectors imports will increase at a moderate level (between 1.21 to 26.13 percent except for dairy and meat products sectors which will decrease by 14. 17 and 2.93 respectively; this can be attributed to the current protection policy on these sectors which will expected to stay in place as TPP is not implemented. The growth baseline scenario further showed as that Canada's real GDP will increase by 9.89 percent an increase worth about 195 billion USD due to changes under the baseline scenario.

The simulation under TPP12 scenario showed that the TPP have important implications on the agricultural and non-agricultural trade between TPP countries and further the RoW. Under TPP12 scenario. Canada total agricultural imports will increase by 8.1 percent (3.7 billion USD), and the total agricultural exports will increase by 6.38 (5.37 billion USD). The trade with TPP countries will also experience growth, agricultural imports from the TPP member countries will increase by 19.4 percent (6.5 billion USD) relative to the baseline scenario the major increase will basically come from the U.S. (about 6.4 billion USD) with also a substantial increase in imports from New Zealand, Chile, and Mexico. On the other hand, Canada agricultural exports to the TPP member countries is projected to increase by about 10 percent (5.1 billion USD), the major increase in Canada agricultural exports is projected to be from its exports to Japan and the U.S. with an increase of 3.5 and 1.3 billion USD respectively. Canada agricultural imports from the RoW are projected to drop by 21 percent (2.7 billion USD) while its agricultural exports to the RoW are projected to grow slightly by about 0.6 percent (184 million USD). This trade diversion is an expected result due to the tariff cuts between TPP members. No significant change in Canada's GDP is projected under this scenario.

Under the TPP11 scenario, part of Canada's trade is projected to divert from the U.S. toward other TPP countries. Canada's total agricultural imports will increase by 23.27 and 20.75 percent from TPP11 region relative to baseline and TPP12 scenarios respectively. Agricultural imports from the U.S. will not witness any significant change relative to baseline scenario, but will drop significantly by 18 percent (about 6.5 billion) relative to the TPP12 scenario. The decrease in imports from the U.S. and the RoW under TPP11, will leave Canada with a 6.3 percent decrease in its total agricultural imports from the whole world relative to the TPP12 scenario. Canada thus will depend more on its domestic production to meet the demand. On the export side, total Canadian agricultural exports are projected to decrease to the U.S. and RoW relative to both simulation scenarios, while to increase by 36.65 and 8.57 relative to Baseline and TPP12 scenarios, respectively. At country level, Canada's agricultural imports and exports from almost all TPP member countries will increase relative to Baseline scenario with major increase for imports from New Zealand and exports from Japan. The results further show that agricultural imports and exports relative to TPP12 scenario will diverge mainly from the U.S. toward other TPP members, with a noticeable increase in imports and decrease in exports from and toward Vietnam. Table 4 provides a general summary of the total Canadian agricultural and non-agricultural imports and exports under Baseline, TPP12, and TPP11 scenarios while Table 5 reports Canada detailed trade simulation results with each TPP member country.

Table 4. General trade simulation results on Canada's imports and exports, 2030 (million USD and %)

| | Total imports | | | | |
|---|---|---|---|---|---|
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 73340 | 75476 | 76332 | 4.08 | 1.13 |
| **U.S.** | 321107 | 325260 | 320651 | -0.14 | -1.42 |
| **RoW** | 198014 | 195155 | 197350 | -0.34 | 1.12 |
| **Total** | 592461 | 595892 | 594332 | 0.32 | -0.26 |
| | Agricultural imports | | | | |
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 3940 | 4023 | 4857 | 23.27 | 20.75 |
| **U.S.** | 29185 | 35641 | 29217 | 0.11 | -18.02 |
| **RoW** | 12856 | 10079 | 12632 | -1.74 | 25.34 |
| **Total** | 45981 | 49742 | 46705 | 1.57 | -6.11 |
| | Non-agricultural imports | | | | |
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 69399 | 71452 | 71476 | 2.99 | 0.03 |
| **U.S.** | 291921 | 289619 | 291435 | -0.17 | 0.63 |
| **RoW** | 185157 | 185077 | 184719 | -0.24 | -0.19 |
| **Total** | 546479 | 546149 | 547627 | 0.21 | 0.27 |
| | Total exports | | | | |
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 58660 | 63084 | 64536 | 10.02 | 2.3 |
| **U.S.** | 474455 | 474922 | 472188 | -0.48 | -0.58 |
| **RoW** | 233059 | 233160 | 231783 | -0.55 | -0.59 |
| **Total** | 766173 | 771165 | 768504 | 0.30 | -0.35 |
| | Agricultural exports | | | | |
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 15043 | 18933 | 20556 | 36.65 | 8.57 |
| **U.S.** | 36866 | 38161 | 36690 | -0.48 | -3.86 |
| **RoW** | 32289 | 32473 | 31950 | -1.05 | -1.61 |
| **Total** | 84195 | 89565 | 89197 | 5.94 | -0.41 |
| | Non-agricultural exports | | | | |
| **Region** | Baseline | TPP12 | TPP11 | % change relative to Baseline | % change relative to TPP12 |
| **TPP11** | 43618 | 44149 | 43979 | 0.83 | -0.39 |
| **U.S.** | 437588 | 436762 | 435498 | -0.48 | -0.29 |
| **RoW** | 200771 | 200688 | 199833 | -0.47 | -0.43 |
| **Total** | 681979 | 681601 | 679306 | -0.39 | -0.34 |

Note. Study model

Table 5. Canada's imports and exports to TPP countries relative to TPP12 scenario, 2030 (million USD and %)

| | Agricultural imports | | | | | Non-agricultural imports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Country** | **Baseline** | **TPP12** | **TPP11** | **% change relative to Baseline** | **% change relative to TPP12** | **Baseline** | **TPP12** | **TPP11** | **% change relative to Baseline** | **% change relative to TPP12** |
| Australia | 675 | 527 | 709 | 5.04 | 33.66 | 3878 | 3887 | 3888 | 0.26 | -0.46 |
| Brunei Darussalam | 0 | 0 | 0 | 0.00 | 0.00 | 42 | 42 | 42 | 0.00 | 0.00 |
| Chile | 530 | 571 | 652 | 23.02 | 14.02 | 2433 | 2424 | 2425 | -0.33 | -0.25 |
| Japan | 126 | 132 | 145 | 15.08 | 7.92 | 20210 | 21771 | 21884 | 8.28 | 0.3 |
| Malaysia | 53 | 57 | 67 | 26.42 | 17 | 4159 | 4248 | 4265 | 2.55 | 0.26 |
| Mexico | 1448 | 1467 | 1511 | 4.35 | 2.81 | 22656 | 22641 | 22566 | -0.40 | -0.46 |
| New Zealand | 591 | 806 | 1220 | 106.43 | 50.74 | 458 | 460 | 463 | 1.09 | -0.22 |
| Peru | 170 | 117 | 172 | 1.18 | 46.36 | 8014 | 8028 | 8017 | 0.04 | -0.32 |
| Singapore | 36 | 67 | 80 | 122.22 | 19.42 | 5346 | 5340 | 5344 | -0.04 | 0.00 |
| U.S. | 29185 | 35641 | 29070 | -0.39 | -18.02 | 291921 | 289619 | 290518 | -0.48 | 0.63 |
| Vietnam | 310 | 278 | 317 | 2.26 | 14.12 | 2202 | 2611 | 2717 | 23.39 | 3.91 |
| Total | 33124 | 39664 | 33944 | 2.48 | -14.09 | 361320 | 361071 | 362129 | 0.22 | 0.51 |
| | **Agricultural exports** | | | | | **Non-agricultural exports** | | | | |
| **Country** | **Baseline** | **TPP12** | **TPP11** | **% change relative to Baseline** | **% change relative to TPP12** | **Baseline** | **TPP12** | **TPP11** | **% change relative to Baseline** | **% change relative to TPP12** |
| Australia | 414 | 441 | 425 | 2.66 | -3.47 | 3758 | 3980 | 3975 | 5.77 | -0.2 |
| Brunei Darussalam | 1 | 1 | 1 | 0.00 | 0.00 | 48 | 49 | 49 | 0.00 | 0.00 |
| Chile | 298 | 321 | 324 | 8.72 | 0.56 | 1922 | 1921 | 1915 | -0.36 | -0.36 |
| Japan | 8759 | 12313 | 12056 | 37.64 | 13.87 | 14638 | 14894 | 14819 | 1.24 | -0.31 |
| Malaysia | 420 | 429 | 428 | 1.90 | -0.52 | 2358 | 2434 | 2433 | 3.18 | -0.13 |
| Mexico | 3976 | 4222 | 4184 | 5.23 | -1.49 | 10880 | 10802 | 10774 | -0.97 | -0.5 |
| New Zealand | 142 | 147 | 142 | 0.00 | -2.21 | 597 | 593 | 591 | -1.01 | 0.3 |
| Peru | 710 | 704 | 711 | 0.14 | 0.13 | 775 | 774 | 774 | -0.13 | -0.13 |
| Singapore | 114 | 116 | 114 | 0.00 | -2.07 | 8003 | 8011 | 7982 | -0.26 | -0.42 |
| U.S. | 36866 | 38161 | 36884 | 0.05 | -3.86 | 437588 | 436762 | 436289 | -0.30 | -0.29 |
| Vietnam | 208 | 441 | 237 | 13.94 | -46.37 | 639 | 3980 | 672 | 5.16 | -83.1 |
| Total | 51909 | 57297 | 55504 | 6.93 | -0.09 | 481206 | 484200 | 480272 | -0.19 | -0.98 |

Note. Study model.

## 6. Conclusion

The multi-country CGE model, developed in this study, provided a quantitative analysis of the economic impact of a TPP on Canada's economy. The major feature of the model included: level of detail, incorporation of natural growth in the analysis, and simulation of the economic impact of a TPP agreement if the agreement was fully implemented without U.S. membership. Three scenarios were developed to assess the economic impact on Canada if the TPP agreement is implemented without U.S. The baseline scenario simulated the trade among TPP countries over the period 2017-2030, assuming no TPP agreement was in place. This scenario accounted for the natural growth in TPP regions, including the growth in population, labour force, and capital, and also accounted for other FTAs between TPP members that would be implemented over the coming decade. The TPP12 scenario simulated TPP implementation, assuming that the TPP agreement would be fully implemented by 2030, including all of its 12-member countries. This scenario eliminated all the remaining tariffs on the agricultural and non-agricultural sectors between TPP member countries, to capture the actual impact of a TPP agreement on Canadian economy. Finally, the TPP11 scenario simulated the assumption that the TPP would be implemented without the U.S.

Both TPP12 and TPP11 simulation scenarios show that the TPP agreement would generate long-term economic gains for Canada with a positive, but limited impact on Canada's macroeconomic indicators. Canada would experience an increase in its trade and improvement to its trade balance in particular its agricultural trade balance by 2030 if the TPP was fully implemented. Under the TPP12 scenario, elimination of the tariff between Canada and TPP member states would cause Canadian agricultural imports from TPP region to increase by 6.5 billion USD, and exports to the TPP region to increase by 5.1 billion USD, hence a trade diversion from the RoW toward the TPP region is also projected. By commodity, the percentage increase in the value of Canada's trade with TPP member countries is projected to be the largest for meat products, dairy products, processed food, and wheat, in absolute value term. The macroeconomic indicators, such as GDP and economic welfare, are projected to improve slightly under the TPP agreement, relative to the baseline scenario. The TPP11 simulation showed that a change in TPP membership will have minimum impact on Canada's economy, if the agreement itself was still fully implemented. Ultimately, total Canadian agricultural imports and exports will decrease from and to the U.S. relative to the TPP12 scenario; however, a large percentage of this decrease would be redirected towards other TPP member countries. Canadian gains under the TPP11 scenario are greater than the gains expected under the TPP12 scenario, due to improved market access for Canadian products to other TPP member countries, in the absence of U.S. competition.

The limited but growing number of CGE-based models in the applied economic literature on of the effect of the TPP agreement on members' economies share broad results. The TPP agreement will have a small effect on most members in terms of a change in GDP or welfare, except for Vietnam, which will experience the largest gains in GDP and welfare relative to the size of its economy (Petri & Plummer, 2016; Burfisher *et al*., 2014; Strutt *et al*., 2015; Petri *et al.*, 2012; Lee & Itakura, 2014; Broadbent *et al*., 2016). None of the current published work attempts to estimate the economic impact on the TPP region if the U.S. were to withdraw from the agreement; hence this research provides a unique analysis of this result.

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