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A NUMERICAL SIMULATION ASSESSMENT OF THE EFFECTS INVOLVED

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ABSTRACT

The Trans-Pacific Partnership (TPP) is a new negotiation on cross border liberalization of goods and service flows going beyond WTO disciplines and focused on issues such as regulation and border controls. Though the US, Australia and other pacific countries are included, China is notable for its exclusion from the process thus far. This paper uses numerical simulation methods to assess the potential effects of a TPP agreement on China and the other participating countries. We use a numerical five-country global general equilibrium model with trade costs and monetary structure incorporating inside money to allow for impacts on trade imbalances. Trade costs are calculated using a method based on gravity equations. Simulation results reveal that China will be hurt by TPP initiatives, but the negative effects are relatively small given the geographical and commodity composition of China's trade. Other non-TPP countries will be hurt but member countries will all gain. Japan's joining TPP would be beneficial to both herself and all other TPP countries, but negative effects on China and other non-TPP countries will increase further. If China takes part in TPP, it will increase China's and other TPP countries' gain, but non-TPP countries will be hurt more. As a regional free trade arrangement, TPP effects are different from global free trade effects which will benefit all countries (not just member countries) in the world, and the positive effects of global free trade are stronger than TPP effects.

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1. Introduction

The Trans-Pacific Partnership (TPP) is a proposed nine-country Asia-Pacific free trade arrangement being negotiated among the United States (US), Australia, Brunei, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam. The aim is to go beyond WTO liberalization and focus on issues of regulation and border controls. As such it differs from tariff based liberalization in there being no revenues involved with the border measures. They also compound with conventional tariffs. The intuition, therefore, is that larger gains may accrue to the importing countries compared to previously studied liberalization. The negotiating partners have agreed that this proposed "living agreement" cover new trade topics and include new members that are willing to adopt the proposed agreement's higher standards. To that end, Japan, Canada and Mexico all have stated that they would have an interest in joining the negotiations. This free trade pact, even without Mexico and Canada, would affect 600 million people in countries that produce 20 trillion US$ of annual economic output (COC, 2011).

As a big country in the Asia-Pacific area, China has not been invited to take part in the TPP initiative. Here we analyze how a TPP arrangement could potentially affect both China and other participating and non-participating countries if this proposal resulted in a true free trade agreement (FTA) among participants. The answer to this question is important for policy making and related research, and depends critically both on the size of barriers involved and their negotiability. Present literature on TPP

is limited and is mostly analytical or simple newsletters and comments, such as Williams (2012), James (2010), Lewis (2011), and Ezell and Atkinson (2011). Few numerical methods have been used to capture potential TPP effects for other countries and the whole world, except Petri *et al* (2011) and Itakura and Lee (2012). Our point of departure is to use numerical general equilibrium simulation methods to explore TPP effects on both China and other countries.

We use a five-country (China, US, Japan, other TPP countries and the rest of world (ROW)) Armington type global general equilibrium model. Each country produces two-goods (Tradable goods and Non-tradable goods) and has two-factors (capital and labor). The model captures trade costs and uses a monetary structure of inside money both so as to also endogenously determine trade imbalance effects from the trade initiative and also allow calibration to a base case capturing China's large trade surplus. We use a trade cost calculation method that recognizes limitations of data by using an estimation treatment that follows Wong (2012) and Novy (2008). We capture endogenously determined trade imbalances by incorporating both current consumption and expected future incremental consumption from saving into the model using an analytical structure attributed to Patinkin (1947), also adopted in Archibald and Lipsey (1960), and used more recently in Whalley *et al* (2011) and Li and Whalley (2012). We calibrate the model to 2010 data and use counterfactual simulations to explore TPP effects.

Our simulation results show, not surprisingly, that the TPP initiative will hurt China, but these effects are relatively small under the present TPP proposal, and so

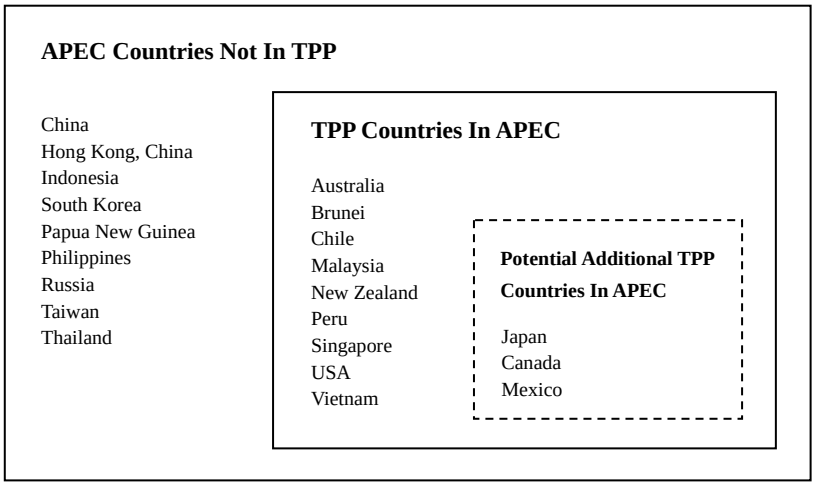
will not have large effects on China. Other non-TPP member countries will be hurt as well. Total world production and welfare will increase under a TPP regional free trade initiative and a TPP will benefit member countries and the effects are significant and comparatively prominent. Among these TPP countries, other TPP countries (OTPPC) in the model will gain proportionally more than the US from this regional arrangement because of their large intra Pacific trade. We also evaluate a partial non-tariff barriers elimination scenario as sensitivity analysis, and also change elasticities and upper bound values in the monetary structure. Results suggest that our simulation results are reasonably robust. We have also simulated the effects that could follow if Japan joins the TPP, and find that these would be beneficial both for Japan and for all other TPP countries, but the negative effect on non-TPP countries (like China and ROW) would increase. We have also evaluated the scenario of China joining the TPP, and find that China and other TPP countries will all gain, but non-TPP countries will be hurt. We also compare TPP effects to global free trade effects in the model, and find they are different. Firstly, global free trade benefits all countries in the world, but TPP benefits just member countries; second, global free trade positive effects are considerably higher than TPP free trade effects.

The remaining parts of the paper are organized as follows: Part 2 introduces the TPP initiative and its development; Part 3 is the global general equilibrium model specification; Part 4 is our calculation of trade costs and TPP barriers change; Part 5 presents data and reports parameters from calibration; Part 6 reports simulation results for six different scenarios. The last part offers conclusions and remarks.

2. The TPP Initiative and Its Development

The Trans-Pacific Partnership (TPP), also known as the Trans-Pacific Strategic Economic Partnership Agreement (TPPA), is a multilateral free trade agreement (FTA) that aims to further liberalize the economies of the Asia-Pacific region. Current negotiating partners include Australia, Brunei, Chile, Malaysia, New Zealand, Peru, Singapore, the United States, and Vietnam, a total of nine countries. Although all original and negotiating parties are members of the Asia-Pacific Economic Cooperation (APEC), the TPP is not an APEC initiative. However, it is considered to be a step towards the proposed Free Trade Area of the Asia Pacific (FTAAP), an APEC initiative. The country member relationships between TPP and APEC are shown in Figure 1.

Fig.1 Country Members of TPP and APEC



Source: Compiled by authors.

The TPP grew out of the Pacific Three Closer Economic Partnership (P3-CEP). Its negotiation was launched on the sidelines of the 2002 APEC Leaders' Meeting in Los Cabos, Mexico, by Chilean President Ricardo Lagos and Prime Ministers Goh

Chok Tong of Singapore and Helen Clark of New Zealand. Brunei first took part as a full negotiating party in the fifth round of talks in April 2005, after which the trade bloc became known as the Pacific-4 (P4). The objective of the original agreement was to eliminate 90% of all tariffs between member countries by January 1, 2006, and reduce all trade tariffs to zero by 2015. It was also to be a comprehensive agreement covering all the main components of a free trade agreement, including trade in goods, rules of origin, trade remedies, sanitary and phytosanitary measures, technical barriers to trade, trade in services, intellectual property, government procurement and competition policy (Wikipedia, 2012).

After the P4 negotiations finished in 2005, its parties agreed to begin negotiating on financial services and investment which were not covered by the original agreement within two years of its entry into force. When these negotiations began in March 2008, the US joined the group pending a decision on whether to participate in a comprehensive negotiation for an expanded TPP agreement. In September 2008, the US announced it would participate fully in the negotiations, and Australia, Peru, and Viet Nam also joined (NZMFAT, 2012).

In November 2009, US President Obama affirmed that the US would engage with TPP countries. Negotiations for an expanded agreement began in March 2010 (Figure 2). During the third round in Brunei in October 2010, Malaysia joined the negotiations. Meanwhile, Japan, Canada and Mexico have all more recently expressed an interest in joining the TPP negotiations. We report information on these rounds of negotiation in Table 1.

Fig. 2 The History of TPP

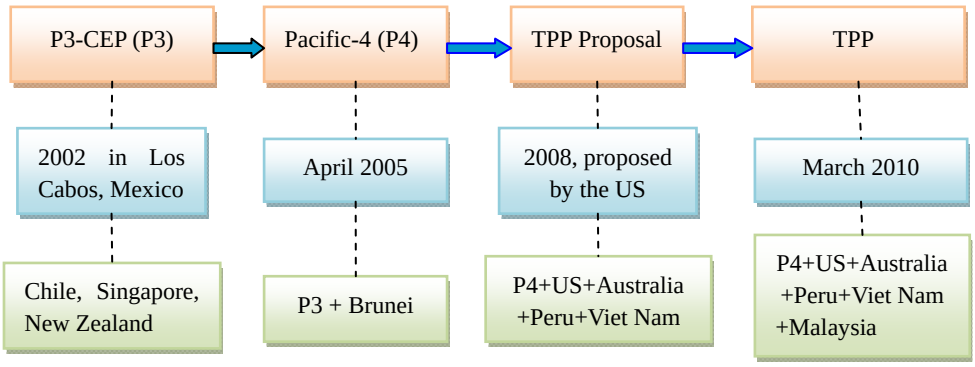


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Table 1 11 Rounds of TPP Negotiations

Round No.	Time	Place	Round No.	Time	Place
round 1	Mar. 15-18, 2010	Melbourne, Australia	round 7	June 20-24, 2011	Ho Chi Minh, Viet Nam
round 2	June 14-18, 2010	San Francisco, US	round 8	Sep. 6-15, 2011	Chicago, US
round 3	Oct. 4-9, 2010	Darussalam, Brunei	round 9	Oct. 19-28, 2011	Lima, Peru
round 4	Dec. 6-10, 2010	Auckland, New Zealand	round 10	Dec. 5-9, 2011	Kuala Lumpur, Malaysia
round 5	Feb. 14-18, 2011	Santiago, Chile	round 11	Mar. 1-9, 2012	Melbourne, Australia
round 6	Mar. 24-Apr. 1, 2011	Singapore	/	/	/

Source: compiled by authors.

The objective of the TPP negotiations remains to develop an FTA agreement which will be able to adapt and incorporate current issues, concerns and interests of members. Working groups have been established in the following areas: market access, technical barriers to trade, sanitary and phytosanitary measures, rules of origin, customs cooperation, investment, services, financial services, telecommunications, e-commerce, business mobility, government procurement, competition policy, intellectual property, labor, environment, capacity building, trade remedies, and legal and institutional issues. A unique departure from other FTAs is the group's additional focus on cross-cutting "horizontal issues" such as regional integration, regulatory coherence, competitiveness, development and small and medium enterprises (SMEs).

TPP member countries are home to more than 500 million people; one fifth of APEC's population. The nine participating economies account for 17.8 trillion USD, or just over half of APEC's GDP. The TPP economies account for 36% of total goods trade and 47% of total service trade in APEC. These economies also accounted for 62% of outward FDI and 58% of inward FDI in the APEC region (NZMFAT, 2012). This regional FTA could have significant impacts on the global economy.

3. Model Specification

To assess the potential impacts of TPP both on China and other countries, we use a general equilibrium model with both international trade in goods and trade costs. Our global general equilibrium model has five countries and each country produce two goods with two factors. These five countries are China, the US, Japan, other TPP countries (OTPPC) and the rest of the world (ROW). The two goods are tradable goods and non-tradable goods and are treated as heterogeneous across countries. The two factors in each country are labor and capital, which are intersectorally mobile but internationally immobile.

To this we add monetary structure using inside money following Whalley *et al* (2011) and Li and Whalley (2012). This allows for the endogenous determination of changes in trade imbalances for trade in goods following a TPP initiative, which are offset through inter-temporal trade across countries in money; and also allows for a calibration to a base case where China has a large trade surplus. This monetary structure builds on Azariadis (1993) where there is extensive discussion of simple overlapping generation models with inside money. Here, in addition, interactions between monetary structure and commodity trade are needed, and hence motivates models with simultaneous inter-temporal and inter-commodity structure.

In our general equilibrium model with monetary structure, we assume there are two goods in each period and allow inter-commodity trade to co-exist within the period along with trade in debt in the form of inside money. We use a single period

model where either claims on future consumption (money holding) or future consumption liabilities (money insuance) enter the utility function as incremental future consumption from current period savings. This is the formulation of inside money used by Patinkin (1947, 1971) and Archibald and Lipsey (1960). This can also be used in a multi-country model structure with trade in both goods and inside money.

On the production side of the model, we assume CES technology for production of each good in each country (Figure 3)

$$Q_i^l = \phi_i^l [\delta_i^l (L_i^l)^{\frac{\sigma_i^l - 1}{\sigma_i^l}} + (1-\delta_i^l)(K_i^l)^{\frac{\sigma_i^l - 1}{\sigma_i^l}}]^{\frac{\sigma_i^l}{\sigma_i^l - 1}}, \qquad i = country, l = goods \tag{1}$$

where Q_i^l is the output of the *lth* industry (including tradable goods and non-tradable goods) in country i, L_i^l and K_i^l are the labor and capital inputs in sector l, ϕ_i^l is the scale parameter, δ_i^l is the distribution parameter and σ_i^l is the elasticity of factor substitution. First order conditions for cost minimization imply the factor input demand equations,

$$K_i^l = \frac{Q_i^l}{\phi_i^l}[\delta_i^l [\frac{(1-\delta_i^l) w_i^L}{\delta_i^l w_i^K}]^{(1-\sigma_i^l)} + (1-\delta_i^l)]^{\frac{\sigma_i^l}{1-\sigma_i^l}} \tag{2}$$

$$L_i^l = \frac{Q_i^l}{\phi_i^l}[\delta_i^l + (1-\delta_i^l)[\frac{\delta_i^l w_i^K}{(1-\delta_i^l) w_i^L}]^{(1-\sigma_i^l)}]^{\frac{\sigma_i^l}{1-\sigma_i^l}} \tag{3}$$

where w_i^K and w_i^L are the prices of capital and labor in country i.

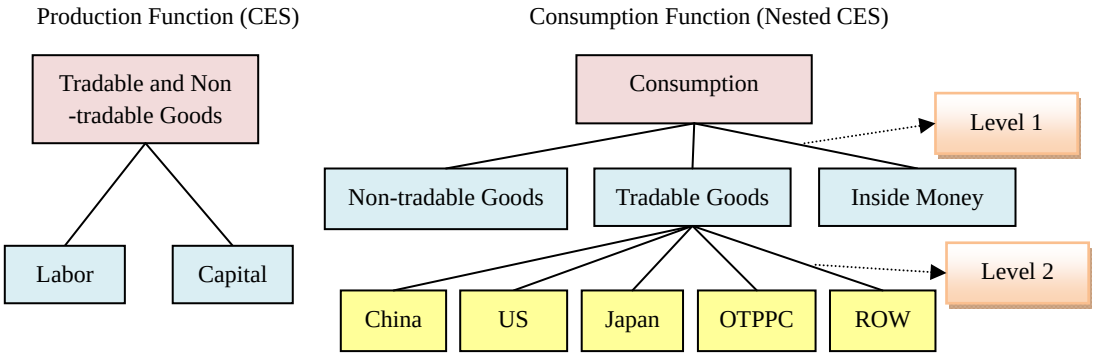
On the consumption side, we use the Armington assumption of product heterogeneity across countries, and assume claims on future consumption enter preferences and are traded between countries. Each country can thus either issue or

buy claims on future consumption using current period income. We use a nested CES utility function to capture consumption (Figure 3)

$$U_i(X_i^T, X_i^{NT}, Y_i) = [\alpha_{i1}^{\frac{1}{\sigma_i}}(X_i^T)^{\frac{\sigma_i-1}{\sigma_i}} + \alpha_{i2}^{\frac{1}{\sigma_i}}(X_i^{NT})^{\frac{\sigma_i-1}{\sigma_i}} + \alpha_{i3}^{\frac{1}{\sigma_i}}(Y_i)^{\frac{\sigma_i-1}{\sigma_i}}]^{\frac{\sigma_i}{\sigma_i-1}}, \quad i = country \quad (4)$$

Where X_i^{NT} denotes the consumption of non-tradable goods in country i, X_i^T denotes the consumption of composite Armington tradable goods in country i, and Y_i denotes the inside money for country i. Additionally α_{i1}, α_{i2} and α_{i3} are share parameters and σ_i is the top level elasticity of substitution in consumption.

Fig. 3 Structure of Production and Consumption Functions



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The composite of tradable goods is defined by another nesting level reflecting the country from which goods come. We assume this level 2 composite consumption is of CES form and represented as,

$$X_i^T = [\sum_j \beta_{ij}^{\frac{1}{\sigma_i'}} x_{ij}^{T\,\frac{\sigma_i'-1}{\sigma_i'}}]^{\frac{\sigma_i'}{\sigma_i'-1}}, \quad j = country \quad (5)$$

Where x_{ij}^T is the consumption of tradable goods from country j in country i. If $i = j$ this denotes that this country consumes its domestically produced tradable goods. β_{ij} is the share parameter for country $j's$ tradable goods consumed in country i. σ_i' is the elasticity of substitution in level 2 preferences in country i.

We assume a representative consumer in country i with income as I_i. The

budget constraint for this consumer's consumption is

$$P_i^T X_i^T + pc_i^{NT} X_i^{NT} + pc_i^Y Y_i = I_i \tag{6}$$

Here, Y_i represents both inside money (debt) held by country i, and also country $i's$ trade imbalance. $Y_i > 0$ implies a trade surplus (or positive claims on future consumption); $Y_i < 0$ implies a trade deficit or future consumption liabilities (effectively money issuance), and $Y_i = 0$ implies trade balance.

For trade deficit countries, utility will decrease in inside money since they are issuers. In order to capture this given that $Y_i < 0$ for these countries, we use an upper bound Y^0 in the utility function in a term $[Y^0 + Y_i]$ following Whalley *et al* (2011) and assume that Y^0 is large enough to ensure that $Y^0 + Y_i > 0$. We use the transformation $y_i = Y^0 + Y_i$ to solve the optimization problem, and the utility function and budget constraint become

$$\begin{aligned} &MaxU_i(X_i^T, X_i^{NT}, Y_i) = [\alpha_{i1}^{\frac{1}{\sigma_i}} (X_i^T)^{\frac{\sigma_i - 1}{\sigma_i}} + \alpha_{i2}^{\frac{1}{\sigma_i}} (X_i^{NT})^{\frac{\sigma_i - 1}{\sigma_i}} + \alpha_{i3}^{\frac{1}{\sigma_i}} (y_i)^{\frac{\sigma_i - 1}{\sigma_i}}]^{\frac{\sigma_i}{\sigma_i - 1}} \\ &s.t.\ P_i^T X_i^T + pc_i^{NT} X_i^{NT} + pc_i^Y y_i = I_i + pc_i^Y Y^0 \equiv I_i^* \end{aligned} \tag{7}$$

The optimization problem (6) above yields

$$X_i^T = \frac{\alpha_{i1} I_i^*}{(P_i^T)^\sigma [\alpha_{i1} (P_i^T)^{1-\sigma} + \alpha_{i2} (pc_i^{NT})^{1-\sigma} + \alpha_{i3} (pc_i^Y)^{1-\sigma}]} \tag{8}$$

$$X_i^{NT} = \frac{\alpha_{i2} I_i^*}{(pc_i^{NT})^\sigma [\alpha_{i1} (P_i^T)^{1-\sigma} + \alpha_{i2} (pc_i^{NT})^{1-\sigma} + \alpha_{i3} (pc_i^Y)^{1-\sigma}]} \tag{9}$$

$$y_i = \frac{\alpha_{i3} I_i^*}{(pc_i^Y)^\sigma [\alpha_{i1} (P_i^T)^{1-\sigma} + \alpha_{i2} (pc_i^{NT})^{1-\sigma} + \alpha_{i3} (pc_i^Y)^{1-\sigma}]} \tag{10}$$

Where P_i^T, pc_i^{NT} and pc_i^Y are separately consumption prices of composite tradable goods, non-tradable goods and inside money in country i. For the composite tradable goods, they enter the second level preferences and come from different

countries, and the country specific demands are

$$x_{ij}^{T} = \frac{\beta_{ij}(X_i^T P_i^T)}{(pc_{ij}^T)^{\sigma_i'}[\sum_j \beta_{ij}(pc_{ij}^T)^{(1-\sigma_i')}]} \tag{11}$$

where pc_{ij}^T is the consumption price in country i of tradable goods produced in country j, $X_i^T P_i^T$ is the total expenditure on tradable goods in country i. The consumption price for the composite of tradable goods is

$$P_i^T = [\sum_{j=1}^{5} \beta_{ij}(pc_{ij}^T)^{(1-\sigma_i')}]^{\frac{1}{1-\sigma_i'}} \tag{12}$$

Equilibrium in the model then characterized by market clearing prices for goods and factors in each country such that

$$Q_i^T = \sum_j x_{ji}^T \tag{13}$$

$$\sum_l K_i^l = \overline{K_i} \quad , \quad \sum_l L_i^l = \overline{L_i} \tag{14}$$

The non-tradable goods market clearing condition will given later in the paper. A zero profit condition must also be satisfied in each industry in each country, such that

$$p_i^l Q_i^l = w_i^K K_i^l + w_i^L L_i^l \qquad l = T, NT \tag{15}$$

Where p_i^l is the producer price of goods l in country i. For global trade (or money) clearance, we have

$$\sum_i Y_i = 0 \tag{16}$$

We introduce trade cost for trade between countries. Trade costs include not only import tariffs but also other non-tariff barriers such as transportation costs, language barriers, institutional barriers and etc. We divide trade costs into two parts in our model; import tariff and non-tariff trade costs. We denote the import tariff in country

i as t_i, and non-tariff trade costs as N_{ij} (ad volume tariff-equivalent non-tariff trade costs for country i imported from country j). This yields the following relation of consumption prices and production prices in country i for country $j's$ exports.

$$pc_{ij}^{T} = (1 + t_i + N_{ij})\, p_j^{T} \tag{17}$$

Import tariffs will generate revenues R_i, which are given by

$$R_i = \sum_{j, i \neq j} p_j^{T} x_{ij}^{T} t_i \tag{18}$$

For non-tariff trade costs, they are different from the import tariff: they cannot collect revenue, and importers need to use actual resources to cover the costs involved. In the numerical model, we assume that the resource costs involved in overcoming all other non-tariff barriers are denominated in terms of domestic non-tradable goods. We incorporate this resource using feature through use of non-tradable goods equal in value terms to the cost of the barrier. We thus assume reduced non-tariff trade costs (including transportation cost) will thus occur under trade liberalization as an increase in non-tradable goods consumption NR_i by the representative consumer in importing countries. The representative consumer's income in country i is thus given by

$$w_i^{K} \overline{K_i} + w_i^{L} \overline{L_i} + R_i = I_i \tag{19}$$

and the demand-supply equality involving non-tradable goods becomes

$$Q_i^{NT} = \frac{NR_i}{p_i^{NT}} + X_i^{NT} \tag{20}$$

where

$$NR_i = \sum_{j, i \neq j} p_j^{T} x_{ij}^{T} N_{ij} \tag{21}$$

The TPP FTA will thus reduce both import tariffs and non-tariff trade costs

between member countries which will influence the whole world. Using the general equilibrium model above, we can calibrate it to a base case data set and then simulate and explore TPP effects.

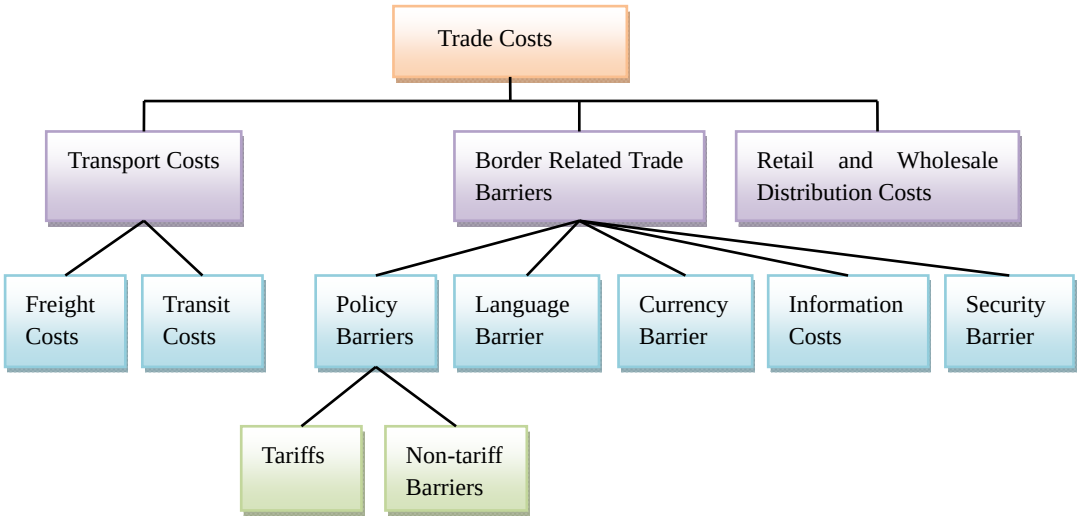
4. Trade Cost Calculations

We report our calculations of trade costs in this part which provide trade cost estimates for use in our general equilibrium model. The methodology we use is from Novy (2008) and Wong (2012). We calculate and report ad valorem tariff-equivalent trade costs between countries for China, the US, Japan, other TPP countries (OTPPC), and ROW from 2000 to 2010.

4.1 Trade Costs Definition

A broad definition of trade costs includes policy barriers (Tariffs and Non-tariff barriers), transportation costs (freight and time costs) as well as communication and other information costs, enforcement costs, foreign exchange costs, legal and regulatory costs and local distribution costs. Figure 4 reports the structure of representative trade costs used by Anderson and Wincoop (2004) to illustrate conceptually what is involved.

Fig. 4 Representative Trade Costs



Source: Anderson and Wincoop (2004) and De (2006).

Trade costs are reported in terms of their ad valorem tax equivalent. They are large, even aside from trade policy barriers and even between apparently highly integrated economies. The tax equivalent of representative trade costs for rich countries is about 170% and this includes all transport, border-related and local distribution costs from foreign producer to final user in the domestic country (Anderson and Wincoop, 2004).

Trade costs also have large welfare implications. Current policy related costs are often more than 10% of national income (Anderson and Wincoop, 2002). Obstfeld and Rogoff (2000) commented that all the major puzzles of international macroeconomics hinge on trade costs. Other studies estimate that for each 1% reduction of trade transaction costs world income could increase by 30 to 40 billion USD (APEC, 2002; OECD, 2003; De, 2006).

4.2 Methodology

Here, we have calculated trade costs for prospective TPP participants, China, and other non-participants following the approaches in Head and Ries (2001), Novy (2008) and Wong (2012). Their method is to take the ratio of bilateral trade flows over local trade, scaled to some parameter values, and then use a measure that capture all barriers. Some papers have argued that this measure is consistent with the gravity equation and robust across a variety of trade models (Novy, 2008; Wong, 2012).

The gravity equation is one of the most robust empirical relationships in economics which relates trade between two country to their economic size, bilateral trade barriers, costs of production in exporter countries, and how remote the importer

is from the rest of the world (Wong, 2012). Some recent studies have provided the micro foundations for the gravity equation, for example Anderson and Wincoop (2003), Eaton and Kortum (2002) and Chaney (2008).

The measure of trade barriers used here is based on the gravity equation derived from Chaney's (2008) model of heterogeneous firms with bilateral fixed costs of exporting. Trade barriers can take two forms in the model, a variable trade barrier τ_{ir} and a fixed cost of exporting F_{ir}. The variable trade barrier τ_{ir} is an iceberg cost. In order to deliver one unit of good to i from r, $\tau_{ir} > 1$ unit of good has to be delivered. The gravity equation supported by this model is:

$$X_{ir} = \frac{Y_i \times Y_r}{Y} \left(\frac{w_r \tau_{ir}}{\theta_i}\right)^{-\gamma} F_{ir}^{-\left(\frac{\gamma}{\sigma-1}-1\right)} \tag{22}$$

Where X_{ir} is import of country i from country r. Y_i, Y_r and Y are the economic sizes of both countries and the total world, w_r is labor costs, τ_{ir} is variable trade costs and F_{ir} is the fixed cost of exporting. The Pareto parameter γ governs the distribution of firm productivities. σ is the elasticity of substitution in preferences. θ_i is a remoteness measure for the importing country which captures trade diversion effects. The mechanism is that the further away i is from the rest of the world, the more likely that r could export more to i due to less competition from third party countries in the importer country. This has a similar interpretation to the multilateral resistance term in Anderson and Wincoop (2003).

We can relate data on trade flows to unobservable trade barriers by taking ratios of bilateral trade flows of two regions over local purchases of each of two countries:

$$\frac{X_{ir}X_{ri}}{X_{ii}X_{rr}} = \left(\frac{\tau_{ri}\tau_{ir}}{\tau_{ii}\tau_{rr}}\right)^{-\gamma}\left(\frac{F_{ri}F_{ir}}{F_{ii}F_{rr}}\right)^{-\left(\frac{\gamma}{\sigma-1}-1\right)} \tag{23}$$

This equation reveals the relationship between observable trade data and unobservable trade barriers and eliminates the need to worry about the omission of unspecified or unobserved trade barriers. If the fixed costs of exporting are not bilaterally differentiated ($F_{ri} = F_r$) or is they are constant across locations ($F_{ri} = F$), the fixed costs drop out of this measure and the measured trade costs would simply be interpreted as variable trade costs, as in models without fixed export costs such as Eaton and Kortum (2002) and Anderson and Wincoop (2003).

For simplicity of exposition, we normalize own trade costs to 1, i.e. $\tau_{ii} = 1$ and $F_{ii} = 1$. Defining the geometric average of trade costs between the country pair i and r as

$$t_{ir} = \left(\frac{X_{ir}X_{ri}}{X_{ii}X_{rr}}\right)^{-\frac{1}{2\gamma}} \tag{24}$$

we then get a measure of the average bilateral trade barrier between country i and r:

$$t_{ir} = \left(\frac{X_{ii}X_{rr}}{X_{ir}X_{ri}}\right)^{\frac{1}{2\gamma}} = (\tau_{ir}\tau_{ri})^{\frac{1}{2}}(F_{ri}F_{ir})^{\frac{1}{2}\left(\frac{1}{\sigma-1}-\frac{1}{\gamma}\right)} \tag{25}$$

Data for this equation is relatively easy to obtain, and so we have a comprehensive measure of trade barriers, and the ad valorem tariff-equivalent bilateral average trade cost between country i and r can be written as

$$\bar{t}_{ir} = t_{ir} - 1 = \left(\frac{X_{ii}X_{rr}}{X_{ir}X_{ri}}\right)^{\frac{1}{2\gamma}} - 1 \tag{26}$$

Using the trade costs equation above, we can calculate actual trade costs between

countries in our general equilibrium model, which are needed in building a benchmark data set for use in calibration and simulation.

4.3 Data and Results of Calculations

We need to calculate trade costs between each country pair for China, the US, Japan, other TPP countries (OTPPC) and ROW. OTPPC denotes the summation of 8 TPP countries: Australia, Brunei, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam. For the ROW, we use world total minus China, the US, Japan and OTPPC to yield the data we use in calculations.

For trade costs, in equation (26), X_{ir} and X_{ri} are separately exports and imports between countries i and r. This trade data is from the UN comtrade database, and total world trade data is from WTO International Trade Statistics 2011. Due to market clearing, intranational trade X_{ii} or X_{rr} can be rewritten as total income minus total exports (see equation (8) in Anderson and Wincoop(2003)),

$$X_{ii} = y_i - X_i \tag{27}$$

Where X_i is the total exports, defined as the sum of all exports from country i, which is

$$X_i \equiv \sum_{r,i\neq r} X_{ir} \tag{28}$$

This data is from the UN Comtrade database also. For y_i, GDP data are not suitable because they are based on value added, whereas the trade data are reported as gross shipments. In addition, GDP data include services that are not covered by the trade data (Novy, 2008). It is hard to get this income data according to such a definition, so here we use GDP data minus total service value added. We get GDP data from World

Bank database, and the service share of GDP data from World Development Indicators (WDI) of World Bank database, we then calculate results for GDP minus services. We take the value of γ to be 8.3 as in Eaton and Kortum (2002).

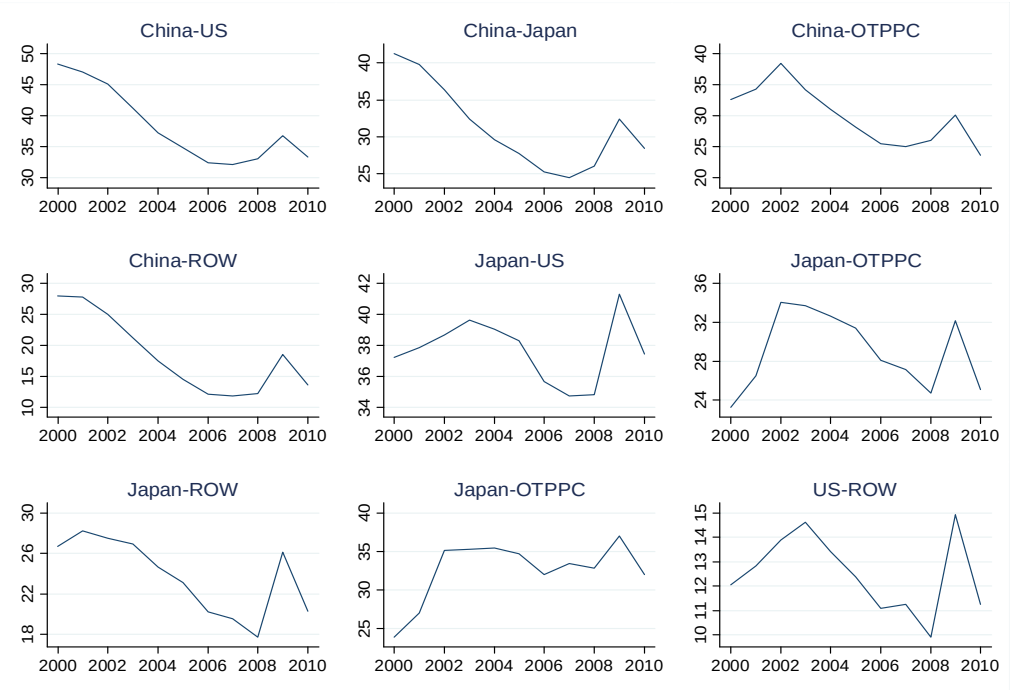
Table 2: Ad Valorem Tariff-Equivalent Trade Costs between Countries between 2000-2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
China-US	48.38	47.05	45.15	41.22	37.25	34.81	32.44	32.15	33.08	36.77	33.38
China-Japan	41.24	39.82	36.36	32.44	29.61	27.74	25.26	24.48	26.03	32.45	28.45
China-OTPPC	32.60	34.26	38.49	34.18	31.06	28.18	25.46	25.05	26.03	30.16	23.68
China-ROW	27.99	27.82	25.02	21.24	17.48	14.55	12.16	11.86	12.25	18.53	13.62
Japan-USA	37.22	37.84	38.67	39.63	39.04	38.31	35.65	34.74	34.80	41.32	37.43
Japan-OTPPC	23.26	26.51	34.06	33.70	32.65	31.39	28.11	27.16	24.70	32.14	25.09
Japan-ROW	26.69	28.21	27.48	26.93	24.64	23.12	20.23	19.51	17.74	26.14	20.26
USA-OTPPC	23.90	26.99	35.11	35.27	35.44	34.65	31.99	33.45	32.82	37.02	32.00
USA-ROW	12.06	12.83	13.89	14.63	13.41	12.39	11.09	11.25	9.93	14.92	11.26
OTPPC-ROW	7.51	10.59	17.22	16.19	14.71	13.29	10.69	10.99	9.69	15.49	9.35

Notes: (1) Units for above results are %; (2) OTPPC denotes other TPP countries except the US, including Australia, Brunei Darussalam, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam.

Source: Calculated by authors.

Fig 5 Ad Valorem Tariff-Equivalent Trade Costs between Countries (Unit: %)



Notes: OTPPC denotes other TPP countries except the US, including Australia, Brunei Darussalam, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam.

Source: Compiled by authors.

Results are shown in Table 2 and Figure 5. We only use trade cost data for 2010

in our numerical general equilibrium model, but to give more information on trade costs over time, we have also calculated trade costs from 2000 to 2010.

From the results, we can see that nearly all trade costs between countries have decreased as time passes; except in 2009, because of the financial crisis. All countries' trade costs increased in that year and then decreased again in 2010. For pairs of country trade costs, China-US trade costs are higher than China-Japan trade costs; and they are separately 33.38% and 28.45% (ad valorem tariff equivalent) in 2010. Japan-US trade costs are higher than China-US trade costs; they are separately 37.43% and 33.38% in 2010.

5. Data and Parameters Calibration

We use 2010 as our base year in building a benchmark general equilibrium dataset for use in calibration and simulation following the method set out in Shoven and Whalley (1992). There are five countries in our model, and the OTPPC data is obtained by adding Australia, Brunei, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam together, and ROW data is obtained from total world values minus values for China, US, Japan and OTPPC. For the two goods, we assume secondary industry (manufacturing) reflects tradable goods, and primary and tertiary industries (agriculture, extractive industries, and services) yield non-tradable goods. For the two factor inputs, capital and labor, we use total labor income (wage) to denote labor values for inputs by sector. All data are in billion US dollars. We adjust some of the data values for mutual consistency for calibration purposes.

Chinese data are from China data online. We use production and capital values to determine labor values by residual for China. US data are from the Statistics Database of Bureau of Economic Analysis (BEA), capital and labor data are from the input-output table. Japan, OTPPC and ROW data are all from World Bank database (World Development Indicate). We use agriculture and service share of GDP data and GDP data to yield production data of tradable goods and non-tradable goods, and use capital/GDP ratio to yield capital and labor input in production. We set the upper bound in our monetary structure, Y^0, to equal 1000 in all countries; and change this value in later sensitivity analysis to check its influence on simulation results. These

data are listed in Table 3.

Table 3 Base Year Data Used for Calibration and Simulation (2010 Data)

Item / Country		China	US	Japan	OTPPC	ROW
Production	Total	5931.2	14526.5	5458.8	1956.5	33852.8
	Tradable	2768.1	4832.5	1473.9	1153.4	11513.9
	Non-tradable	3163.1	9694	3984.9	803.1	22338.9
Capital	Tradable	2281.5	4158.3	1033.4	744.7	6743.5
	Non-tradable	1827	3950.7	2793.9	518.5	13083.6
Labor	Tradable	486.6	674.2	440.5	408.7	4770.4
	Non-tradable	1336.1	5743.3	1191.0	284.6	9255.3
Inside Money	Y_i	181.8	-689.5	77.3	107.3	323.1
	Y^0	1000	1000	1000	1000	1000
	y_i	1181.8	310.5	1077.3	1107.3	1323.1
Endowment	capital	4108.5	8109	3827.3	1263.2	19827.1
	labor	1822.7	6417.5	1631.5	693.3	14025.7

Note: (1) Units for production, capital, labor, inside money and endowments are all billion US$, and labor here denotes factor income (wage). (2) We sum data for Australia, Brunei, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam to get OTPPC data. (3) We use world values minus China, US, Japan and OTPPC to generate ROW values.

Sources: Chinese data from China data online; US data from the Statistics database of Bureau of Economic Analysis (BEA); Japan, OTPPC and ROW data are all calculated from WDI of World Bank database.

Trade data between each pair of countries are from the UN Comtrade database. We use individual country total export and import values to indirectly yield exports to and imports from the ROW. Using production and trade data, we can then calculate each country's consumption values. All trade data are listed in Table 4.

Table 4: Trade between Countries (Unit: Billion USD)

Countries		Exporter				
		China	US	Japan	OTPPC	ROW
Importer	China	/	102.7	176.7	172.0	944.6
	US	283.8	/	123.6	85.0	1474.1
	Japan	121.0	60.5	/	100.1	411.0
	OTPPC	121.2	89.2	72.7	/	585.0
	ROW	1051.8	1024.6	396.9	618.3	/

Notes: (1) OTPPC denotes other TPP countries except the US, including Australia, Brunei Darussalam, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam. (2) We get OTPPC trade data by adding all eight other TPP countries' trade data together. (3) We get the ROW trade data by deducting from each country's total export, total import and total world trade value.

Source: United Nations (UN) Comtrade database.

We divide trade costs into two parts, import tariffs and all other non-tariff barriers. We obtain each country's import tariff data from WTO Statistics Database.

For ROW, we cannot obtain its import tariff directly, and so we use European Union's tariff rate to denote these values. We calculate all other non-tariff barriers by using trade costs (in Table 2) minus import tariffs. All import tariffs and other non-tariff barrier values are listed in Tables 5 and 6.

Table 5: Import Tariffs for Countries in 2010 (Unit: %)

Countries	China	US	Japan	Other TPP Countries	ROW
Import Tariff	9.6	3.5	4.4	4.6	5.1

Notes: (1) Import tariffs here are simple average MFN applied tariff rates; (2) Tariffs for other TPP countries are the average tariff of 8 TPP member countries (except the US); (3) We use the import tariff of European Union to denote the tariff for the ROW.

Source: World Development Indicate (WDI) of World Bank database.

Table 6: Other Trade Costs Except Import Tariff (Ad Valorem Tariff-Equivalents)

Countries		Exporter				
		China	US	Japan	OTPPC	ROW
Importer	China	/	23.8	18.9	14.1	4.0
	US	29.9	/	33.9	28.5	7.8
	Japan	24.1	33	/	20.7	15.9
	OTPPC	19.1	27.4	20.5	/	4.8
	ROW	8.5	6.2	15.2	4.3	/

Notes: (1) Units are %; (2) OTPPC denotes other TPP countries except the US, including Australia, Brunei Darussalam, Chile, Malaysia, New Zealand, Peru, Singapore and Vietnam.

Source: Calculations by authors.

Table 7 Parameters Generated by Calibration

Variable/Country		China		US		Japan		OTPPC		ROW	
		T.	N-T.	T.	N-T.	T.	N-T.	T.	N-T.	T.	N-T.
Share Parameters in Production	K	0.684	0.539	0.713	0.453	0.605	0.605	0.574	0.574	0.543	0.543
	L	0.316	0.461	0.287	0.547	0.395	0.395	0.426	0.426	0.457	0.457
Scale Parameters in Production		1.761	1.988	1.693	1.983	1.916	1.916	1.957	1.957	1.985	1.985

		Consumption Side				
		China	US	Japan	OTPPC	ROW
Consumption Share Parameters for Level 2	Products From					
	China	0.378	0.081	0.112	0.139	0.113
	US	0.058	0.567	0.065	0.117	0.105
	Japan	0.093	0.037	0.398	0.085	0.048
	OTPPC	0.084	0.024	0.089	0.134	0.061
	ROW	0.387	0.291	0.336	0.525	0.673
Consumption Share Parameters for Level 1	Composite T.	0.429	0.394	0.267	0.424	0.340
	N-T.	0.411	0.587	0.573	0.225	0.622
	Inside Money	0.160	0.019	0.160	0.351	0.038

Note: T denotes tradable goods; N-T denotes non-tradable goods.

Source: Calculated using the model structure above and calibration methods cited above by the authors.

There are no available estimates of elasticities for individual countries on the demand and production sides of the model. Many of the estimates of domestic and import goods substitution elasticity are around 2 (Betina *et al*, 2006), so we set all these elasticities in our model to 2 (Whalley and Wang, 2010). We change these elasticities later in sensitivity analysis to check their influence on simulation results.

With these data, we calibrate the model parameters and report parameter values in Table 7. When used in model solution these will regenerate the benchmark data as an equilibrium for the model. Then, using these parameters we can simulate the effects of TPP changes under different scenarios.

6. Simulation Results

We report counterfactual simulation results in this part to assess the potential effects of TPP on China and other countries under different scenarios. In our model, we divide trade costs into two parts, import tariffs and other all non-tariff barriers. According to the TPP negotiation targets, the aim is to set up a free trade area, and for import tariffs to be completely eliminated among participants after the negotiation of the TPP. In the meanwhile, TPP negotiations will focus on institutional areas, technical and standard barriers, investment, services and other impediments, which implies other all non-tariff barriers will be reduced and, in the long run, even completely removed. In our simulation analysis, we first assume that the TPP will completely eliminate tariff barriers (free trade), and then either partially (with weights denoting the percentage by which non-tariff barriers will be reduced) or completely eliminate other all non-tariff barriers. We focus on effects on production, welfare (utility), export, import and revenue and trade imbalances, and use percentage changes compared to 2010 data to show these effects.

6.1 Potential Effects of TPP on China and Other Countries

We initially use two different scenarios to capture TPP effects, the first assumes TPP eliminates all trade costs (including tariff and other all non-tariff barriers) between members; the second assumes TPP only eliminates tariffs between member countries. Table 8 and Figure 6 show these results.

For China, production, welfare, import and revenue all will be negatively affected,

but exports and the trade imbalance increase. Under whole trade costs elimination, these effects are stronger than only under import tariff elimination. When all trade costs are removed, China's welfare will decrease -0.056%, production will decrease -0.042%, imports will decrease -0.171% and revenues will decrease about -0.172%; meanwhile, exports and the trade imbalance will separately increase 0.132% and 2.439%. But when only import tariffs are removed, China's welfare, production, import and revenue separately decline by -0.011%, -0.009%, -0.035% and -0.035%; and exports and the trade imbalance improve separately by 0.04% and 0.609%. This suggests that TPP initiatives could have negative effects on China but the impacts are not severe.

Table 8 TPP Effects on Individual Countries and the World (Units: % Change)

Item / Countries	China	US	Japan	OTPPC	ROW	World
Whole Trade Costs Elimination						
△Welfare	-0.056	0.224	-0.015	1.434	-0.022	0.095
△Production	-0.042	0.872	0.053	3.640	-0.027	0.371
△Export	0.132	4.952	-0.016	5.609	-0.063	1.468
△Import	-0.171	3.223	-0.036	7.026	-0.130	1.468
△Imbalance	2.439	0.009	0.171	-6.052	0.572	0.009
△Revenue	-0.172	-4.241	-0.036	-10.755	-0.130	-1.778
Only Import Tariff Elimination						
△Welfare	-0.011	0.004	-0.002	0.051	-0.004	0.000
△Production	-0.009	0.059	0.016	0.137	-0.004	0.019
△Export	0.040	0.468	0.002	0.364	0.001	0.127
△Import	-0.035	0.298	0.001	0.607	-0.014	0.127
△Imbalance	0.609	-0.020	0.011	-1.636	0.143	-0.020
△Revenue	-0.035	-4.256	0.000	-10.411	-0.015	-1.661

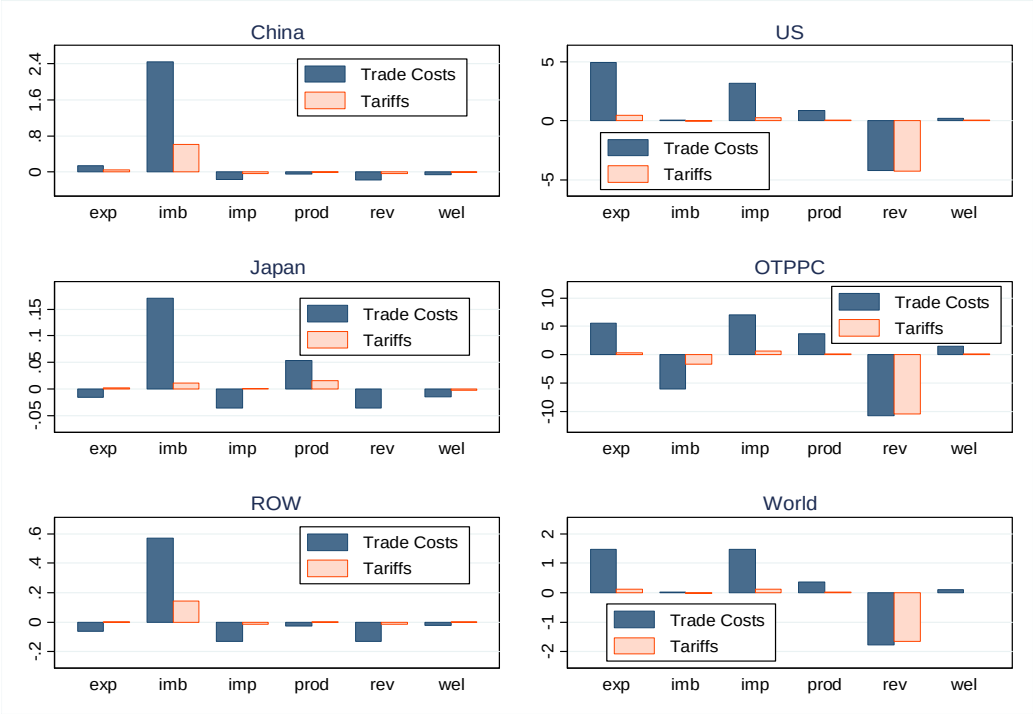
Note: Changes in welfare (△Welfare) equal the change in total utility; In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Source: Calculated and compiled by authors.

TPP member countries, US and other TPP countries (OTPPC), both gain from the FTA agreement. Their production, welfare, export and import all increase and only revenues decrease. Comparatively, OTPPC will gain more than the US. For Japan, its

total production will increase (gain) but welfare will decrease (lose); revenue, export and import all will decrease (lose) but their trade surplus will increase also. ROW will lose comprehensively, its total production, welfare, export, import and revenue all decrease and only their trade surplus will increase. Total world production, welfare and trade all increase.

Fig. 6 TPP Effects on Individual Countries



Note: (1) Units for above results are %. (2) The “exp” denotes export, “imp” denotes import, “imb” denotes imbalance, “prod” denotes production, “rev” denotes revenue, “wel” denotes welfare. (3) Trade Costs denote the case where TPP eliminate all trade costs between members; Tariffs denote the case where TPP eliminates just import tariffs between members.

Source: Calculated and compiled by authors.

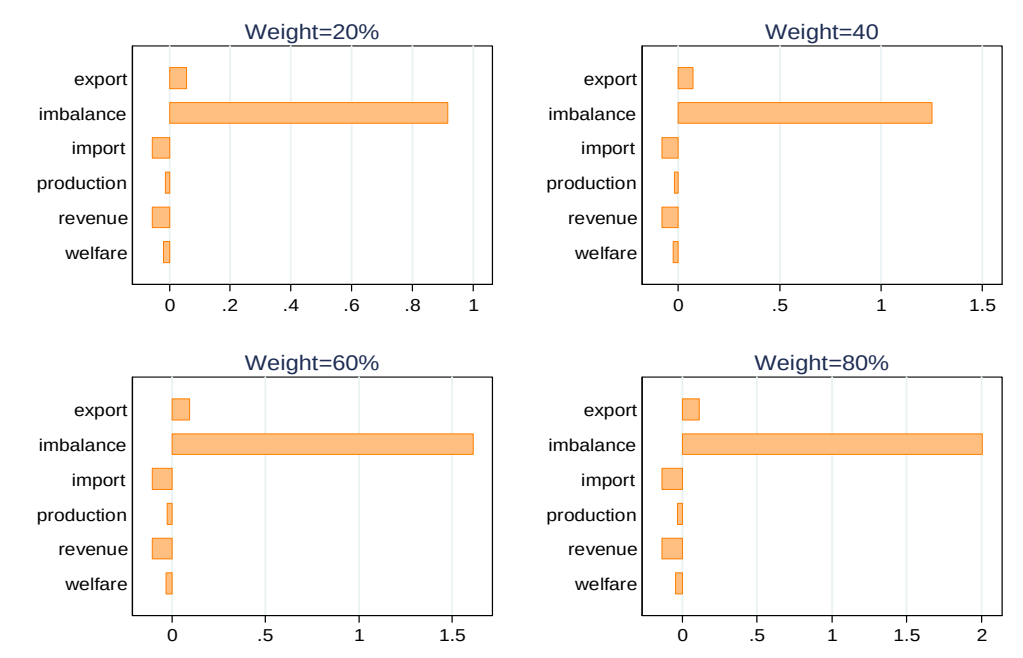
In general, present TPP initiatives are beneficial for member countries, but will hurt other countries outside of the organization like China, Japan and ROW. Although this kind of regional FTA is good for regional trade liberalization but may form another kind of protectionism to outside countries. Additionally, the effects of current cooperation among TPP countries are small because trade between these member countries is not very big. In the meanwhile, present TPP negotiations have not yet

reached agreement and they may need a long time to negotiate and may even not reach agreement. Therefore, the TPP initiative for now does not provide a major economic challenge to China and other non-TPP countries.

6.2 Effects of TPP under Giving Weights to Non-tariff Barriers Elimination

Other non-tariff barriers include transportation costs and some other costs that cannot be reduced by a TPP negotiation, such as added transportation costs, so it may not be realistic to assume that a TPP can remove all other non-tariff barriers. We therefore give weights to other non-tariff barriers elimination by assuming that TPP just removes part of non-tariff barriers. We use weights 20%, 40%, 60% and 80% to explore four different cases, which means that TPP can remove separately 20%, 40%, 60% and 80% of other all non-tariff trade barriers. We report these results in Table 9 and Figure 7.

Fig. 7 TPP Effects on China When Non-tariff Barriers Are Just Partially Eliminated



Note: (1) Units for above results are %.

Sources: Compiled by authors.

Table 9 TPP Effects When Weights Given to Non-tariff Barrier Elimination (%)

Item / Countries	China	US	Japan	OTPPC	ROW	World	Item / Countries	China	US	Japan	OTPPC	ROW	World
		Weights = 20%							**Weights = 60%**				
△Welfare	-0.019	0.04	-0.004	0.277	-0.007	0.016	△Welfare	-0.035	0.123	-0.009	0.797	-0.013	0.051
△Production	-0.014	0.176	0.022	0.633	-0.007	0.069	△Production	-0.027	0.469	0.036	1.889	-0.016	0.195
△Export	0.056	1.131	-0.001	1.123	-0.009	0.324	△Export	0.091	2.761	-0.007	3.017	-0.032	0.81
△Import	-0.057	0.729	-0.005	1.55	-0.033	0.324	△Import	-0.109	1.793	-0.018	3.879	-0.076	0.81
△Imbalance	0.917	-0.017	0.036	-2.389	0.215	-0.017	△Imbalance	1.613	-0.007	0.094	-4.077	0.378	-0.007
△Revenue	-0.057	-4.251	-0.003	-10.471	-0.033	-1.679	△Revenue	-0.109	-4.243	-0.019	-10.6	-0.076	-1.723
		Weights = 40%							**Weights = 80%**				
△Welfare	-0.027	0.08	-0.007	0.524	-0.01	0.033	△Welfare	-0.045	0.171	-0.012	1.098	-0.018	0.072
△Production	-0.02	0.311	0.029	1.211	-0.012	0.127	△Production	-0.034	0.654	0.044	2.689	-0.022	0.275
△Export	0.073	1.889	-0.004	1.999	-0.02	0.549	△Export	0.11	3.771	-0.011	4.207	-0.047	1.113
△Import	-0.082	1.224	-0.011	2.631	-0.053	0.549	△Import	-0.139	2.452	-0.027	5.328	-0.101	1.113
△Imbalance	1.25	-0.013	0.065	-3.201	0.293	-0.013	△Imbalance	2.007	0	0.132	-5.025	0.471	0
△Revenue	-0.082	-4.245	-0.01	-10.533	-0.053	-1.7	△Revenue	-0.138	-4.241	-0.026	-10.675	-0.101	-1.748

Note: (1) Units for all results are %. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Source: Calculated and compiled by authors.

TPP impacts are similar to those in Table 8, but the intensity of the effects becomes stronger as weights increase. We can take China's welfare variations as an example. This will change separately by -0.019%, -0.027%, -0.035% and -0.045% when weights equals 20%, 40%, 60% and 80%. In summary, TPP effects shown in this part are as follows: China, Japan and ROW will have a reduction in total production, welfare and trade. The US and OTPPC will gain from this FTA agreement. Total world production and welfare will increase. All countries' revenue will decrease.

TPP effects are relatively robust even if we assume that TPP can just partially remove other non-tariff barriers. For the TPP influence on China which we focus on in this paper, it is clear that it will hurt China, but the effects are not severe. Meanwhile, it is China's exports will increase and imports will decrease which means that the trade surplus will increase. This result comes in part from the import increase by ROW from China.

6.3 Sensitivity Analysis of TPP Effects

We perform sensitivity analysis by changing the values of elasticities and upper bound money to check the robustness of TPP effects. We change elasticities in both production and consumption to separately equal 0.6, 1.6 and 2.6, and change the upper bound Y^0 to 2000, 3000, and 4000. We then recalibrate parameters and simulate TPP effects. For simplicity, we only check the sensitivities of TPP effects for the whole trade costs elimination case, which is the main result for this paper. These results are reported in Table 10 and Figure 8.

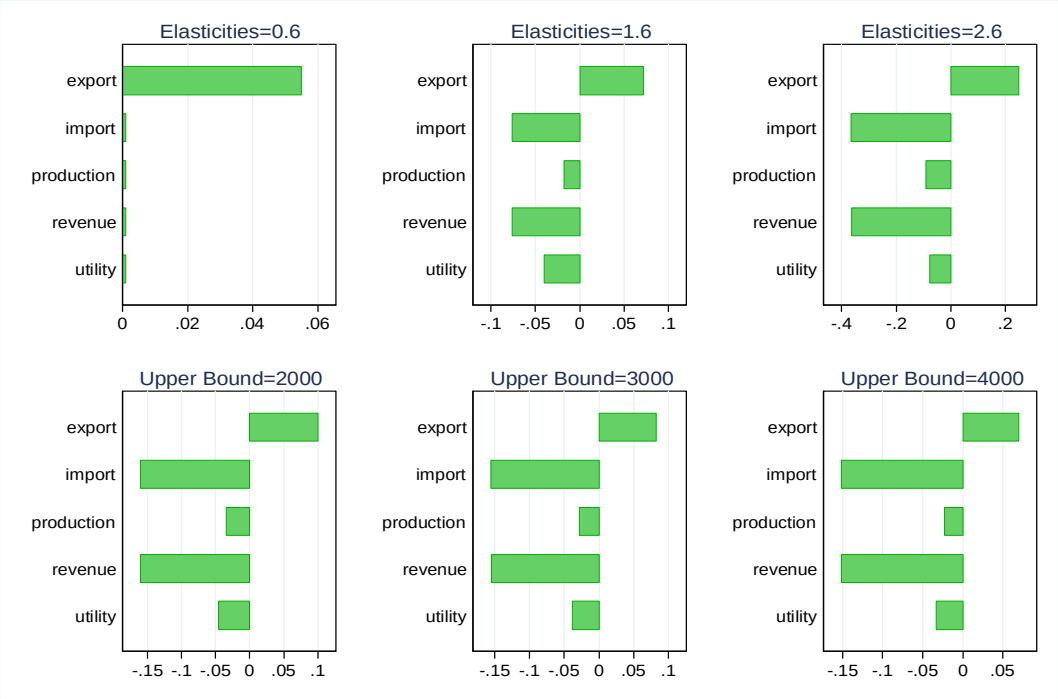
Table 10 Sensitivity Analysis for Whole Trade Costs Elimination Results (%)

Item / Countries	China	US	Japan	OTPPC	ROW	World	Item / Countries	China	US	Japan	OTPPC	ROW	World
		Elasticity=0.6[5]							**Upper Bound=2000**				
△Welfare	0.001	0.176	0.02	0.578	0.021	0.079	△Welfare	-0.045	0.21	-0.017	1.083	-0.022	0.089
△Production	0.001	0.314	0.01	1.883	-0.011	0.165	△Production	-0.034	0.878	0.049	3.573	-0.023	0.372
△Export	0.055	1.378	0.076	1.31	0.058	0.422	△Export	0.1	4.956	0.009	5.565	-0.058	1.461
△Import	0.001	0.884	0.045	1.729	0.035	0.422	△Import	-0.16	3.187	-0.106	7.168	-0.156	1.461
△Imbalance	0.472	-0.031	0.355	-2.082	0.275	-0.031	△Imbalance	2.077	-0.089	1.092	-7.622	0.862	-0.089
△Revenue	0.001	-4.211	0.046	-10.386	0.035	-1.619	△Revenue	-0.16	-4.272	-0.107	-10.631	-0.156	-1.782
		Elasticity=1.6[5]							**Upper Bound=3000**				
△Welfare	-0.04	0.212	-0.013	1.288	-0.018	0.09	△Welfare	-0.038	0.198	-0.017	0.87	-0.022	0.084
△Production	-0.018	0.69	0.027	3.022	-0.013	0.306	△Production	-0.028	0.88	0.044	3.534	-0.02	0.372
△Export	0.072	3.795	0.008	4.505	-0.015	1.161	△Export	0.082	4.96	0.016	5.538	-0.053	1.458
△Import	-0.076	2.464	-0.005	5.443	-0.05	1.161	△Import	-0.155	3.166	-0.132	7.253	-0.173	1.458
△Imbalance	1.197	-0.01	0.132	-3.179	0.313	-0.01	△Imbalance	1.887	-0.148	1.419	-8.568	1.071	-0.148
△Revenue	-0.076	-4.25	-0.007	-10.524	-0.05	-1.696	△Revenue	-0.154	-4.289	-0.133	-10.554	-0.172	-1.784
		Elasticity=2.6[5]							**Upper Bound=4000**				
△Welfare	-0.078	0.244	-0.018	1.636	-0.027	0.103	△Welfare	-0.033	0.187	-0.016	0.727	-0.022	0.079
△Production	-0.091	1.181	0.105	4.702	-0.053	0.48	△Production	-0.023	0.88	0.04	3.509	-0.017	0.372
△Export	0.249	6.897	-0.082	7.369	-0.163	1.966	△Export	0.07	4.961	0.019	5.52	-0.048	1.456
△Import	-0.365	4.505	-0.105	9.656	-0.29	1.966	△Import	-0.151	3.153	-0.145	7.308	-0.185	1.456
△Imbalance	4.901	0.054	0.133	-11.579	1.043	0.054	△Imbalance	1.763	-0.181	1.569	-9.196	1.234	-0.181
△Revenue	-0.364	-4.226	-0.104	-11.207	-0.29	-1.94	△Revenue	-0.151	-4.3	-0.143	-10.51	-0.185	-1.786

Note: (1) Units for all results are %. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level. (4) Inside money change with 1000 variation is a suitable change for sensitivity analysis. (5) These cases refer to changes in both production and consumption elasticities, and in all countries.

Source: Calculated and compiled by authors.

Fig. 8 Sensitivity Analysis Results For TPP Effects to China



Note: (1) Units for above results are %.

Sources: Compiled by authors.

Comparing sensitivity results with the basic results in Table 8, we find that all impacts (positive or negative) are of the same sign except for production, import and revenue changes for China, welfare changes for Japan, and welfare, export and import changes for ROW under elasticities equal to 0.6. These results suggest that TPP impact results on China and other countries are reasonably reliable and robustness.

We take the effects on China as an example to compare different influences under different elasticities and upper bound money values (Figure 8). We find that China's production will decrease except when elasticities equal 0.6, welfare will decrease and change between -0.018 and -0.091 except when elasticities equal 0.6, export will increase expect when elasticities are small (0.6), imports will decrease except when elasticities equal 0.6, and revenues will decrease except when elasticities equal 0.6.

All sensitivity analyze results show TPP effects are beneficial for member

countries but adverse for countries out of TPP. Total world production and welfare improved.

6.4 Effects When Japan Joins in TPP

Japan has already decided to negotiate to join in TPP. As one of big developed countries, its joining TPP will influence the global economy significantly. We thus further explore the effects if Japan joins in. We do this by scenario simulation and report these results in Table 11 and Figure 9. We divide this scenario into three cases: whole trade costs elimination, 50% non-tariff barrier elimination and only tariff elimination.

Simulation results show that China will be adversely affected by TPP, and this loss is larger than the case if Japan does not participate in the TPP. Specifically China's production and welfare decrease are about -0.056% and 0.084% in the whole trade costs elimination case. These effects will weaken if TPP is partially eliminated non-tariff barriers or only import tariff barriers are eliminated. A difference from the results when Japan does not join in TPP, is that China's exports, imports and trade imbalance all will be reduced after Japan's participation. Revenue for China will d**e**crease also.

For TPP member countries, the US, Japan and OTPPC all gain from the FTA, but comparatively the US and OTPPC gain more when Japan does not take part. Specifically, the US, Japan and OTPPC will separately increase production by 1.981%, 7.166% and 6.043%; and will separately increase welfare by 0.51%, 1.057% and 2.461% in a whole trade costs elimination case. But these member countries' revenues

all decrease. As a country out of TPP, the ROW will suffer in terms of welfare, production, export, import, trade imbalance and revenue impacts. Total world production and welfare will increase from Japan's participation in TPP. Additionally TPP effects under whole trade costs elimination are the strongest, whole effects under partial non-tariff barrier elimination are the second strongest. Effects under tariff elimination only are the least.

Table 11 TPP Effects When Japan Joins TPP (%)

Item / Countries	China	US	Japan	OTPPC	ROW	World
Whole Trade Cost Elimination						
△Welfare	-0.084	0.510	1.057	2.461	-0.056	0.288
△Production	-0.056	1.981	7.166	6.043	-0.101	1.189
△Export	-0.371	9.783	17.195	10.049	-0.584	4.110
△Import	-0.244	6.626	17.011	11.775	-0.582	4.110
△Imbalance	-1.345	0.758	18.929	-4.154	-0.601	0.758
△Revenue	-0.244	-12.120	-22.205	-18.987	-0.583	-5.561
Non-tariff Barriers Elimination Given Weight 50%						
△Welfare	-0.052	0.224	0.467	1.165	-0.030	0.126
△Production	-0.036	0.844	3.260	2.690	-0.050	0.521
△Export	-0.124	4.410	7.862	4.721	-0.265	1.894
△Import	-0.155	2.983	7.912	5.646	-0.282	1.894
△Imbalance	0.108	0.330	7.389	-2.892	-0.106	0.330
△Revenue	-0.154	-11.236	-22.780	-18.873	-0.282	-5.313
Only Tariff Elimination						
△Welfare	-0.025	0.000	0.017	0.133	-0.009	0.000
△Production	-0.018	0.106	0.567	0.340	-0.012	0.072
△Export	0.039	0.808	1.441	0.902	-0.036	0.369
△Import	-0.075	0.533	1.621	1.237	-0.059	0.369
△Imbalance	0.907	0.021	-0.253	-1.849	0.192	0.021
△Revenue	-0.075	-10.619	-23.167	-18.786	-0.059	-5.128

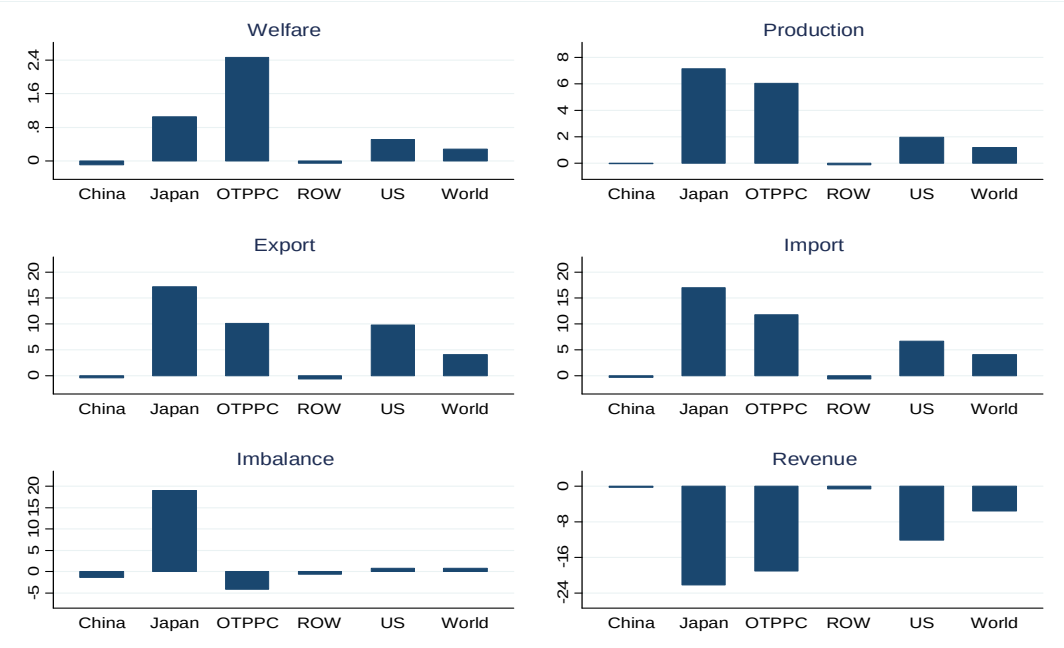
Note: (1) Units for all results are %. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Source: Calculated and compiled by authors.

In summary, China and ROW will suffered for an alleviation of TPP. On the contrary, TPP member countries, including the US, Japan and OTPPC all gain. Comparatively in proportional terms OTPPC gains the most, Japan gains second, and

the US gains the least. Therefore, Japan's joining TPP will negatively affect China, but good for both Japan and present TPP member countries.

Fig. 9 TPP Effects When Japan Joins TPP Under Whole Trade Costs Elimination



Note: (1) Units for above results are %. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Sources: Compiled by authors.

6.5 Comparing the Effects of TPP Free Trade and Global Free Trade

We compare the effects of TPP free trade and global free trade in this part and report simulation results in Table 12 which shows changes under global free trade relative to the benchmark situation. Figure 10 compares effects of TPP free trade and global free trade.

It is clear that global free trade will benefit both China and all other countries. For China, its welfare will increase by 2.57%, production by 10.89%, export by 37.4%, imports by 33.9% and trade balance increase by 63.7% for the whole trade costs elimination case. But under only tariff elimination, China's imbalance will decrease by about -31.3%.

All other countries will benefit from global free trade. For the whole trade costs elimination case, the welfare of the US, Japan, OTPPC, ROW and the world will increase separately by about 1.6%, 3.2%, 6.3%, 0.7% and 1.6%. These gains are much higher than for a TPP regional free trade agreement.

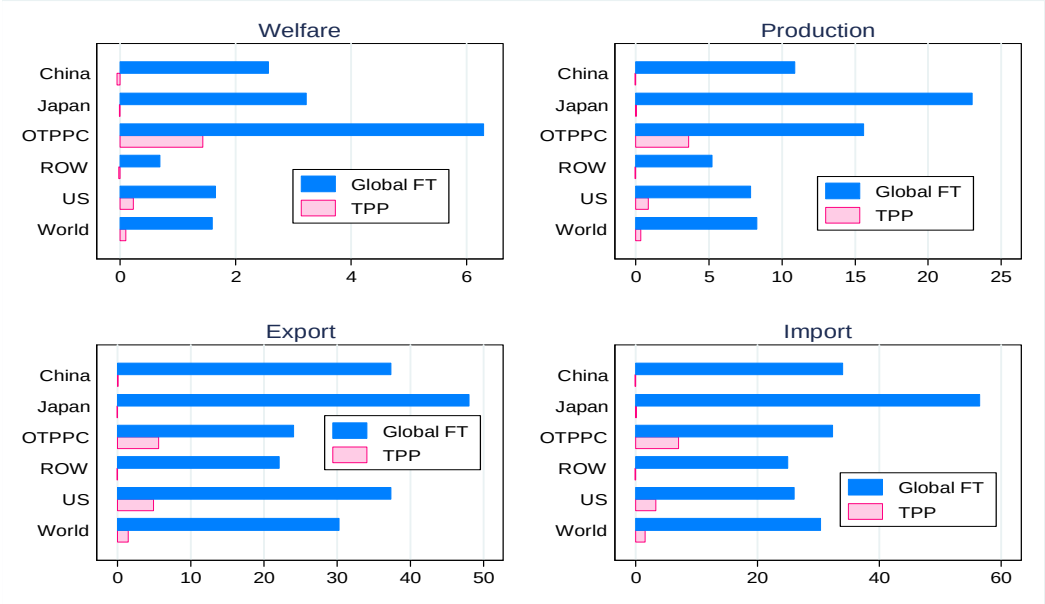
Table 12 Effects of Global Free Trade (%)

Item / Countries	China	US	Japan	OTPPC	ROW	World
Whole Trade Costs Elimination						
△Welfare	2.571	1.649	3.226	6.289	0.692	1.593
△Production	10.889	7.839	23.001	15.581	5.215	8.282
△Export	37.354	37.340	48.028	24.083	22.123	30.275
△Import	33.901	26.003	56.434	32.337	24.884	30.275
△Imbalance	63.654	4.929	-31.022	-43.848	-4.170	4.929
Only Tariff Elimination						
△Welfare	0.035	-0.050	-0.002	0.715	0.004	0.025
△Production	3.580	1.291	2.738	2.794	1.672	1.963
△Export	8.736	9.724	9.087	8.133	9.178	9.042
△Import	13.996	6.037	7.055	7.701	9.540	9.042
△Imbalance	-31.319	-0.815	28.201	11.689	5.726	-0.815

Note: (1) Units for all results are % change. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Source: Calculated and compiled by authors.

Fig. 10 Comparison of Effects of Global Free Trade and TPP



Note: (1) Units for above results are % change. (2) Global FT denotes global free trade, TPP denotes Trans-Pacific Partnership.

Sources: Compiled by authors.

There are some differences between the TPP effects and global free trade effects. Firstly, global free trade will increase all country's trade, production and welfare, but TPP just benefits member countries but hurts other countries outside of the TPP. Secondly, global free trade effects are much stronger and more significant than TPP effects. We also find that small countries will gain more from free trade and big countries will gain less, whether this trade freedom is global or regional.

6.6 The Effects of China's Becoming A TPP Member

China is a big country in APEC and one of main trade partner countries with present TPP member countries. So it is helpful to explore the potential effects of China's joining TPP. We report results for this scenario simulation in Table 13 and Figure 11. We evaluate this scenario in three separate subcases: whole trade cost elimination, 50% non-tariff barriers elimination, and only import tariff elimination.

Table 13 Effects From China participating in TPP (% Change)

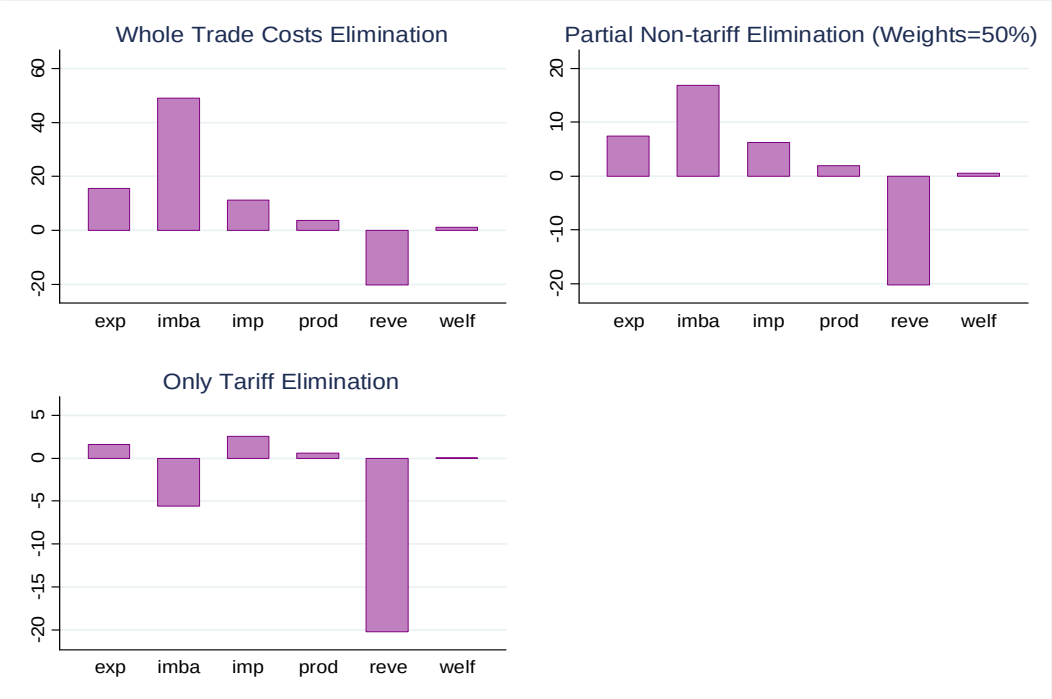
Item / Countries	China	US	Japan	OTPPC	ROW	World
Whole Trade Cost Elimination						
△Welfare	1.125	0.731	0.128	3.459	-0.093	0.398
△Production	3.816	2.963	1.231	8.011	-0.176	1.560
△Export	15.603	12.862	-2.145	11.162	-1.434	5.664
△Import	11.218	9.282	1.541	15.644	-1.022	5.664
△Imbalance	49.005	2.627	-36.803	-25.725	-5.350	2.627
△Revenue	-20.117	-22.084	1.540	-23.887	-1.023	-12.258
Non-tariff Barriers Elimination Weight Given 50%						
△Welfare	0.505	0.332	0.024	1.754	-0.057	0.177
△Production	1.967	1.324	0.427	3.846	-0.098	0.726
△Export	7.497	6.279	-0.844	6.228	-0.653	2.875
△Import	6.273	4.500	0.433	7.882	-0.549	2.875
△Imbalance	16.815	1.192	-12.854	-7.378	-1.640	1.192
△Revenue	-20.173	-20.093	0.432	-23.919	-0.549	-11.866
Only Tariff Elimination						
△Welfare	0.006	0.004	-0.034	0.369	-0.026	0.001
△Production	0.590	0.212	-0.070	0.806	-0.035	0.142
△Export	1.602	1.704	0.015	2.474	-0.090	0.851

△Import	2.544	1.064	-0.218	2.155	-0.175	0.851
△Imbalance	-5.567	-0.124	2.206	5.104	0.717	-0.125
△Revenue	-20.178	-18.689	-0.218	-24.016	-0.175	-11.562

Note: (1) Units for all results are % change. (2) The change in welfare (△Welfare) equal the change in total utility. (3) In order to show total world unbalance situation change, we use the sum of all countries' absolute imbalance values change (△Imbalance for world) to reflect effects to world unbalance level.

Source: Calculated and compiled by authors.

Fig. 11 Effects on China of China's Joining TPP



Note: (1) Units for above results are %. (2) The "exp" denotes export, "imba" denotes imbalance, "imp" denotes import, "prod" denotes production, "rev" denotes revenue, "welf" denotes welfare.

Sources: Compiled by authors.

From these results, it seems clear that China will benefit from TPP participation (see Figure 11). On production side, China will increase output separately by 3.816%, 1.967% and 0.59% under the three different trade costs elimination cases. On the welfare side, China will gain about 1.125% under whole trade costs elimination situation. Trade for China also will increase significantly under TPP participation.

Other TPP member countries, the US and OTPPC will all gain in terms of total production, welfare, export and import. Countries outside of TPP (ROW) will lose in

production, welfare, export and import. Total world production, welfare and trade will all rise which suggests that regional trade liberalization will in aggregate benefit global trade and welfare. Japan is a different case in that although not a member of TPP, still gains in production, welfare and trade. Comparing specific impacts on TPP member countries, OTPPC will gain the most, China the second, the US the third and Japan the least. TPP effects will increase as trade costs decrease more.

These results thus suggest that China will gain if China joins TPP and China's engagement will further improve other TPP member countries' production and welfare.

7. Conclusions and Remarks

We explore the potential effects of a Trans-Pacific Partnership (TPP) negotiation on participant and non-participant countries, stressing the effects on China. We use a general equilibrium model with monetary structure incorporating inside money to yield an endogenously determined trade surplus, and also numerically calibrate to 2010 data in a five country single period global general equilibrium model covering China, US, Japan, Other TPP countries (OTPPC) and the rest of world (ROW) in which large trade imbalances occur. We calculate trade costs using a revised gravity model method following Novy (2008) and Wong (2012). We incorporate trade costs in the numerical general equilibrium model and explore potential TPP effects on China and other countries. We capture possible TPP effects by considering six cases. These are: (1) TPP effects under complete removal of tariff and non-tariff barriers against each other; (2) TPP effects under partial other non-tariff barriers removal; (3) sensitivity analysis with changing elasticities and an upper bound parameter in the monetary structure; (4) TPP effects if Japan joins; (5) Comparison of TPP and global free trade effects; (6) TPP effects if China joins.

Our simulation results reveal that present TPP arrangements will hurt China and other non-TPP member countries, including Japan and the rest of world, but benefit TPP member countries. Total world production and welfare will improve because of these regional trade liberalization effects. These effects will be more significant as trade liberalization deepening occurs. If Japan joins TPP, China will suffer further

compared with a TPP without Japan. But Japan and other TPP countries will gain. When China joins TPP initiative, all countries will benefit except ROW, and China's total production will increase by about 3.8%, welfare will increase about 1.1% and trade increase more than 10% under complete trade costs removal. Effects from a comparison of TPP and global free trade suggest that global free trade is beneficial to all countries, not like TPP (regional free trade) which just benefits member countries but hurt others. Global free trade effects are much stronger than TPP effects.

TPP will hurt non-member countries' including China, but these negative effects are not strong, so that China may not need to worry too much about TPP's influence. Japan can gain from TPP participation; but this will hurt China further. China will gain if she joins TPP, and it will benefit other countries in TPP for China is an important trade partner for them. Therefore TPP may become more important and have more influence if China can become a member. As a regional free trade arrangement, TPP will benefit member countries and contribute to global total production and welfare but will hurt non-member countries. TPP, in some form may function as a kind of regional trade protectionism instrument, and so ultimately it is global free trade that will benefit all countries.

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