Numerical General Equilibrium Analysis of China's Impacts from Possible Mega Trade Deals*

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* We are grateful to the Ontario Research Fund and to The Centre for International Governance Innovation (CIGI) for financial support.

October, 2014

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Abstract

This paper explores the potential impacts on both China and other major countries of possible mega trade deals. These include the Trans-Pacific Partnership (TPP), the Regional Comprehensive Economic Partnership (RCEP), and various blocked deals. We use a numerical 13-country global general equilibrium model with trade costs to investigate both tariff and non-tariff effects, and include inside money to endogenously determine imports on the trade imbalance. Trade costs are calculated using a method based on gravity equations. Simulation results reveal that all FTA participation countries will gain but all FTA non-participation countries will lose. If non-tariff barriers are reduced more, the impacts will be larger. All effects to China on welfare, trade, export and import are positive. Comparatively China-TPP and RCEP will yield the highest welfare outcomes for the US in our model, China-Japan-Korea FTA will generate the second highest welfare outcome, and China-US FTA will generate the third highest welfare outcome. For the US, China-TPP FTA will generate the highest welfare outcome. For the EU, all China involved mega deals have negative impacts except China-US FTA. For Japan, RCEP will generate the highest welfare outcome. For both Korea and India, RCEP will generate the highest welfare outcome.

Keywords: Mega Trade Deal; China; General Equilibrium; Impacts

JEL Classification: F53, F47, C68

1. Introduction

The term "mega deal" has been widely used in relation to large prospective trade deals between the US and Europe (the Transatlantic Trade and Investment Partnership, TTIP) and in Asia and the Pacific (Trans-Pacific Partnership, TPP) (see Felbermayr *et al* (2013), Plummer (2013), Stoler (2013), and Hengel (2013)). Here we argue that the phenomenon of mega deal is much broader than just these two (TPP and TTIP). Big countries, like the US, the EU, China, Japan and India, engaged regional trade agreement (RTA) or bilateral free trade agreement (FTA) may all be able to conclude deals in the mega category. As the second largest country and the biggest export country in the world, China's involved mega deals may have influential impacts both on herself and the world. Until now, China has been excluded from the TPP and TTIP negotiation,

but China is active in both negotiating and trying to initiate new mega deals like Regional Comprehensive Economic Partnership (RCEP) and China-Japan-South Korea Free Trade Agreement (CJK FTA). Meanwhile, some other big mega deals may be negotiated in the future like China-TPP FTA and China-US FTA. This paper aims to explore the potential impacts on China of possible mega trade deals with computational general equlibirum methods.

The impacts of mega trade deals, stressed by traditional trade theory, include both the benefits of improved and more secure access to export markets abroad, and the benefits to both consumers and producers at home of increased specialization and improved variety and quality of products imported, reduced in price by the reductions in tariffs toward bilateral trading partners. There is a variety of theoretical research in the literature, including Viner (1950), Michaely (1965), Baldwin and Venables (1995), Pomfret (1997), Schiff and Winters (2003). Two survey papers, Adams et al (2003) and Lloyd and Maclaren (2004) summarize these researches. Given the ambiguities that still remain in the predictions of general equilibrium theory, the use of CGE models is a natural vehicle to explore the economic effects of RTAs. These models can be used to evaluate the effects of changes in trade policy resulting on production, employment, consumption, trade, prices and welfare. Related literatures include Brown *et al* (1992), Hertel et al (2001), Scollay and Gilbert (2001), Hertel *et al* (2003), Baldwin (2008), Lee *et al* (2009), Patricio (2011), Itakura and Lee (2012), and so on.

Among regional trade agreement literatures, some literatures pay attention to China related mega deals, but are largely analytical. For example, Shabir and Kazmi (2007) analytically analyze the economic effects of Pakistan-China FTA. Song and Yuan (2012) analyze China's free trade agreement strategies. Choi (2013) study the expected effects and future directions of a China-Korea FTA. Fukunaga and Isono (2013) paid attention to how to take ASEAN+1 FTAs towards the RCEP. Li, Wang and Whalley (2014) have comprehensively discussed China involved mega trade deals. Only a few papers have used computational general equilibrium models to empirically simulate potential effects of China's FTAs. Mai (2005) and Siriwardana and Yang (2007) both studied the economic effects of Australia-China FTA with the GTAP model. Jin *et al* (2006) explore the effects of the FTA among China, Japan and South Korea. Tan and Cai (2009) use the GTAP model to quantitively analyze the impacts of a China-New Zealand FTA on both sides. Petri *et al* (2011) used a CGE model to study the effects of TPP and Asia-Pacific Integration and have paid attention to the impacts to China. Li and Whalley (2014) used an 11-country numerical general equilibrium model to explore the effects of TPP to China. Until now, none of researches have focused on the combined influence of China's possible mega deals.

We use numerical general equilibrium simulation methods to explore possible mega trade deal impacts on both China and other main big countries in this paper. The analytical novelty of the paper relative to present literature lies in two directions. The first is we divide trade costs into tariff and non-tariff barriers and calculate trade costs between countries empirically with gravity model methodology. This can comprehensively explore the FTA effects from both tariff and non-tariff reduction. The second is to use an inside money structure to form an endogenous trade imbalance model which is more consistent with reality given China's large imbalances in trade.

We use a 13-country 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 (1956), also adopted in Archibald and Lipsey (1960), and used more recently in Whalley *et al* (2011) and Li and Whalley (2012, 2014). We calibrate the model to 2011 data and use counterfactual simulations to explore the effects.

Our simulation results show that almost all mega deal member countries will gain and nearly all mega deal non-member countries will lose. The more that non-tariff barriers are eliminated by each mega deal, the more significant impacts the mega deal have on all countries. All mega deals will benefit China in terms of welfare, trade, export and import. Comparatively, RCEP and China-TPP will generate the highest welfare outcome in our model, the next highest is China-Japan-Korea FTA, and then China-US FTA. For the US, China-TPP will generate the highest welfare outcome, the next highest is China-US FTA. For the EU, all China involved mega deals will generate negative welfare outcome except China-US FTA. For Japan, RCEP will generate the highest welfare outcome and the next highest is China-TPP. For Korea, RCEP will generate the highest welfare outcome and the next highest is China-Japan-Korea FTA. For India, RCEP will generate the highest welfare outcome and the next is China-India FTA.

We use a monetary endogenous trade imbalance model structure and a exogenous fixed trade imbalance model structure to do sensitivity analysis, and change elasticities and upper bound inside money parameters. All of these results suggest that our simulation results are reasonably robust.

The remaining parts of the paper are organized as follows: Part 2 introduces China's possible mega deals; Part 3 is the global general equilibrium model specification; Part 4 presents data and reports parameters from calibration; Part 5 reports simulation results for different scenarios. The last part offers conclusions and policy implications.

2. China's Possible Mega Deals

Table 1 lists existing and prospective mega deals for China, the US and the EU. The description of a trade deal as "mega" refers both to regional trade agreements (RTAs) between large countries or groups of countries and the barrier coverage of such deals. The commitment to multilateral WTO negotiation, now weakened by experience in the Doha Round, has so far largely precluded large-large bilateral or regional negotiations. Combined with a focus of restoring growth in the OECD, this picture is changed by the TPP negotiations, the EU-US TTIP, China's emerging mega trade deals (including RCEP), and deals under discussion of others including Japan and ASEAN.

Table 1: Existing and Prospective Mega Trade Deals for China, US and EU

China	The EU	The US
	In Place	
ASEAN-China;	EU-Mexico;	US-Canada-Mexico NAFTA;

	EU-Korea;	US-Australia; US-Korea;
Under Negotiation or Discussion		
China-Australia (negotiating); RCEP (negotiating); China-Japan-Korea (negotiating); China-India (discussing); China-US (discussing);	EU-ASEAN; EU-US (TTIP); EU-India; EU-Japan; EU-Canada;	TPP; US-EU (TTIP); US-Japan (under TPP); US-ASEAN (under TPP); US-China (discussing);

Source: Compiled by authors.

We can simply label all deals between countries above a certain size as a mega deal, but in reality, there are the 'large' mega deals both directly involving the EU, the US, China, and ASEAN, and deals involving the midsize economies (Japan, Canada, Brazil, Turkey, for example). As large economies, China, the US and the EU involved regional trade agreements (RTAs) are the most noticeable. For China there are ongoing negotiations with India, and Japan/Korea, and ASEAN+6 on a RCEP (Regional Comprehensive Economic Partnership), as well as possible future involvement in the Trans Pacific Partnership (TPP) negotiation and even a possible US-China deal. For the US, there are the TPP negotiations and negotiations with the EU on a TTIP for which China is not a party. For the EU there are negotiations under way with the US on TTIP, an India negotiation, and an ASEAN negotiation.

In this paper we focus on the impacts of China's possible mega deals. We firstly need to explore China's RTAs in place to have a general idea about the situation. Table 2 lists the regional agreements in place for China which could also provide part of the precedent working background for prospective mega deals with other partners. Nearly all the agreements listed in each case are with smaller entities, and the China-ASEAN agreement is the only one that qualifies as being labeled a "mega" deal. Among these existing RTAs, only the agreement with New Zealand is a developed country agreement and this has a different structure from other Chinese developing country agreements.

Table 2: Regional Trade Agreements in Place for China

RTA	Type	Date Concluded
China-Pakistan	Bilateral-with Developing Countries	November 2006
China-Chile FTA		November 2005
China-Peru FTA		April 2009
China-Costa Rica FTA		April 2010
China-New Zealand FTA	Bilateral-with Developed Countries	April 2008
China-Singapore FTA		October 2008
China-Iceland FTA		April 2013
China-Switzerland FTA		July 2013
China-ASEAN FTA	Multilateral	November 2004
CEPA	Domestic FTAs	March 2003
ECFA		June 2010
China Pilot Free-trade Zone		September 2013

Source: Compiled by authors based on information from "China FTA Network" (http://fta.mofcom.gov.cn/).

China involved possible mega deals include Regional Comprehensive Economic Partnership (RCEP),

China-Japan-Korea Free Trade Agreement (CJK), China-TPP Free Trade Agreement, China-US Free Trade Agreement, and China-India Free Trade Agreement. As far as the specifics of prospective Chinese agreements are concerned, two potential mega deals have gone to substantive negotiations; the others are at various stages of discussion. Table 3 summarizes these possible mega trade deals.

(1) The Regional Comprehensive Economic Partnership (RCEP) is a proposed Free Trade Agreement (FTA) between the 10 ASEAN Member countries and its FTA Partners (Australia, China, India, Japan, Korea and New Zealand). RCEP aims to be a significant step in the evolution of trade policy frameworks in East Asia. RCEP started as a study group for an FTA between ASEAN, China, Japan, and Korea (known as ASEAN+3), with a parallel study process for an ASEAN+6 FTA, which included the ASEAN+3 partners plus Australia, India, and New Zealand. It has now formalized itself as a 16 country negotiation. RCEP negotiations were formally launched in November 2012 at the ASEAN Summit in Cambodia; it has already initiated several rounds of negotiations. RCEP negotiations are scheduled to conclude by end-2015.

RCEP will cover trade in goods, trade in services, investment, economic and technical cooperation, intellectual property, competition, dispute settlement and other issues. The agreement will encompass trade in goods and services, economic and technical issues, intellectual property and investments, and dispute settlement mechanisms. The RCEP will have broader and deeper engagement with significant improvements over the existing ASEAN+1 FTAs, while recognizing the individual and diverse circumstances of the participating countries.

Table 3: China's Main Possible Mega Deals

Mega Deal	Stage	Contents
RCEP	Under negotiation; began from 2012 and scheduled to conclude by the end of 2015	RCEP will cover trade in goods, trade in services, investment, economic and technical cooperation, intellectual property, competition, dispute settlement and other issues. RCEP will have broader and deeper engagement with significant improvements over the existing ASEAN+1 FTAs.
CJK FTA	Under negotiation; began from 2012	Three rounds of talks were held in 2013. The pace of the negotiations has been slowed by the island disputes between China-Japan and Japan-Korea. No specific negotiation contents are known.
China-TPP	Research level discussion	China-TPP trade deal is under consideration and discussion by researchers.
China-US FTA	Research level discussion	There are as yet no official statements concerning or discussions of a China-US free trade agreement, but at a research level, a China-US free trade agreement has been discussed. China-US bilateral investment treaty (BIT) negotiation is in process and it will lay a foundation for possible FTA negotiation.
China-India FTA	Formal mutual research stage	China and India have conducted a Joint Study Group which finalized a report on the feasibility of a China-India Regional Trading Arrangement (RTA) in October 2007.

Source: Compiled by authors.

(2) The China-Japan-South Korea Free Trade Agreement is a proposed trilateral free trade agreement between China, Japan and South Korea. Negotiations on the agreement were started in 2012. Three rounds of talks were held in 2013. The pace of the negotiations has been slowed by the island disputes between China-Japan and Japan-Korea.

In the first two rounds, the three sides discussed key issues such as ways to lower tariffs and the scope of future negotiations based on terms of reference adopted at the first round of talks. The second round of negotiation included working-group meetings on goods, services and competition along with expert dialogue on intellectual property rights and e-commerce. The three Asian countries talked about the trilateral FTA's modality, such as how to draft liberalization for goods at the third round of negotiation. Working group meetings were held to discuss a wide range of topics such as indications of origin, customs, trade remedy, sanitary and phytosanitary (SPS) and technical barriers to trade (TBT) along with services, investment, competition, general rules and intellectual property rights. Discussions among experts were on e-commerce, environment, government procurement and food sectors.

(3) Trans-Pacific Partnership (TPP) is one of the most important FTA arrangements under negotiation in the Asia Pacific region; and it has received global attention in recent years. China is, for now, not involved in the TPP negotiation, but some Chinese researchers have proposed that China should take part in the TPP negotiation (Song and Yuan, 2012). There is substantial secrecy about the possible content of TPP, with as yet no official documents released.

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. Since the initiation of TPP in 2010, 18 formal rounds of negotiation have been held. Working groups have been established in areas of 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).

There are many debates about whether China should join the TPP negotiations and they are quite lively. Not only Chinese media but also some commentators from the US and Europe have expressed interest in this topic. A China-TPP trade deal is under consideration and discussion by researchers, and maybe in the future, China will take part in the TPP.

(4) There are as yet no official statements concerning or discussions of a China-US free trade agreement, but at a research level, a China-US free trade agreement has been discussed. Although there will be a lot of difficulties, as the two biggest countries in the world it may be possible to initiate a free trade agreement negotiation in the future. Trade and investment between the US and China have continued to grow at a substantial rate. As with any relationship between major powers, there is friction and concern on both sides about how the trade relationship is conducted. US negotiating concerns would likely focus beyond tariff with such issues as alleged currency manipulation and its effects on the trade surplus, and state owned enterprises and their trade impacts. Chinese objectives could potentially focus on security of access to US markets, and restrictions on foreign ownership and investment. A China-US bilateral investment treaty (BIT) negotiation is in process and it could lay a foundation for possible FTA negotiation.

(5) China and India have conducted a Joint Study Group which finalized a report on the feasibility of a China-India Regional Trading Arrangement (RTA) in October 2007. The report supports the position that a

China-India RTA would benefit each other and both sides agreed to explore the possibility of commencing discussions on a RTA but no further formal agreement to proceed further has been achieved.

In the meanwhile, economic relations between China and India have developed quickly. As two main emerging countries, China and India can gain from an RTA, and they are near each other in geography (Antkiewicz and Whalley, 2005). These factors might suggest that China and India may take further a regional trade agreement negotiation in the reasonably near future, but with higher tariffs in India, Indian manufacturing interests are cautious.

3. Model Structure

In order to capture the potential effects of China's involvement in possible Mega deals, we use a 13-country Armington type global general equilibrium model. These 13 countries are China, the US, the EU, Japan, Korea, Canada, Mexico, India, AN (Australia plus New Zealand), CP (Chile plus Peru), BMSV (Brunei, Malaysia, Singapore plus Vietnam), CILMPT (Cambodia, Indonesia, Laos, Malaysia, Philippine plus Thailand) and the rest of the world (ROW). Each country produces two-goods (Tradable goods and Non-tradeable goods), and has two-factors (capital and labor) which are intersectorally mobile but internationally immobile.

3.1 Endogenous Trade Imbalance General Equilibrium Model with Inside Money

In our global general equilibrium model, we add a monetary structure using inside money following Whalley et al (2011) and Li and Whalley (2014) to endogenously determine the trade imbalance, which is 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 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 (1956, 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 1)

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

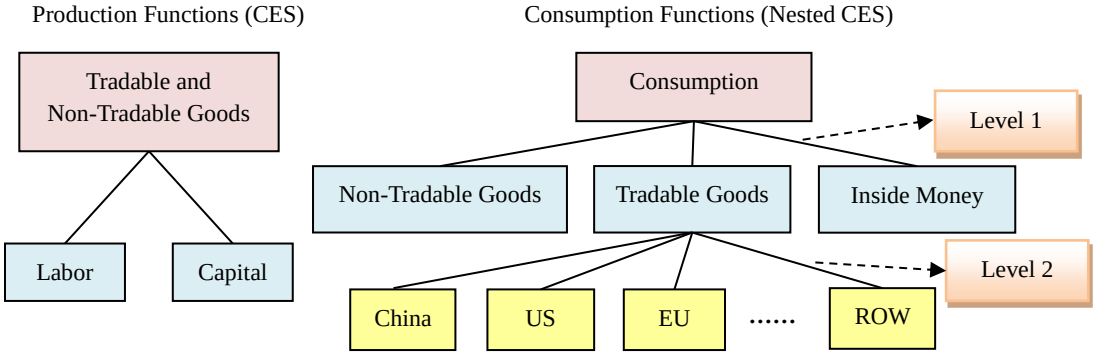
where Q_i^l is the output of the lth industry (including both tradable and non-tradable goods) in country i, L_i^l and K_i^l are the labor and capital inputs in sector l, ϕ_i^l are the scale parameters, δ_i^l are the distribution parameters and σ_i^l is the elasticity of factor substitution. First order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

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

$$U_i(X_i^T, X_i^{NT}, Y_i) = [\alpha_{i1}^{\frac{1}{\sigma_i}} (X_i^T)^{\frac{\sigma_i - 1}{\sigma_i}} + \alpha_{i2}^{\frac{1}{\sigma_i}} (X_i^{NT})^{\frac{\sigma_i - 1}{\sigma_i}} + \alpha_{i3}^{\frac{1}{\sigma_i}} (Y_i)^{\frac{\sigma_i - 1}{\sigma_i}}]^{\frac{\sigma_i}{\sigma_i - 1}}, \quad i = country \tag{2}$$

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. 1 Nesting Structure In Production and Consumption Functions



Source: Compiled by authors.

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

$$X_i^T = [\sum_j \beta_{ij}^{\frac{1}{\sigma_i'}} x_{ij}^{T\frac{\sigma_i'-1}{\sigma_i'}}]^{\frac{\sigma_i'}{\sigma_i'-1}}, \quad j = country \tag{3}$$

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

$$P_i^T X_i^T + pc_i^{NT} X_i^{NT} + pc_i^Y Y_i = I_i \tag{4}$$

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

$$\begin{aligned} &MaxU_i(X_i^T, X_i^{NT}, Y_i) = [\alpha_{i1}^{\frac{1}{\sigma_i}}(X_i^T)^{\frac{\sigma_i-1}{\sigma_i}} + \alpha_{i2}^{\frac{1}{\sigma_i}}(X_i^{NT})^{\frac{\sigma_i-1}{\sigma_i}} + \alpha_{i3}^{\frac{1}{\sigma_i}}(y_i)^{\frac{\sigma_i-1}{\sigma_i}}]^{\frac{\sigma_i}{\sigma_i-1}} \\ &s.t.\ P_i^T X_i^T + pc_i^{NT} X_i^{NT} + pc_i^Y y_i = I_i + pc_i^Y Y^0 \equiv I_i^* \end{aligned} \tag{5}$$

The optimization problem (5) above yields

$$X_i^T = \frac{\alpha_{i1} I_i^*}{(P_i^T)^\sigma [\alpha_{i1}(P_i^T)^{1-\sigma} + \alpha_{i2}(pc_i^{NT})^{1-\sigma} + \alpha_{i3}(pc_i^Y)^{1-\sigma}]} \tag{6}$$

$$X_i^{NT} = \frac{\alpha_{i2} I_i^*}{(pc_i^{NT})^{\sigma}[\alpha_{i1}(P_i^T)^{1-\sigma} + \alpha_{i2}(pc_i^{NT})^{1-\sigma} + \alpha_{i3}(pc_i^Y)^{1-\sigma}]} \tag{7}$$

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

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 of tradable goods, they enter the second level preferences and come from different countries, and the country specific demands are

$$x_{ij}^T = \frac{\beta_{ij}(X_i^T P_i^T)}{(pc_{ij}^T)^{\sigma_i'}[\sum_j \beta_{ij}(pc_{ij}^T)^{(1-\sigma_i')}]} \tag{9}$$

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

$$P_i^T = [\sum_{j=1}^{5} \beta_{ij}(pc_{ij}^T)^{(1-\sigma_i')}]^{\frac{1}{1-\sigma_i'}} \tag{10}$$

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

$$Q_i^T = \sum_j x_{ji}^T \tag{11}$$

$$\sum_l K_i^l = \overline{K_i} \quad , \quad \sum_l L_i^l = \overline{L_i} \tag{12}$$

A zero profit condition must also be satisfied in each industry in each country, such that

$$p_i^l Q_i^l = w_i^K K_i^l + w_i^L L_i^l \qquad \exists , \ T \tag{13}$$

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

$$\sum_i Y_i = 0 \tag{14}$$

We introduce trade costs for trade between countries. Trade costs include not only import tariffs but also other non-tariff barriers such as transportation costs, language barriers, and institutional barriers. 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.

$$pc_{ij}^T = (1 + t_i + N_{ij}) p_j^T \tag{15}$$

Import tariffs will generate revenues R_i, which are given by

$$R_i = \sum_{j, i \neq j} p_j^T x_{ij}^T t_i \tag{16}$$

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

$$w_i^K \overline{K_i} + w_i^L \overline{L_i} + R_i = I_i \tag{17}$$

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

$$Q_i^{NT} = \frac{NR_i}{p_i^{NT}} + X_i^{NT} \tag{18}$$

where

$$NR_i = \sum_{j, i \neq j} p_j^T x_{ij}^T N_{ij} \tag{19}$$

A possible mega-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 the potential effects.

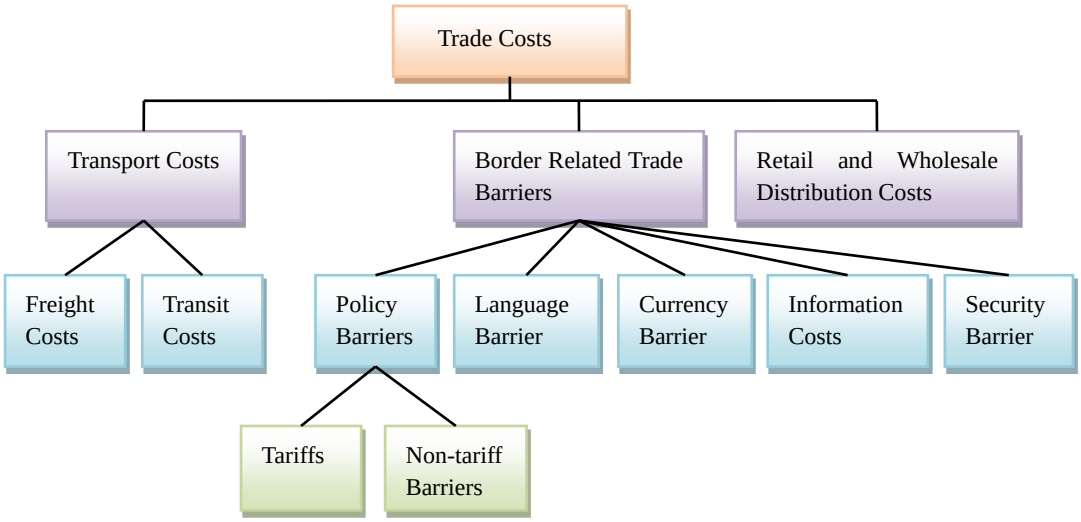
3.2 Trade Cost Calculation

We report our calculations of trade costs in this part which provides 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 in 2011.

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 2 reports the structure of representative trade costs used by Anderson and Wincoop (2004) to illustrate conceptually what is involved.

Fig. 2 Representative Trade Costs Structure



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

Trade costs 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).

Here, we have calculated trade costs following the approaches in 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:

$$X_{ir} = \frac{Y_i \times Y_r}{Y} \left(\frac{w_r \tau_{ir}}{\theta_i}\right)^{-\gamma} F_{ir}^{-\left(\frac{\gamma}{\sigma-1}-1\right)} \tag{20}$$

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:

$$\frac{X_{ir} X_{ri}}{X_{ii} X_{rr}} = \left(\frac{\tau_{ri} \tau_{ir}}{\tau_{ii} \tau_{rr}}\right)^{-\gamma} \left(\frac{F_{ri} F_{ir}}{F_{ii} F_{rr}}\right)^{-\left(\frac{\gamma}{\sigma-1}-1\right)} \tag{21}$$

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

$$t_{ir} = \left(\frac{X_{ir} X_{ri}}{X_{ii} X_{rr}}\right)^{-\frac{1}{2\gamma}} \tag{22}$$

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

$$t_{ir} = (\frac{X_{ii}X_{rr}}{X_{ir}X_{ri}})^{\frac{1}{2\gamma}} = (\tau_{ir}\tau_{ri})^{\frac{1}{2}}(F_{ri}F_{ir})^{\frac{1}{2}(\frac{1}{\sigma-1}-\frac{1}{\gamma})} \quad (23)$$

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

$$\bar{t}_{ir} = t_{ir} - 1 = (\frac{X_{ii}X_{rr}}{X_{ir}X_{ri}})^{\frac{1}{2\gamma}} - 1 \quad (24)$$

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.

We need to calculate trade costs between each country pair for China, the US, the EU, Japan, Korea, Canada, Mexico, India, AN (Australia plus New Zealand), CP (Chile plus Peru), BMSV (Brunei, Malaysia, Singapore plus Vietnam), CILMPT (Cambodia, Indonesia, Laos, Malaysia, Philippine plus Thailand) and the rest of the world (ROW). For the ROW, we use world total minus all countries in our model to yield the data we use in calculations.

For trade costs, in equation (24), 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)),

$$X_{ii} = y_i - X_i \quad (25)$$

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

$$X_i \equiv \sum_{r,i\neq r} X_{ir} \quad (26)$$

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). We only use trade cost data for 2011 in our numerical general equilibrium model, calculation results are shown in Table 4.

Table 4: Ad Valorem Tariff-Equivalent Trade Costs Between Countries in 2011 (Unit: %)

Country	US	EU	China	Japan	Korea	Canada	Mexico	India	AN	CP	BMSV	CILMPT	ROW
US	0	0.253	0.265	0.344	0.293	0.151	0.142	0.854	0.225	0.411	0.468	0.714	0.632
EU	0.253	0	0.268	0.423	0.319	0.408	0.391	0.728	0.262	0.484	0.462	0.746	0.649
China	0.265	0.268	0	0.252	0.171	0.427	0.412	0.733	0.175	0.414	0.335	0.489	0.436
Japan	0.344	0.423	0.252	0	0.247	0.515	0.541	1.029	0.267	0.597	0.334	0.591	0.538
Korea	0.293	0.319	0.171	0.247	0	0.461	0.383	0.791	0.177	0.439	0.264	0.491	0.439
Canada	0.151	0.408	0.427	0.515	0.461	0	0.312	1.194	0.424	0.55	0.793	0.983	0.888
Mexico	0.142	0.391	0.412	0.541	0.383	0.312	0	1.188	0.433	0.486	0.739	1.058	0.956
India	0.854	0.728	0.733	1.029	0.791	1.194	1.188	0	1.144	1.219	1.001	1.602	0.625
AN	0.225	0.262	0.175	0.267	0.177	0.424	0.433	1.144	0	0.741	0.217	0.718	0.638
CP	0.411	0.484	0.414	0.597	0.439	0.55	0.486	1.219	0.741	0	0.976	1.094	0.987
BMSV	0.468	0.462	0.335	0.334	0.264	0.793	0.739	1.001	0.217	0.976	0	0.535	0.516
CILMPT	0.714	0.746	0.489	0.591	0.491	0.983	1.058	1.602	0.718	1.094	0.535	0	0.439
ROW	0.632	0.649	0.436	0.538	0.439	0.888	0.956	0.625	0.638	0.987	0.516	0.439	0

Notes: (1) (1) BMSV denotes Brunei+Malaysia+Singapore+Vietnam, AN denotes Australia+New Zealand, CP denotes Chile+Peru, CILMPT denotes Cambodia+Indonesia+Laos+Myanmar+Philippine+Thailand. (2) We see group countries as a whole to calculate trade costs.

Source: Calculated by authors.

3.3 Some Other Trade Imbalance GE Models for Sensitivity Analysis

In order to comprehensively explore the impacts of possible mega deals, we use another two different general equilibrium model structures to do simulation for sensitivity analysis. One is endogenously determined trade imbalance model is the monetary structure. The other is exogenous fixed trade imbalance general equilibrium model.

(1) Endogenous Monetary Trade Imbalance GE Model

To accommodate a trade surplus or deficit as an endogenous variable in the model structure, we use a monetized extension of this structure incorporating a fixed exchange rate and non-accommodative monetary policy following Whalley and Wang (2010), and Li and Whalley (2014). If we only consider the transactions demand for money in each country and for simplicity assume unitary velocity, the money demand will equal all transaction values in one country. In our model, it equals all consumption values of tradable goods and non-tradable goods.

In traditional models, money is neutral in the sense that once domestic money supplies are specified, an equilibrium exchange rate is determined independently of the real side, and a fixed exchange rate regime and trade imbalance does not occur. And if the exchange rate is fixed, then the relative domestic money stocks need to accommodate so as to support it as an equilibrium exchange rate. In the structure we use, the monetary regime is non-accommodative to the fixed exchange rate; and in this case the trade surplus or deficit will be endogenously determined by the equation

$$S_i = I_i - \overline{M}_i \tag{27}$$

Where S_i is trade surplus for country i, I_i is the total income of country i, $\overline{M}_i$ is the money supply in country i. Once money supply in country i has been fixed, then the trade imbalance for country i will be endogenously determined. Global trade clearance determines that all of countries' trade should be balanced, which is

$$\sum_i S_i = 0 \tag{28}$$

We added these conditions in the global general equilibrium model yielding an endogenous monetary trade imbalance general equilibrium model structure.

(2) Exogenous Fixed Trade Imbalance GE Model

Exogenous fixed trade imbalance general equilibrium structure is a traditional assumption, which assumes that trade imbalances for all countries are fixed all the time. We assume an exogenously determined fixed trade imbalance, denoted as S_i, which will be positive when in trade surplus and negative when in trade deficit. Trade equilibrium will influence individual country's budget constraint. In the equilibrium, we have

$$I_i = E_i + S_i \tag{26}$$

which means that one country's total income (I_i) equals its total consumption expenditure (E_i) plus its surplus (trade imbalance), if one country has trade surplus then its income will more than consumption expenditure, but if one country has trade deficit than its income will be less than consumption expenditure.

4. Data and Parameters Calibration

We use 2011 as our base year in building a benchmark general equilibrium dataset for use in calibration and simulation following the methods set out in Shoven and Whalley (1992). There are 13 countries in our model, AN denotes Australia and New Zealand, CP denotes Chile and Peru, BMSV denotes Brunei, Malaysia, Singapore and Vietnam, CILMPT denotes Cambodia, Indonesia, Laos, Myanmar, Philippine and Thailand. We add countries together to generate AN, CP, BMSV values. We use world values minus all individual countries to generate ROW values. 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.

Table 5: Base Year Data Used For Calibration and Simulation (2011 Data)

Country	GDP	T-G	NT-G	Y_i	yi	Capital		Labor	
						T-G	NT-G	T-G	NT-G
USA	14991.3	2998.3	11993	-788.2	211.8	959.5	1289.2	2038.8	10703.8
EU	17589.8	4397.5	13192.3	-413.1	586.9	1945.5	1220.7	2452	11971.6
China	7318.5	3366.5	3952	155	1155	1387.6	2125.3	1978.9	1826.7
Japan	5867.2	1642.8	4224.4	-32.2	967.8	516.3	657.1	1126.5	3567.3
Korea	1116.2	680.9	435.3	30.8	1030.8	204.5	119.2	476.4	316.1
Canada	1736.1	590.3	1145.8	-0.2	999.8	309.6	89.7	280.7	1056.1
Mexico	1153.3	415.2	738.1	-1.2	998.8	207.6	80.7	207.6	657.4
India	1872.8	561.8	1311	-160.9	839.1	201.3	454.2	360.5	856.8
AN	1539.1	314.2	1224.9	46.7	1046.7	81.3	321.4	232.9	903.5
CP	425.5	164.9	260.6	14.4	1014.4	96.2	10.1	68.7	250.5
BMSV	667.6	462	205.6	-204.3	795.7	84.9	90.5	377.1	115.1
CILMPT	1489.8	694.2	795.6	5.9	1005.9	304.7	139.9	389.5	655.7
ROW	14129.6	5039	9090.6	1347.3	2347.3	1078.9	2266.2	3960.1	6824.4

Note: (1) Units for production, capital, labor, inside money and endowments are all billion US$, and labor here denotes factor income (wage). (2) AN denotes Australia+New Zealand, CP denotes Chile+Peru, BMSV denotes Brunei+Malaysia+Singapore+Vietnam, CILMPT denotes Cambodia+Indonesia+Laos+Malaysia+Philippine+Thailand. (3) T-G denotes tradable goods production; NT-G denotes non-tradable goods production. (4) We add countries together to generate AN, CP, BMSV values. (5) We use world values minus all individual countries to generate ROW values.

Sources: EU data from EU statistics, and the currency unit is Euro, we use annual average exchange rate to change them into US dollar currency unit; Other countries' data are all calculated from WDI of World Bank database.

EU data is from EU statistics, and the currency unit is Euro, we use annual average exchange rate to change them into US dollar; Other countries' data are all calculated from WDI of World Bank database. 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 5.

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 6.

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 1) minus import tariffs. All import tariffs and other non-tariff barrier values are listed in Table 7 and Table 8.

Table 7: Import Tariffs for Countries in 2011 (Unit: %)

Country	USA	EU	China	Japan	Korea	Canada	Mexico
Tariff	3.5	5.3	9.6	5.3	12.1	4.5	8.3
Country	India	AN	CP	BMSV	CILMPT	ROW	/
Tariff	12.6	2.4	4.9	4.8	8.1	7.8	/

Notes: (1) Import tariffs here are simple average MFN applied tariff rates. (2) We use the average individual country's import tariff to get country groups' import tariff. (3) AN denotes Australia+New Zealand, CP denotes Chile+Peru, BMSV denotes Brunei+Malaysia+Singapore+Vietnam, CILMPT denotes Cambodia+Indonesia+Laos+Malaysia+Philippine+Thailand. (4) We use import tariff of the world to denote the tariff for the ROW.

Source: WTO Statistics Database.

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.

Table 6：Trade between Countries in 2011 (Unit: Billion USD)

Country		Importer												
		USA	EU	China	Japan	Korea	Canada	Mexico	India	AN	CP	BMSV	CILMPT	ROW
Exporter	USA	0	256.7	103.9	66.2	43.5	280.7	174.9	22.6	31	24.2	54	26.1	461.8
	EU	329.3	0	172	61.8	41	37.4	30.1	51.1	43.3	13.2	56.5	29.9	1068.6
	China	417.3	406.7	0	148.3	82.9	25.3	52.2	55.5	37.6	15.5	90.1	69	498
	Japan	132.4	93.9	194.6	0	66.2	8.9	10.2	11.2	19.7	3.2	58.3	63	161.6
	Korea	58.6	50.3	162.7	39.8	0	4.9	16.5	12.3	9.3	3.8	41.9	28.1	127
	Canada	319.1	31.5	22.2	13	6.6	0	9.6	2.3	2.3	1.5	2.4	2.9	37
	Mexico	275	22.6	6	4	2.3	10.6	0	2.2	2	3.9	2.2	0.4	18.4
	India	32.9	54.8	16.7	5.6	4.5	1.9	1.3	0	2.4	1	22.9	10.2	147.3
	AN	13.7	20.6	87.7	59.8	27.8	2.1	1.5	14.1	0	16.4	27.9	16.2	19.2
	CP	16.2	24.1	28.5	12.1	6.9	5.7	2.3	2.2	5.3	0	5.1	1.3	17.3
	BMSV	56.8	73.5	69.6	52.1	24.5	3.3	4.8	4.9	38	16.7	0	50.8	7.2
	CILMPT	54.4	56.3	79.1	68.5	25.2	5	4.7	15.5	17	1.6	71.2	0	55.9
	ROW	628.1	1256.3	800.4	324.2	193	64.8	42.7	268.5	52.4	11.6	174	150.6	0

Notes: (1) BMSV denotes Brunei+Malaysia+Singapore+Vietnam, AN denotes Australia+New Zealand, CP denotes Chile+Peru, CILMPT denotes Cambodia+Indonesia+Laos+Myanmar+Philippine+Thailand. (2) We get trade data of AN, CP, and BMSV by adding separate country's trade data together, and these do not include inner trade between these group countries. (3)We get the ROW trade data by deducting from each country's total export, total import and total world trade value.

Sources: United Nations (UN) Comtrade database and WTO Statistics.

Table 8: Non-Tariff Barriers between Countries in 2011 (Unit: %)

Country	US	EU	China	Japan	Korea	Canada	Mexico	India	AN	CP	BMSV	CILMPT	ROW
US	0	0.218	0.23	0.309	0.258	0.116	0.107	0.819	0.19	0.376	0.433	0.679	0.597
EU	0.2	0	0.215	0.37	0.266	0.355	0.338	0.675	0.209	0.431	0.409	0.693	0.596
China	0.169	0.172	0	0.156	0.075	0.331	0.316	0.637	0.079	0.318	0.239	0.393	0.34
Japan	0.291	0.37	0.199	0	0.194	0.462	0.488	0.976	0.214	0.544	0.281	0.538	0.485
Korea	0.172	0.198	0.05	0.126	0	0.34	0.262	0.67	0.056	0.318	0.143	0.37	0.318
Canada	0.106	0.363	0.382	0.47	0.416	0	0.267	1.149	0.379	0.505	0.748	0.938	0.843
Mexico	0.059	0.308	0.329	0.458	0.3	0.229	0	1.105	0.35	0.403	0.656	0.975	0.873
India	0.728	0.602	0.607	0.903	0.665	1.068	1.062	0	1.018	1.093	0.875	1.476	0.499
AN	0.201	0.238	0.151	0.243	0.153	0.4	0.409	1.12	0	0.717	0.193	0.694	0.614
CP	0.362	0.435	0.365	0.548	0.39	0.501	0.437	1.17	0.692	0	0.927	1.045	0.938
BMSV	0.321	0.314	0.287	0.286	0.216	0.545	0.691	0.353	0.169	0.628	0	0.287	0.268
CILMPT	0.633	0.665	0.408	0.51	0.41	0.902	0.977	1.521	0.637	1.013	0.454	0	0.358
ROW	0.554	0.571	0.358	0.46	0.361	0.81	0.878	0.547	0.56	0.909	0.438	0.361	0

Notes: (1) (1) BMSV denotes Brunei+Malaysia+Singapore+Vietnam, AN denotes Australia+New Zealand, CP denotes Chile+Peru, CILMPT denotes Cambodia+Indonesia+Laos+Myanmar+Philippine+Thailand. (2) We see group countries as a whole to calculate trade costs.

Source: Calculated by authors.

5. Simulation of the Effects from Possible Mega Deals

We use numerical global general equilibrium model to simulate the impacts on China involved possible mega deals in this part. We mainly pay attention to the impacts on welfare, trade, export and import. For the welfare, we use a widely used Hicks equivalent variation (EV) as a percent share of GDP to show the effects. For the trade, export and import, we use percent change to base model to denote the effects. Our model structure has 13-country, so we can get the effects to all these 13 countries. In order to save paper space and make the results easier to show, we just give the effects to six big countries, they are China, US, EU, Japan, Korea and India. We do sensitivity analysis with different model structure and with changing elasticities and upper bound inside money value.

For the possible China involved mega deals, we explore seven different feasible situations. The first is China-India FTA (we denote it as "C-India" later). The second is China-Japan-Korea FTA (we denote it as "CJK" later). The third is China-TPP (we denote it as "C-TPP" later). The fourth is Regional Comprehensive Economic Partnership (RCEP). The fifth is China-US FTA. The sixth is a mixed situation that China-India FTA, CJK, RCEP and China-US FTA exist at the same time (we denote this as "1+2+4+5" situation). The seventh is also a mixed situation that China-Indian FTA, CJK, China-TPP, RCEP and China-US FTA exist at the same time (we denote this as "1-5" situation). Among these different situations, the former five ones are single FTAs; the latter two ones are mixed FTAs.

For the trade cost reduction level by FTAs, we separate three different situations in simulation. The first is the effects restricted to tariffs. The second is the effect of assuming FTAs eliminate tariff and 25% of non-tariff barriers. The third is the effects of assuming FTAs eliminate tariff and 50% of non-tariff barriers. We use these three different assumptions because China is involved possible mega deals which will definitely reduce both tariffs and non-tariffs among members, so if we just take account of tariff reduction effects as traditional literatures will underestimate the potential effects. But we do not know how much of non-tariff barriers can mega deals eliminate, therefore we use two different assumptions that FTAs eliminate 50% and 25% non-tariff barriers to show and compare these different influences.

5.1 Impacts of Mega Deals on Welfare

We separately analyze the effects restricted to tariffs, effects incorporated by trade cost, and effects with using compensation variation (CV) to comprehensively explore mega deals effects on welfare.

On the welfare effects restricted to tariff, all free trade agreement participation countries will gain except China in China-India FTA and China-US FTA. All FTA non-participation countries will lose. The main reason is that FTA participation countries will gain on trade, production and consumption and then increase their welfare, but the FTA non-participation countries' trade, production and consumption will decrease and then lose welfare (See Table 9).

For China, under only tariff elimination situation, almost all FTA arrangement can benefit China's welfare except China-India FTA and China-US FTA. The reason for negative welfare effects on China is that China's tariff level is comparatively high, meanwhile India and US are both big countries, so when China construct a FTA arrangement, tariff reduction effects and terms of trade effects jointly hurt China. Comparing all the effects of possible mega deals, China-TPP will generate the highest welfare outcome in

our model for China, the next highest is RCEP, and then is China-Japan-Korea FTA. For the mixed mega deals situation, FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time will generate the highest welfare outcome for China in our model (see Figure 1).

Table 9: Welfare Impacts Restricted to Tariffs (EV as a % of GDP)

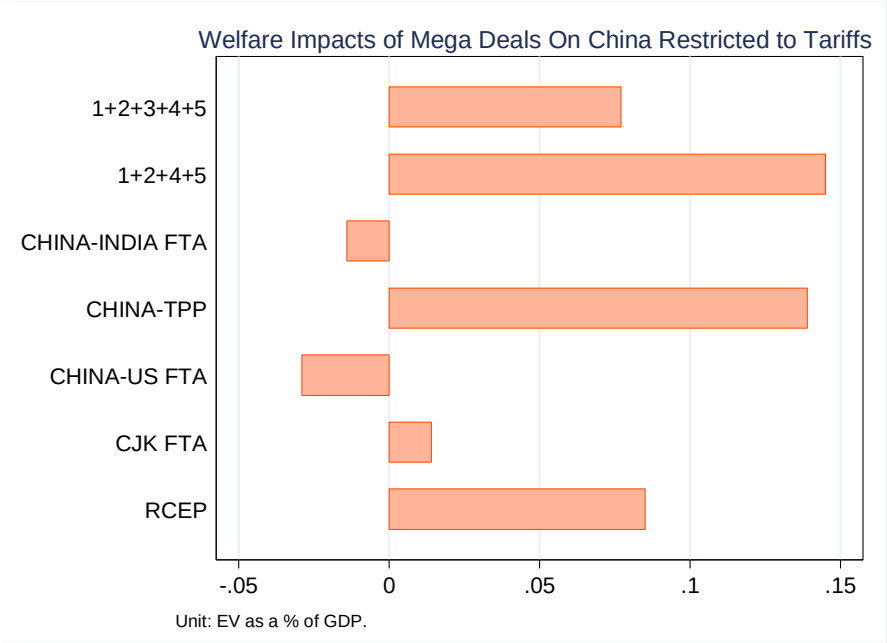
FTAs/Country	China	US	EU	Japan	Korea	India
(1) China-India FTA	-0.014	-0.013	-0.014	-0.014	-0.053	1.683
(2) China-Japan-Korea FTA	0.014	-0.008	-0.01	0.028	2.059	-1.982
(3) China-TPP	0.139	0.003	-0.04	0.009	-0.381	-0.146
(4) RCEP	0.085	-0.058	-0.054	-0.049	2.765	1.791
(5) China-US FTA	-0.029	0.009	0.001	0.012	0.039	-1.934
(6) 1+2+4+5	0.145	-0.06	-0.057	-0.050	2.767	1.787
(7) All Mega Deals 1-5	0.077	-0.043	-0.08	-0.063	2.591	1.691

Note: (1) we use the Hicks equivalent variation (EV)[1] as a % of GDP.

(2) "1+2+4+5" denotes the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

Figure 1: Welfare Impacts on China of Mega Deals Restricted to Tariffs



Source: compiled by authors.

For some other main countries, FTA participation countries all gain from potential mega deals but FTA non-participation countries all lose. For the separate countries, the US will generate the highest welfare outcome in our model with China-US FTA and the next highest welfare with China-TPP FTA. The EU will generate the highest welfare outcome in our model with China-US FTA and will lose with all other mega deals for she is not a mega deal participation country. Japan will generate the highest welfare outcome in our model with China-Japan-Korea FTA and the next highest welfare with China-TPP FTA. Korea will generate the highest welfare outcome with RCEP and the next highest welfare with CJK. India will generate the highest welfare outcome with RCEP and the next highest welfare outcome with China-India FTA (See Table 9).

[1] A widely used measure of economics welfare change in money terms.

We then analyze the welfare impacts incorporating trade cost variation. Actually present FTAs negotiations mainly focus on non-tariff reduction; therefore it is important to take account of the non-tariff barriers. We explore the welfare impacts by assume two situations: the first is FTAs eliminate tariff and 25% of non-tariff, the second is FTAs eliminate tariff plus 50% of non-tariff.

Under the trade cost elimination welfare effects, all FTA participation countries will gain from China's potential mega deals including China, and all FTA non-participation countries will lose by China's potential mega deals. For the welfare effects to specific countries, two characteristics are prominent. The first is all FTA participating countries' welfare gain will increase as trade cost elimination increases, but all FTA non-participation countries' welfare loss will also increase as trade cost removes more. The second is China's welfare effects will change to positive under trade cost elimination situation (See Table 10).

For China, China-TPP will generate the highest welfare outcome on our model, the next highest is RCEP, and then CJK. But as non-tariff barriers eliminate more (under 50% situation), RCEP will generate the highest welfare outcome and the next highest is China-TPP. In general, China-TPP and RCEP are both good choices in the perspective of welfare outcome generated by our model (See Table 10).

For other main countries, China-TPP will generate the highest welfare outcome for the US and the next highest is China-US FTA. China-US FTA will generate the highest welfare outcome for the EU. RCEP will generate the highest welfare for Japan and the next highest is China-TPP. CJK will generate the highest welfare outcome for Korea and the next highest is RCEP. RCEP will generate the highest welfare outcome for India and the next highest is China-India FTA (See Table 10).

Table 10: Welfare Impacts Incorporated by Trade Cost Changes (EV as a % of GDP)

FTAs/Country	China		US		EU	
	A	B	A	B	A	B
(1) China-India FTA	0.060	0.148	-0.01	-0.017	-0.004	-0.006
(2) China-Japan-Korea FTA	0.246	0.505	-0.013	-0.019	-0.012	-0.015
(3) China-TPP	0.552	1.01	0.343	0.735	-0.062	-0.086
(4) RCEP	0.538	1.065	-0.092	-0.13	-0.079	-0.106
(5) China-US FTA	0.108	0.272	0.138	0.289	0.002	0.003
(6) 1+2+4+5	0.715	1.376	0.038	0.155	-0.078	-0.099
(7) All Mega Deals 1-5	0.596	1.378	0.279	0.712	-0.115	-0.09
FTAs/Country	Japan		Korea		India	
	A	B	A	B	A	B
(1) China-India FTA	-0.014	-0.023	-0.038	-0.064	1.458	3.05
(2) China-Japan-Korea FTA	0.275	0.565	2.696	3.382	-1.686	-1.298
(3) China-TPP	0.557	1.219	-0.542	-0.719	-0.226	-0.33
(4) RCEP	0.571	1.345	4.026	5.473	4.56	8.697
(5) China-US FTA	0.018	0.025	0.084	0.138	-1.625	-1.215
(6) 1+2+4+5	0.576	1.356	4.083	5.602	4.581	8.756
(7) All Mega Deals 1-5	0.759	1.994	3.764	5.776	4.444	8.599

Note: (1) A- Assume FTA eliminates tariff and 25% of non-tariff barriers; B- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) We use the Hicks equivalent variation as a % of GDP.

(3) 1+2+4+5 denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

In order to check the robustness and reliability of the above simulation results with EV/GDP, we use another widely used welfare effects indicator, Hicks compensation variation (CV) as a percent of GDP, to compare the simulation results. Table 11 gives all the results; we find that they are mostly the same as the EV/GDP results. It proves that all the above results in the paper are reliable.

Table 11: Welfare Impacts of CV as A Percent of GDP (%)

FTAs/Country	China			US			EU		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	-0.015	0.035	0.07	-0.014	-0.01	-0.017	-0.014	-0.004	-0.006
(2) China-Japan-Korea FTA	-0.124	0.081	0.287	-0.009	-0.014	-0.019	-0.01	-0.013	-0.016
(3) China-TPP	0.058	0.373	0.68	-0.011	0.273	0.545	-0.041	-0.067	-0.098
(4) RCEP	0.006	0.354	0.694	-0.061	-0.097	-0.141	-0.057	-0.084	-0.116
(5) China-US FTA	-0.129	-0.001	0.128	0.003	0.097	0.178	0.001	0.002	0.002
(6) 1+2+4+5	0.046	0.485	0.918	-0.069	-0.013	0.019	-0.059	-0.085	-0.114
(7) All Mega Deals 1-5	-0.018	0.379	0.841	-0.057	0.209	0.473	-0.083	-0.125	-0.112
FTAs/Country	Japan			Korea			India		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	-0.014	-0.014	-0.024	-0.054	-0.038	-0.065	1.168	1.046	1.898
(2) China-Japan-Korea FTA	0.004	0.199	0.396	1.649	2.113	2.581	-2.983	-2.303	-1.6
(3) China-TPP	-0.02	0.416	0.851	-0.387	-0.566	-0.778	-0.148	-0.235	-0.358
(4) RCEP	-0.081	0.417	0.916	2.232	3.148	4.059	1.253	3.257	5.382
(5) China-US FTA	0.012	0.018	0.023	0.038	0.083	0.133	-2.937	-2.243	-1.521
(6) 1+2+4+5	-0.082	0.426	0.939	2.236	3.21	4.192	1.25	3.28	5.45
(7) All Mega Deals 1-5	-0.103	0.55	1.322	2.06	2.913	4.103	1.153	3.152	5.164

Note: (1) A-Assume FTA eliminated tariff only; B- Assume FTA eliminates tariff and 25% of non-tariff barriers; C- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) We use the Hicks compensation variation (CV) as a % of GDP.

(3) 1+2+4+5 denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

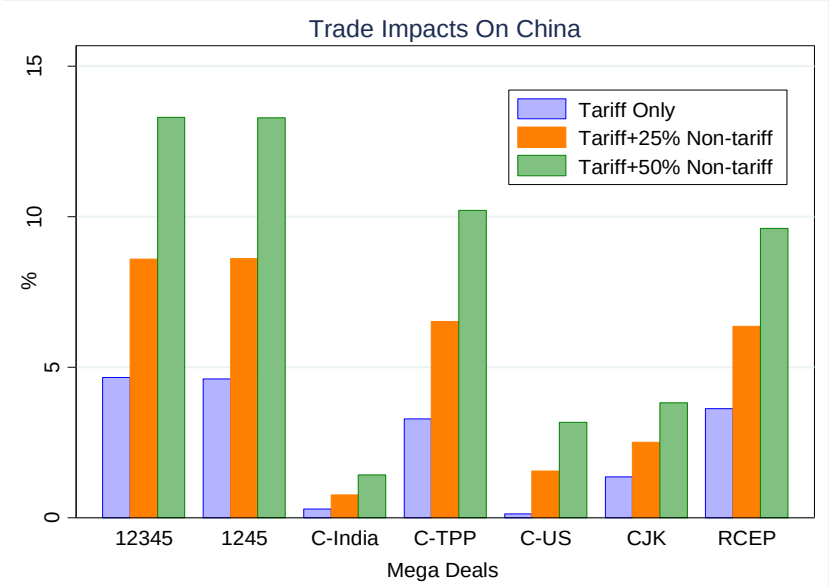
Source: Calculated and compiled by authors.

5.2 Impacts of Mega Deals on Total Trade

On the trade aspect, nearly all FTA participating countries' trade are positively impacted, but almost all FTA non-participation countries' trade are hurt. FTAs participation countries' trade will increase more as trade costs eliminates more, but FTAs non-participation countries' trade will decrease more (see Table 12).

For China, all mega deals together will generate the highest trade benefit in our model. RCEP will generate the highest trade benefit among single FTAs under only tariff elimination situation, and China-TPP will generate the highest trade benefit among single FTAs under trade cost elimination situation. Comparing trade effects of these different possible mega deals, positive impacts of China-TPP is the most significant one in the model simulation results; RCEP is the next most one, and then are sequentially China-Japan-Korea FTA, China-US FTA and China-India FTA (see Figure 2).

Figure 2: Trade Impacts on China of Possible Mega Deals



Source: compiled by authors.

For other main countries, China-TPP will generate the highest trade benefit for the US in our model, trade effects to the EU are negative and China-Japan-Korea FTA will generate the lowest negative trade influence, RCEP will benefit Japan, Korea and India the most on trade side under the view of model simulation results. China-Japan-Korea FTA and China-US FTA will generate negative trade impact for India in our model. In general, FTAs participation countries will gain but non-participating countries will lose on trade.

Table 12: Trade Impacts of China's Potential Mega Deals (Unit: % Change)

FTAs/Country	China			US			EU		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.288	0.768	1.425	-0.002	-0.015	-0.025	-0.014	-0.031	-0.055
(2) China-Japan-Korea FTA	1.357	2.516	3.819	-0.006	-0.017	-0.028	0.001	-0.015	-0.033
(3) China-TPP	3.292	6.516	10.209	3.677	6.884	10.515	-0.071	-0.321	-0.589
(4) RCEP	3.629	6.363	9.608	-0.067	-0.107	-0.15	-0.108	-0.173	-0.248
(5) China-US FTA	0.126	1.552	3.173	0.926	1.773	2.727	-0.027	-0.199	-0.397
(6) 1+2+4+5	4.619	8.615	13.277	0.831	1.628	2.521	-0.17	-0.405	-0.677
(7) All Mega Deals 1-5	4.659	8.599	13.301	3.681	6.919	10.782	-0.122	-0.396	-0.541
FTAs/Country	Japan			Korea			India		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.001	-0.012	-0.02	-0.017	-0.042	-0.074	0.209	3.318	6.252
(2) China-Japan-Korea FTA	3.88	6.126	8.632	5.216	6.677	8.247	-3.885	-3.216	-2.387
(3) China-TPP	4.361	9.327	15.129	-0.277	-0.524	-0.8	-0.005	-0.007	0.022
(4) RCEP	5.183	10.456	16.806	6.83	9.909	13.442	1.272	7.009	15.356
(5) China-US FTA	-0.049	-0.171	-0.31	-0.022	-0.132	-0.258	-3.871	-3.206	-2.383
(6) 1+2+4+5	5.115	10.261	16.46	6.76	9.733	13.145	1.274	6.998	15.31
(7) All Mega Deals 1-5	6.083	13.374	22.344	6.73	9.667	12.94	1.29	7.002	15.447

Note: (1) A-Assume FTA eliminated tariff only; B- Assume FTA eliminates tariff and 25% of non-tariff barriers; C- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) "1+2+4+5" denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

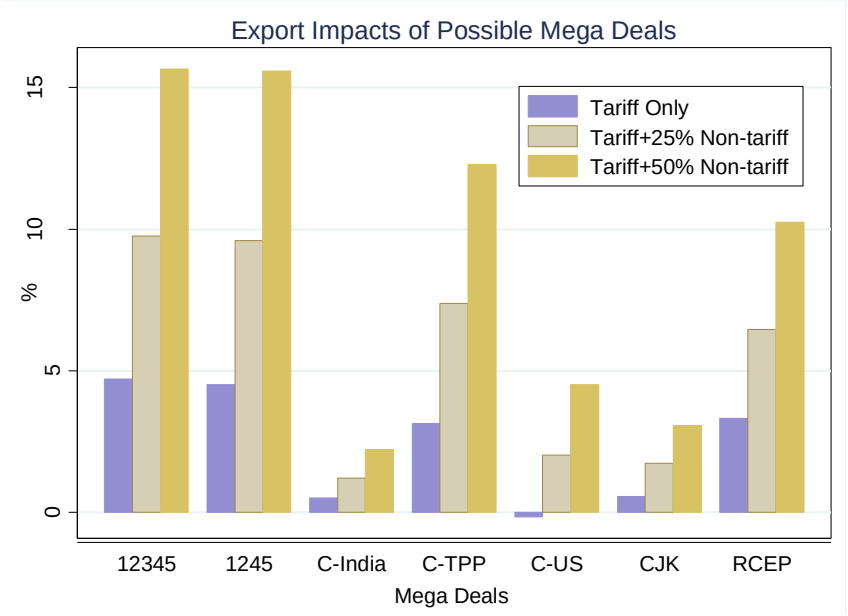
Source: Calculated and compiled by authors.

5.3 Impacts of Mega Deals on Export

On the export aspect, simulation results are nearly the same as the total trade situation. All FTA participation countries can benefit from potential mega deals, but non-participating countries will lose. Meanwhile, as non-tariff barriers eliminate more, export effects will become more severe (see Table 13).

For China, China-TPP and RCEP have generated the most significant positive export effects in our model, the next most significant one is China-US FTA, and then is China-Japan-Korea FTA. China-India FTA will generate the lowest export benefit. Meanwhile, mixed mega deals will generate more export influence than single FTAs (see Figure 3).

Figure 3: Export Impacts on China of Possible Mega Deals



Source: compiled by authors.

For other main countries, China-TPP will generate the highest export benefit for the US, and China-US FTA also has prominent positive export effects for the US. The EU will generate negative influence on export by these mega deals in our model, and comparatively China-India FTA will generate the lowest negative export impact. For Japan, RCEP and TPP has more effects on Japan's export than other FTAs, China-Japan-Korea FTA will benefit her significantly as well. For Korea, RCEP and China-Japan-Korea both will generate significant positive export influence. For India, China-India FTA will generate the highest export benefit in our model; other mega deals including China-US FTA and China-Japan-Korea FTA have negative effects on India's export.

Table 13: Export Impacts of China's Potential Mega Deals (Unit: % Change)

FTAs/Country	China			US			EU		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.504	1.22	2.219	0.02	0.021	0.037	0.002	-0.015	-0.028
(2) China-Japan-Korea FTA	0.567	1.737	3.075	-0.041	-0.044	-0.046	-0.013	-0.026	-0.041
(3) China-TPP	3.144	7.376	12.282	4.64	8.666	13.26	-0.045	-0.301	-0.574
(4) RCEP	3.323	6.449	10.24	-0.05	-0.052	-0.046	-0.086	-0.128	-0.178
(5) China-US FTA	-0.157	2.028	4.51	1.136	2.23	3.49	-0.044	-0.225	-0.434
(6) 1+2+4+5	4.517	9.596	15.584	1.1	2.192	3.469	-0.149	-0.378	-0.65
(7) All Mega Deals 1-5	4.701	9.763	15.659	4.689	8.771	13.423	-0.064	-0.334	-0.653
FTAs/Country	Japan			Korea			India		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	-0.006	-0.054	-0.096	-0.039	-0.123	-0.221	-1.138	2.368	4.782
(2) China-Japan-Korea FTA	4.679	6.99	9.556	4.553	6.021	7.599	-2.968	-2.507	-1.926
(3) China-TPP	4.78	9.797	15.665	-0.303	-0.81	-1.423	-0.145	-0.891	-1.776
(4) RCEP	5.944	11.25	17.642	5.46	8.562	12.118	-0.268	5.022	12.972
(5) China-US FTA	-0.059	-0.322	-0.624	-0.015	-0.323	-0.682	-3.137	-3.149	-3.09
(6) 1+2+4+5	5.819	10.872	16.978	5.313	8.133	11.343	-0.453	4.36	11.773
(7) All Mega Deals 1-5	6.863	14.267	22.725	5.327	8.154	10.238	-0.41	4.4	10.499

Note: (1) A-Assume FTA eliminated tariff only; B- Assume FTA eliminates tariff and 25% of non-tariff barriers; C- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) 1+2+4+5 denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

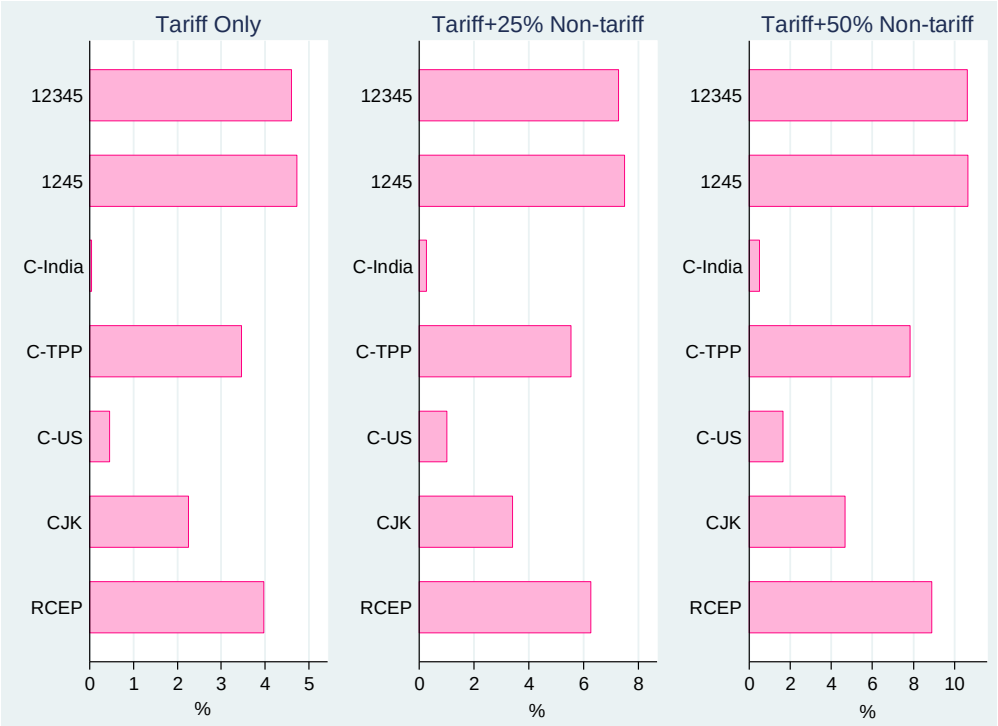
Source: Calculated and compiled by authors.

5.4 Impacts of Mega Deals on Import

On the import aspect, simulation results are almost the same as export impacts. Almost all FTA participation countries can gain from potential mega deals, and nearly all FTA non-participation countries will loss. As non-tariff barriers eliminate more, export impacts become more significant (see Table 14).

For China, all mega deals have positive effects. China-TPP and RCEP will generate the highest positive import influence for China in our model, the next highest is China-US FTA, and then is CJK. China-India FTA will generate the lowest positive import impact for China. These results mean that from the perspective of increased import, China-TPP will gain China the most, RCEP lists the next.

Figure 4: Import Impacts on China of Possible Mega Deals



Source: compiled by authors.

For other main countries, China-TPP has the most prominent positive impacts on US's import. Positive effects of possible mega deals to EU are small. China-TPP, RCEP, and China-Japan-Korea FTA all have significant positive influence to Japan's import. China-TPP has negative effects to Korea's import, but RCEP has significant positive effects to Korea's import. China-Japan-Korea FTA and China-US FTA have negative effects to India's import, and RCEP has the most prominent positive effects to India's import.

Table 14: Import Impacts of China's Potential Mega Deals (Unit: % Change)

FTAs/Country	China			US			EU		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.041	0.252	0.519	-0.016	-0.038	-0.066	-0.027	-0.045	-0.078
(2) China-Japan-Korea FTA	2.257	3.405	4.667	0.017	0.002	-0.017	0.013	-0.005	-0.027
(3) China-TPP	3.46	5.534	7.845	3.031	5.689	8.675	-0.092	-0.339	-0.601
(4) RCEP	3.979	6.266	8.886	-0.078	-0.145	-0.22	-0.125	-0.209	-0.306
(5) China-US FTA	0.45	1.008	1.649	0.785	1.467	2.216	-0.013	-0.177	-0.366
(6) 1+2+4+5	4.735	7.497	10.646	0.651	1.25	1.887	-0.187	-0.426	-0.7
(7) All Mega Deals 1-5	4.61	7.272	10.612	3.006	5.678	9.013	-0.169	-0.447	-0.448
FTAs/Country	Japan			Korea			India		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.008	0.028	0.053	0.007	0.045	0.084	1.08	3.932	7.203
(2) China-Japan-Korea FTA	3.108	5.29	7.739	5.928	7.38	8.942	-4.478	-3.675	-2.685
(3) China-TPP	3.955	8.873	14.61	-0.249	-0.216	-0.13	0.087	0.566	1.185
(4) RCEP	4.447	9.689	15.998	8.301	11.353	14.863	2.267	8.295	16.897
(5) China-US FTA	-0.039	-0.025	-0.005	-0.029	0.073	0.197	-4.346	-3.242	-1.926
(6) 1+2+4+5	4.433	9.669	15.959	8.312	11.45	15.077	2.392	8.704	17.598
(7) All Mega Deals 1-5	5.329	12.511	21.974	8.236	11.291	15.839	2.389	8.685	18.648

Note: (1) A-Assume FTA eliminated tariff only; B- Assume FTA eliminates tariff and 25% of non-tariff barriers; C- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) 1+2+4+5 denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

5.5 Impacts of Mega Deals on Trade Imbalance

On the trade imbalance aspects, mega trade deal effects to participation countries and non-participation countries are ambiguous. The results are determined by both trade expanding effects and trade diversion effects. All simulation results are reported in Table 15.

For China, nearly all mega trade deals will increase her trade imbalance except China-Japan-South Korea FTA. For the US, almost all mega trade deals will decrease her trade imbalance except China-Japan-South Korea FTA. For the EU, China-US FTA and China-Japan-South Korea FTA will increase her trade imbalance, and all others will decrease her trade imbalance. For Japan, China-India FTA and China-US FTA will increase her trade imbalance, and all others will decrease her trade imbalance. For Korea, all FTAs in our scenario will decrease her trade imbalance except China-US FTA. For India, only China-Japan-South Korea FTA and China-US FTA will decrease her trade imbalance, and all others will increase her trade imbalance.

Table 15: Trade Imbalance Impacts of China's Potential Mega Deals (Unit: % Change)

FTAs/Country	China			US			EU		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	3.803	8.117	14.318	-0.088	-0.159	-0.276	-0.167	-0.187	-0.316
(2) China-Japan-Korea FTA	-11.467	-10.133	-8.263	0.136	0.095	0.043	0.133	0.092	0.042
(3) China-TPP	0.895	20.491	43.863	-0.239	-0.360	-0.644	-0.319	-0.520	-0.730
(4) RCEP	-1.347	7.752	19.880	-0.133	-0.334	-0.575	-0.310	-0.598	-0.921
(5) China-US FTA	-4.483	9.292	24.873	0.071	-0.084	-0.375	0.134	0.049	-0.044
(6) 1+2+4+5	2.960	24.538	50.733	-0.260	-0.665	-1.328	-0.366	-0.657	-0.943
(7) All Mega Deals 1-5	5.347	27.492	51.587	-0.415	-0.609	0.049	-0.673	-0.989	0.533
FTAs/Country	Japan			Korea			India		
	A	B	C	A	B	C	A	B	C
(1) China-India FTA	0.425	2.458	4.479	-0.671	-2.438	-4.408	5.140	6.795	11.635
(2) China-Japan-Korea FTA	-43.502	-45.154	-46.185	-14.346	-12.659	-10.862	-7.242	-5.812	-4.076
(3) China-TPP	-20.539	-18.542	-16.711	-1.041	-8.977	-19.190	0.511	3.233	6.606
(4) RCEP	-39.972	-36.614	-32.790	-33.583	-29.791	-25.597	6.911	14.286	24.084
(5) China-US FTA	0.570	8.766	18.358	0.175	-5.761	-12.755	-6.559	-3.414	0.205
(6) 1+2+4+5	-36.710	-26.032	-14.281	-35.898	-37.446	-39.970	7.602	16.659	28.264
(7) All Mega Deals 1-5	-40.173	-39.613	-0.304	-34.643	-34.944	-66.720	7.515	16.531	33.572

Note: (1) A-Assume FTA eliminated tariff only; B- Assume FTA eliminates tariff and 25% of non-tariff barriers; C- Assume FTA eliminates tariff and 50% of non-tariff barriers.

(2) 1+2+4+5 denote the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

5.6 Sensitivity Analysis with Some Other Trade Imbalance Model

We separately use the endogenous monetary trade imbalance model and exogenous fixed trade imbalance model to recalculate the potential impacts of China involved mega deals. It is helpful for checking the reliability of our simulation results with the inside money trade imbalance model.

Table 15 and Table 16 show all the influence results on welfare, trade, export and import by comparing two different model structures. We find that almost all results show the same influence direction (positive or negative). Differences mainly exist in influence level with different impact numbers, these difference are not huge. Comparatively, differences within endogenous trade imbalance models are much smaller than differences between endogenous trade imbalance models and exogenous trade imbalance models.

We take China as an example to compare different effects with their absolute value gap between different model structures. Table 17 shows the gaps for China between monetary endogenous trade imbalance model and inside money endogenous trade imbalance model, and Table 18 shows the gaps for China between exogenous fixed trade imbalance model and inside money endogenous trade imbalance model. We find that these differences are not very big. Comparatively in general, impacts of monetary structure model and exogenous fixed trade imbalance model are more significant than inside money structure to China.

Table 17: Influence Gap for China between Inside Money and Monetary Structure

Mega Deal	EV/GDP	EXPORT	IMPORT	TRADE
C-India	0.021	0.098	0.039	0.485
CJK	0.360	0.080	0.383	0.383
C-TPP	0.688	0.242	1.006	1.325
RCEP	0.861	1.083	1.190	0.068
C-US	0.073	0.632	0.104	0.935
1245	0.925	0.595	1.321	1.420
12345	1.131	1.087	1.689	1.536

Source: Calculated and compiled by authors.

Table 18: Influence Gap for China between Inside Money and Fixed Imbalance Structure

Mega Deal	EV/GDP	EXPORT	IMPORT	TRADE
C-India	0.080	0.477	0.362	0.640
CJK	0.159	0.919	2.583	1.007
C-TPP	0.828	3.149	6.011	1.966
RCEP	0.875	3.426	6.532	1.377
C-US	0.061	0.344	1.099	0.586
1245	1.011	4.159	7.908	2.546
12345	1.634	5.756	8.671	3.093

Source: Calculated and compiled by authors.

The sensitivity analysis with different model structures suggests that our simulation results are reliable and impact directions are nearly all the same.

Table 15: Sensitivity Analysis For the Tariff Plus 25% Non-Tariff Elimination Situation with Monetary Model Structure

FTAs/Countries	CHINA		US		EU		JAPAN		KOREA		INDIA	
Model Structure	Inside M	Monetary	Inside M	Monetary	Inside M	Monetary	Inside M	Monetary	Inside M	Monetary	Inside M	Monetary
EV/GDP (%)												
(1) China-India FTA	0.060	0.081	-0.010	-0.011	-0.004	0.0006	-0.014	-0.020	-0.038	-0.017	1.458	0.415
(2) China-Japan-Korea FTA	0.246	0.606	-0.013	-0.012	-0.012	-0.004	0.275	-0.068	2.696	1.913	-1.686	-1.919
(3) China-TPP	0.552	1.240	0.343	0.639	-0.062	0.026	0.557	0.406	-0.542	0.024	-0.226	-1.061
(4) RCEP	0.538	1.399	-0.092	-0.048	-0.079	0.019	0.571	0.441	4.026	3.333	4.560	2.398
(5) China-US FTA	0.108	0.181	0.138	0.369	0.002	-0.013	0.018	-0.038	0.084	-0.038	-1.625	-2.012
(6) 1+2+4+5	0.715	1.640	0.038	0.321	-0.078	0.005	0.576	0.409	4.083	3.308	4.581	2.292
(7) All Mega Deals 1-5	0.596	1.727	0.279	0.621	-0.115	0.052	0.759	0.622	3.764	3.504	4.444	2.335
EXPORT (% Change)												
(1) China-India FTA	1.220	1.122	0.021	-0.005	-0.015	-0.020	-0.054	-0.040	-0.123	-0.072	2.368	3.577
(2) China-Japan-Korea FTA	1.737	1.657	-0.044	-0.038	-0.026	-0.019	6.990	7.483	6.021	6.548	-2.507	-1.139
(3) China-TPP	7.376	7.134	8.666	7.591	-0.301	-0.409	9.797	10.112	-0.810	-0.982	-0.891	0.538
(4) RCEP	6.449	5.366	-0.052	-0.346	-0.128	-0.380	11.25	10.864	8.562	8.416	5.022	5.674
(5) China-US FTA	2.028	2.660	2.230	1.829	-0.225	-0.024	-0.322	-0.086	-0.323	-0.091	-3.149	-1.291
(6) 1+2+4+5	9.596	9.001	2.192	1.431	-0.378	-0.46	10.872	10.726	8.133	8.291	4.360	5.469
(7) All Mega Deals 1-5	9.763	8.676	8.771	7.527	-0.334	-0.646	14.267	14.125	8.154	7.992	4.400	5.212
IMPORT (% Change)												
(1) China-India FTA	0.252	0.291	-0.038	-0.001	-0.045	0.024	0.028	0.010	0.045	0.015	3.932	5.160
(2) China-Japan-Korea FTA	3.405	3.788	0.002	-0.039	-0.005	-0.018	5.290	4.233	7.380	6.419	-3.675	-2.634
(3) China-TPP	5.534	6.540	5.689	6.953	-0.339	0.125	8.873	8.499	-0.216	0.113	0.566	1.170
(4) RCEP	6.266	7.456	-0.145	-0.026	-0.209	0.123	9.689	9.026	11.353	9.978	8.295	8.784
(5) China-US FTA	1.008	1.112	1.467	2.727	-0.177	0.015	-0.025	0.009	0.073	0.018	-3.242	-2.532
(6) 1+2+4+5	7.497	8.818	1.250	2.694	-0.426	0.128	9.669	9.034	11.450	9.981	8.704	8.879
(7) All Mega Deals 1-5	7.272	8.961	5.678	6.947	-0.447	0.196	12.511	11.684	11.291	10.067	8.685	8.925
TRADE (% Change)												
(1) China-India FTA	0.252	0.737	-0.038	-0.003	-0.045	0.003	0.028	-0.014	0.045	-0.028	3.932	4.507
(2) China-Japan-Korea FTA	3.405	3.788	0.002	-0.039	-0.005	-0.018	5.290	4.233	7.380	6.419	-3.675	-2.634
(3) China-TPP	5.534	6.859	5.689	7.217	-0.339	-0.126	8.873	9.291	-0.216	-0.426	0.566	0.909
(4) RCEP	6.266	6.334	-0.145	-0.158	-0.209	-0.114	9.689	9.929	11.353	9.209	8.295	7.501
(5) China-US FTA	1.008	1.943	1.467	2.355	-0.177	-0.003	-0.025	-0.038	0.073	-0.035	-3.242	-2.020
(6) 1+2+4+5	7.497	8.917	1.250	2.172	-0.426	-0.148	9.669	9.865	11.450	9.149	8.704	7.473
(7) All Mega Deals 1-5	7.272	8.808	5.678	7.187	-0.447	-0.200	12.511	12.883	11.291	9.045	8.685	7.394

Note: (1) "Inside Money" denotes inside money model structure; "Monetary" denotes monetary structure; (2) "1+2+4+5" denotes the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

Table 16: Sensitivity Analysis for the Tariff Plus 25% Non-Tariff Elimination Situation with Exogenous Trade Imbalance Model

FTAs/Countries	CHINA		US		EU		JAPAN		KOREA		INDIA	
Model Structure	Inside M	Exogenous	Inside M	Exogenous	Inside M	Exogenous	Inside M	Exogenous	Inside M	Exogenous	Inside M	Exogenous
EV/GDP (%)												
(1) China-India FTA	0.060	0.140	-0.010	0.013	-0.004	0.006	-0.014	-0.003	-0.038	-0.044	1.458	-0.008
(2) China-Japan-Korea FTA	0.246	0.087	-0.013	-0.017	-0.012	-0.008	0.275	0.613	2.696	2.487	-1.686	-2.281
(3) China-TPP	0.552	1.380	0.343	0.816	-0.062	0.087	0.557	1.224	-0.542	0.905	-0.226	-0.567
(4) RCEP	0.538	1.413	-0.092	0.125	-0.079	0.110	0.571	1.460	4.026	5.983	4.560	2.443
(5) China-US FTA	0.108	0.169	0.138	0.267	0.002	0.008	0.018	-0.006	0.084	-0.076	-1.625	-2.200
(6) 1+2+4+5	0.715	1.726	0.038	0.388	-0.078	0.113	0.576	1.435	4.083	5.758	4.581	2.431
(7) All Mega Deals 1-5	0.596	2.230	0.279	0.971	-0.115	0.188	0.759	2.010	3.764	6.747	4.444	2.685
EXPORT (% Change)												
(1) China-India FTA	1.220	0.743	0.021	-0.284	-0.015	-0.265	-0.054	-0.190	-0.123	-0.146	2.368	3.824
(2) China-Japan-Korea FTA	1.737	2.656	-0.044	0.160	-0.026	0.150	6.990	7.104	6.021	6.815	-2.507	-0.509
(3) China-TPP	7.376	4.227	8.666	6.144	-0.301	-2.220	9.797	7.210	-0.810	-3.805	-0.891	-2.519
(4) RCEP	6.449	3.023	-0.052	-2.226	-0.128	-2.304	11.250	8.490	8.562	5.751	5.022	3.357
(5) China-US FTA	2.028	1.684	2.230	1.561	-0.225	-0.391	-0.322	-0.326	-0.323	-0.233	-3.149	-1.080
(6) 1+2+4+5	9.596	5.437	2.192	-0.870	-0.378	-2.838	10.872	8.061	8.133	5.503	4.360	2.936
(7) All Mega Deals 1-5	9.763	4.007	8.771	5.198	-0.334	-3.446	14.267	10.468	8.154	4.169	4.400	1.306
IMPORT (% Change)												
(1) China-India FTA	0.060	0.422	-0.010	-0.229	-0.004	-0.252	-0.014	-0.272	-0.038	-0.311	1.458	3.995
(2) China-Japan-Korea FTA	0.246	2.829	-0.013	0.086	-0.012	0.091	0.275	6.851	2.696	6.450	-1.686	-3.410
(3) China-TPP	0.552	6.563	0.343	6.711	-0.062	-1.374	0.557	8.895	-0.542	-0.749	-0.226	-0.205
(4) RCEP	0.538	7.070	-0.092	-0.960	-0.079	-1.160	0.571	10.571	4.026	9.434	4.560	7.212
(5) China-US FTA	0.108	1.207	0.138	2.193	0.002	-0.365	0.018	-0.410	0.084	-0.460	-1.625	-3.812
(6) 1+2+4+5	0.715	8.623	0.038	1.062	-0.078	-1.685	0.576	9.881	4.083	8.636	4.581	6.550
(7) All Mega Deals 1-5	0.596	9.267	0.279	6.338	-0.115	-2.019	0.759	12.438	3.764	8.450	4.444	6.442
TRADE (% Change)												
(1) China-India FTA	1.220	0.580	0.021	-0.253	-0.015	-0.259	-0.054	-0.233	-0.123	-0.244	2.368	3.935
(2) China-Japan-Korea FTA	1.737	2.744	-0.044	0.119	-0.026	0.121	6.990	6.973	6.021	6.598	-2.507	-2.395
(3) China-TPP	7.376	5.410	8.666	6.463	-0.301	-1.805	9.797	8.084	-0.810	-1.988	-0.891	-1.014
(4) RCEP	6.449	5.072	-0.052	-1.512	-0.128	-1.744	11.250	9.569	8.562	7.941	5.022	5.864
(5) China-US FTA	2.028	1.442	2.230	1.917	-0.225	-0.378	-0.322	-0.370	-0.323	-0.368	-3.149	-2.856
(6) 1+2+4+5	9.596	7.050	2.192	0.219	-0.378	-2.273	10.872	9.005	8.133	7.366	4.360	5.286
(7) All Mega Deals 1-5	9.763	6.670	8.771	5.840	-0.334	-2.746	14.267	11.490	8.154	6.714	4.400	4.646

Note: (1) "Inside Money" denotes inside money model structure; "Exogenous" denotes exogenous fixed trade imbalance model structure; (2) "1+2+4+5" denotes the FTAs of China-India, China-Japan-Korea, RCEP and China-US exist at the same time.

Source: Calculated and compiled by authors.

5.7 Sensitivity Analysis to Elasticities and Upper Bound Inside Money

Elasticities in our general equilibrium model all equal to 2 according to some literatures. We change the elasticities value to separately equal 1.6 and 2.4 to check the sensitivity of the results. Meanwhile, upper bound inside money value in our model is choose to equal 1000, we change this value to separately equal 2000 and 3000 to check the sensitivity of the results. Table 19 reports all these sensitivity analysis results.

According to the elasticities sensitivity analysis results, all the impact directions (positive or negative) are the same. Comparatively, big elasticity value will generate more severe and significant influence. According to the upper bound inside money sensitivity analysis results, all the impact directions (positive or negative) are the same either. Comparatively, big upper bound inside money value will generate more severe and significant influence too.

Sensitivity analysis to elasticities and upper bound inside money prove that all simulation results in our paper are reliable and definite.

Table 19: Sensitivity Analysis for the Tariff Plus 25% Non-Tariff Elimination Situation to Elasticity and Upper Bound Inside Money

FTAs/Country	CHINA			US			EU			JAPAN			KOREA			INDIA		
Elasticity	E=1.6	E=2	E=2.4	E=1.6	E=2	E=2.4	E=1.6	E=2	E=2.4	E=1.6	E=2	E=2.4	E=1.6	E=2	E=2.4	E=1.6	E=2	E=2.4
									EV/GDP (%)									
(1)CN-INDIA	0.054	0.060	0.066	-0.010	-0.010	-0.010	-0.004	-0.004	-0.004	-0.009	-0.014	-0.018	-0.019	-0.038	-0.057	1.197	1.458	1.738
(2)CJK FTA	0.187	0.246	0.306	-0.011	-0.013	-0.014	-0.011	-0.012	-0.013	0.283	0.275	0.269	2.25	2.696	3.165	-1.581	-1.686	-1.78
(3)CHINA-TPP	0.495	0.552	0.616	0.317	0.343	0.367	-0.056	-0.062	-0.068	0.554	0.557	0.561	-0.383	-0.542	-0.704	-0.113	-0.226	-0.353
(4)RCEP	0.482	0.538	0.601	-0.081	-0.092	-0.101	-0.069	-0.079	-0.088	0.583	0.571	0.560	3.462	4.026	4.612	3.901	4.56	5.238
(5)CHINA-US	0.081	0.108	0.138	0.119	0.138	0.154	0.0003	0.002	0.004	0.016	0.018	0.02	0.08	0.084	0.089	-1.504	-1.625	-1.735
(6)1+2+4+5	0.638	0.715	0.800	0.030	0.038	0.045	-0.07	-0.078	-0.085	0.590	0.576	0.564	3.53	4.083	4.661	3.945	4.581	5.235
(7)All 1-5	0.544	0.596	0.658	0.261	0.279	0.296	-0.102	-0.115	-0.127	0.779	0.759	0.741	3.298	3.764	4.252	3.85	4.444	5.054
									TRADE (% Change)									
(1)CN-INDIA	0.591	0.768	0.956	-0.012	-0.015	-0.020	-0.031	-0.031	-0.034	-0.003	-0.012	-0.023	-0.018	-0.042	-0.066	2.539	3.318	4.136
(2)CJK FTA	1.958	2.516	3.105	-0.005	-0.017	-0.030	-0.004	-0.015	-0.026	4.951	6.126	7.342	5.484	6.677	7.904	-2.674	-3.216	-3.695
(3)CHINA-TPP	5.140	6.516	7.922	5.442	6.884	8.322	-0.287	-0.321	-0.375	7.529	9.327	11.15	-0.344	-0.524	-0.726	0.016	-0.007	-0.053
(4)RCEP	5.062	6.363	7.694	-0.067	-0.107	-0.168	-0.133	-0.173	-0.23	8.494	10.46	12.444	8.261	9.909	11.56	5.676	7.009	8.354
(5)CHINA-US	1.165	1.552	1.962	1.306	1.773	2.247	-0.191	-0.199	-0.211	-0.149	-0.171	-0.197	-0.107	-0.132	-0.157	-2.655	-3.206	-3.694
(6)1+2+4+5	6.817	8.615	10.456	1.210	1.628	2.029	-0.356	-0.405	-0.477	8.334	10.260	12.206	8.132	9.733	11.34	5.675	6.998	8.326
(7)All 1-5	6.811	8.599	10.428	5.485	6.919	8.335	-0.341	-0.396	-0.482	10.865	13.370	15.902	8.108	9.667	11.23	5.686	7.002	8.313
Inside Money	1000	2000	3000	1000	2000	3000	1000	2000	3000	1000	2000	3000	1000	2000	3000	1000	2000	3000
									EV/GDP (%)									
(1)CN-INDIA	0.060	0.065	0.070	-0.010	-0.012	-0.016	-0.004	-0.005	-0.007	-0.014	-0.024	-0.031	-0.038	-0.071	-0.088	1.458	1.736	1.920
(2)CJK FTA	0.246	0.361	0.455	-0.013	-0.017	-0.021	-0.012	-0.013	-0.015	0.275	0.156	0.105	2.696	2.947	3.140	-1.686	-1.929	-2.122
(3)CHINA-TPP	0.552	0.710	0.846	0.343	0.422	0.477	-0.062	-0.069	-0.082	0.557	0.443	0.384	-0.542	-0.714	-0.811	-0.226	-0.455	-0.582
(4)RCEP	0.538	0.731	0.895	-0.092	-0.119	-0.144	-0.079	-0.098	-0.117	0.571	0.427	0.36	4.026	4.327	4.548	4.56	5.116	5.449
(5)CHINA-US	0.108	0.113	0.126	0.138	0.234	0.300	0.002	0.008	0.007	0.018	-6E-04	-0.017	0.084	0.003	-0.048	-1.625	-1.990	-2.214
(6)1+2+4+5	0.715	0.916	1.096	0.038	0.108	0.148	-0.078	-0.092	-0.114	0.576	0.407	0.317	4.083	4.277	4.434	4.581	4.983	5.238
(7)All 1-5	0.596	0.801	0.985	0.279	0.335	0.375	-0.115	-0.137	-0.162	0.759	0.552	0.441	3.764	3.948	4.114	4.444	4.843	5.107
									TRADE (% Change)									
(1)CN-INDIA	0.768	0.787	0.788	-0.015	-0.007	-0.010	-0.031	-0.011	-0.008	-0.012	-0.011	-0.015	-0.042	-0.044	-0.050	3.318	3.550	3.636
(2)CJK FTA	2.516	2.543	2.546	-0.017	-0.036	-0.038	-0.015	-0.036	-0.035	6.126	6.040	5.940	6.677	6.765	6.776	-3.216	-3.407	-3.481
(3)CHINA-TPP	6.516	6.687	6.727	6.884	7.119	7.126	-0.321	-0.234	-0.206	9.327	9.341	9.261	-0.524	-0.515	-0.532	-0.007	-0.089	-0.148
(4)RCEP	6.363	6.471	6.481	-0.107	-0.132	-0.151	-0.173	-0.159	-0.152	10.456	10.41	10.284	9.909	10.08	10.06	7.009	7.479	7.563
(5)CHINA-US	1.552	1.648	1.694	1.773	1.977	2.067	-0.199	-0.114	-0.085	-0.171	-0.114	-0.101	-0.132	-0.111	-0.116	-3.206	-3.409	-3.506
(6)1+2+4+5	8.615	8.837	8.893	1.628	1.823	1.897	-0.405	-0.283	-0.243	10.261	10.28	10.161	9.733	9.920	9.898	6.998	7.453	7.505
(7)All 1-5	8.599	8.799	8.846	6.919	7.089	7.064	-0.396	-0.307	-0.281	13.374	13.35	13.195	9.667	9.836	9.811	7.002	7.425	7.472

Source: Calculated and compiled by authors.

6. Conclusions and Policy Implications

Mega trade deals have grown very fast in recent years after the global financial crisis, and with them China will play an important role as a big trade country. This paper uses a numerical global general equilibrium model with added monetary structure using inside money to endogenously determine the trade imbalance which are offset through inter-temporal trade across countries in money. We have added the trade cost into the model which is important and suitable for exploring FTAs effects. Then we simulate the potential impacts of China involved possible mega deals with this numerical general equilibrium model.

We investigate seven different mega deal scenarios including China-India FTA, China-Japan-Korea FTA, China-TPP, RCEP, China-US FTA, and other two mixed FTAs cases. We divide trade cost reduction level into three different situations, which are elimination of tariffs only, eliminating tariff and 25% non-tariff, eliminating tariff and 50% non-tariff to separately study the influences. We pay attention to the effects on welfare, export, import, total trade and trade imbalance for six big countries of China, the US, the EU, Japan, Korea and India. We do sensitivity analysis with different model structure and variable elasticities and upper bound inside money.

Our simulation results show that almost all FTA participation countries will gain from possible mega deals, but nearly all FTA non-participation countries will lose from these mega deals. In the meanwhile, as non-tariff barrier eliminates more, the impacts will be more severe and more significant.

All effects to China on welfare, trade, export and import are positive which means that China will gain from these possible mega deals. Comparatively China-TPP and RCEP will generate the highest welfare outcome in our model for China, the next highest is China-Japan-Korea FTA, and then China-US FTA.

For the US, China-TPP will generate the highest welfare outcome in our model and the next highest is China-US FTA. For the EU, all China involved mega deals have negative welfare outcomes except China-US FTA. For Japan, RCEP will generate the highest welfare outcome and the next highest is China-TPP. For Korea, RCEP will generate the highest welfare outcome and the next highest is China-Japan-Korea FTA. For India, RCEP will generate the highest welfare outcome and the next highest is China-India FTA.

These results have some policy implications. For China, actually China-TPP will benefit China a lot; China should take account of entering TPP in the future instead of seeing it as a threat. In the meanwhile, RCEP, China-US FTA and China-India FTA all have significant positive impacts on China; China should consider seriously negotiating these mega deals. For the US, China-TPP and China-US FTA both have significant positive effects to her, it is good for the US to welcome China entering the TPP and negotiate with China about bilateral FTA. For Japan and Korea, both RCEP and CJK FTA will benefit them significantly, they should pay more attention to this two mega deals. For India, RCEP and China-India FTA both have positive effects; it is a good choice to fasten the step of RCEP and China-India negotiation.

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