Global Trade Analysis Project
https://www.gtap.agecon.purdue.edu/

This paper is from the
GTAP Annual Conference on Global Economic Analysis
https://www.gtap.agecon.purdue.edu/events/conferences/default.asp

The Impact Analysis of TTIP on BRICs—based on dynamic GTAP model considering GVC

Cai Songfeng[1] Zhang Yaxiong[1] Meng Bo[2]

（1,State Information Center of China; 2, Institute of Developing Economies, Japan External Trade Organization）

Abstract

Within the global value chain (GVC), the intermediate inputs of the products in one country come from various countries around the world, the imported products consumed in domestic may also include the domestic intermediate inputs. Therefore, it is very important to reflect this GVC characteristic when Using GTAP (Global Trade Analysis Project) model to analyze the trade policy. Because of the lack of necessary data, the armington assumption of trade linkage is implemented in two levels in the GTAP model: producers and consumers distinguish the domestic variety of a good from its imported variety without regard to the country of origin of the imported input; the sourcing of imported goods is placed at the border of an economy. In order to improve this common approach which simplifies the import decision at the border level, we introduce the WIOD（World Input-Output Database）with a micro-based determination of bilateral trade to place the sourcing of imports at the agent level. In this study, we use the improved dynamic GTAP model (we call it GTAP-GVC model) to assess the economy-wide impact of TTIP (Transatlantic Trade and Investment

Partnership) on BRICs. In the simulation, we mainly do the work in two aspects. Firstly, we reduce both tariff and non-tariff barriers (NTBs) between US and EU. Because average tariff levels on both sides of the Atlantic are relatively low already, various non-tariff barriers or NTBs (often in the form of domestic regulations) on both sides of the Atlantic constitute important impediments to deepening transatlantic trade linkages. For quantification of NTBs, this study has adopted the equivalent tariff levels of NTBs from the research results of Ecorys (2009) to capture the impact of removing NTBs. Secondly, the simulations that are carried out also take into account two sets of possible spillover effects beyond bilateral liberalization. These are defined as follows. First, we have included direct spillover. It is based on the assumption that improved regulatory conditions negotiated between the EU and the US will also result in a limited fall in related trade costs for third countries exporting to the EU and US. A second indirect effect involving third countries is considered as well: the indirect spillover. It means to gauge the economic implications if third countries adopt some of the common standards agreed between the EU and the US.

Key words: TTIP, BRICS, GVC, NTBs

1. Introduction

Economic globalization and regional economic integration are two important trends in global economic development. It is remarkable that among free trade agreements that appear around the world, bilateral ones are increasing, becoming new hot issues in international economic integration.

Since Obama was re-elected in 2013, America has promoted the Trans-Pacific Partnership (TPP), and planned the Transatlantic Trade and Investment Partnership (TTIP) with the European Union for free trade zone talks. The talks are part of the plan for America to double its export, to accelerate its economic recovery, and to benefit from geo-political dividend. The EU and the U.S. are the largest economies in the world and the largest trade partners for each other, with an average daily trade volume of 2 billion Euros, and a bilateral investment stock of over 2 trillion Euros. Both economies' GDP and trade account for one half and one third, respectively, among the global volume. If the EU-US free trade area (TTIP) is established, it is going to profoundly influence economy of the world and the developing countries.

BRICS, as an important developing economy in the world, plays a significant role in global trade. Yet initiating the TTIP will greatly influence BRICS. So it is crucial to analyze the area's impact on BRICS economy, its bilateral trade and multilateral trade.

In terms of current essays, many have studied regional trade liberalization based on

GTAP models. Ianchovichina, et al (1999) applied a dynamic GTAP model in the context of Asian financial crisis to analyze the strength and weakness of Asian economic integration. Lewis, et al (1999) used GTAP to study southern Africa and the economic effect of multilateral trade agreements. Walmsley, et al (2000) adopted dynamic recursion of GTAP to assess the dynamic effects since Japan and Singapore established the FTA. Walsmsley indicated that in the long run, developing a FTA can benefit both parties more than other regions of the world. Harbuzyuk (2011) applied GTAP to simulate and analyze the impact of Ukraine's entry into the EU. Kouparitsas (2001) adopted a dynamic GTAP model to research the effect of North American Free Trade Agreement between Canada and America. Manchin (2004) used GTAP to simulate several possible scenarios and applied quantitative analysis to the economic effects of the EU-Russia FTA. Brown, et al (2005) established a GTAP model of 18 sectors and 22 countries and regions to assess the economic effects of the Free Trade Area of the Americas. Shakur (2005) used GTAP for simulation and research, suggesting that through regional trade with its neighboring countries, especially India, Bangladesh can benefit from the welfare of trade liberalization. Hajrtono, et al (2007) simulated and studied the welfare effect in Indonesia in the participation of bilateral, regional and multilateral FTA (with welfare effect covering economic growth, poverty, and income distribution). Walmsley and Strutt (2010) explored the latest financial crisis to study its impact on international trade and industrial sectors. Kitou (2010) used GTAP for the research into economic influence of the EU-Canada FTA. Francois

(2013) applied a dynamic model to simulate the economic influence of reducing tariff barriers and NTBs in the TTIP.

The existing literature on regional trade liberalization regarding GTAP indicates the follow aspects. In terms of research subject, much research focused on what impact the bilateral and regional trade liberalization had on the members within the FTA, instead of other countries outside the area. In terms of research methods, much of the research used a static GTAP model rather than a dynamic one. And most GTAP models assumed on a simple national basis for trade association among countries, while the assumption cannot represent the current global trade value added and global value chain (GVC). So this study has revised the GTAP model, overcome the above two inadequacies, and applied the latest dynamic GTAP model (2007). On such basis, the study expands a module to reflect GVC, simulates the TTIP impact on BRICS, and offered conclusions and suggestions.

The rest of the paper is organized as follows. Modeling, description, and simulation design of the paper are given in Section 2. Results of the simulation are offered in Section 3, and concluding remarks are in Section 4.

2. Modeling and Simulation Design

2.1 Modeling

2.1.1 Brief introduction of GTAP

This paper is based on the Global Trade Analysis Project (GTAP) model. GTAP, in accordance with the Neo-classical economics, is a multi-country, multi-sector applied general equilibrium model. It is developed by Professor Hertel, head of the Global Trade Analysis Project from Purdue University. The model is widely applied for analyzing trade policies. In GTAP modeling, detailed sub-national/sub-regional models are constructed in terms of production, consumption, government expenditure, etc. Then each sub models are linked through international trade relations to build a multi-country, multi-sector general equilibrium model. In the policy simulation of the model, we can explore the policy impact on the national or regional production, import, export, price, supply and demand of production factors, factor returns, GDP, social welfare, etc. For detailed information, please see Hertel (1997).

GTAP, which has a high quality for quantitative analysis of policies, can offer necessary quantitative analysis for policy choices and decision making. It is adopted in international economic and trade analysis by major economic organizations, such as World Trade Organization, International Monetary Fund, World Bank, etc, producing positive results. This paper, based on GTAP to simulate related impact of TTIP, is quite feasible and widely recognized by the international community.

The latest release is the GTAP 8 Data Base, which has adopted the 2007 Social Accounting Matrix of various countries. The database covers 129 countries and 57

products. To comply with the research demand, we have pulled up an aggregate of 36 sectors and 11 countries and regions (See Appendix 1).

2.1.2 Improvement of GTAP Model

2.1.2.1 Improvement in armington specification

Figure 1 illustrates the implementation of the armington specification in the traditional GTAP model. The topside of Figure 1 sketches substitution possibilities in the production process of a particular sector. At the top level, valued-added, a composite of labour and capital, can be substituted with intermediate inputs. At the second level,the domestic variety of a particular intermediate input can be substituted with itsimported variety; this is the first component of the armington assumption. The GTAP model incorporates similar substitution possibilities for household demands. The downside of Figure 1 shows that the sourcing of imported goods, for instance how much to import from particular countries, is modelled for the economy as a whole;

We build a GVC flavored CGE model that improves over a common approach to simplify import decisions at the border level based on development of the GVC data. As is shown in the Figure 2, a particular producer decides not only how much to import of a particular good, but also from where to source these imports from. Thus in the GTAP-GVC model we have potentially established tighter linkages between sectors located in different economies than the linkages contained in the GTAP model.

We have also substituted an aggregate mechanism that determines bilateral trade, i.e., sourcing of imports for the economy as a whole in the GTAP model, with a micro-based mechanism of bilateral trade, such as the sourcing of imports at the agent level.

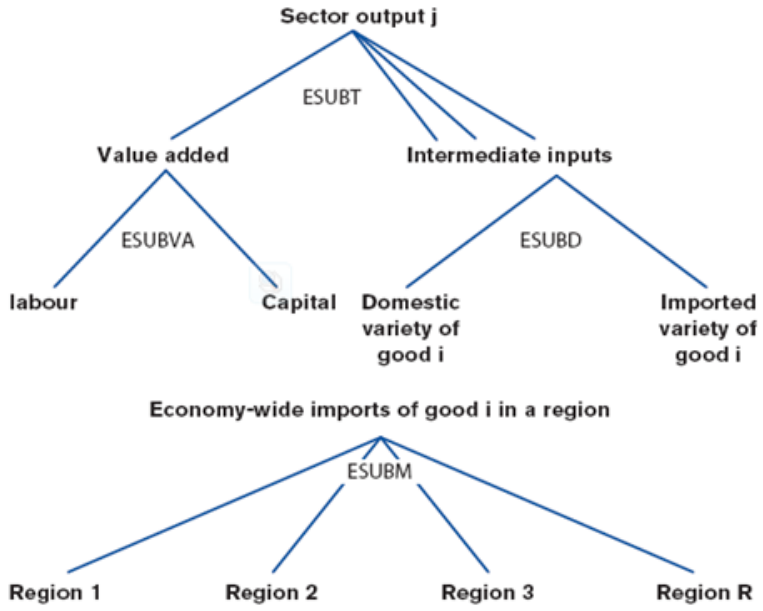

Figure 1 Armington assumption of original GTAP model

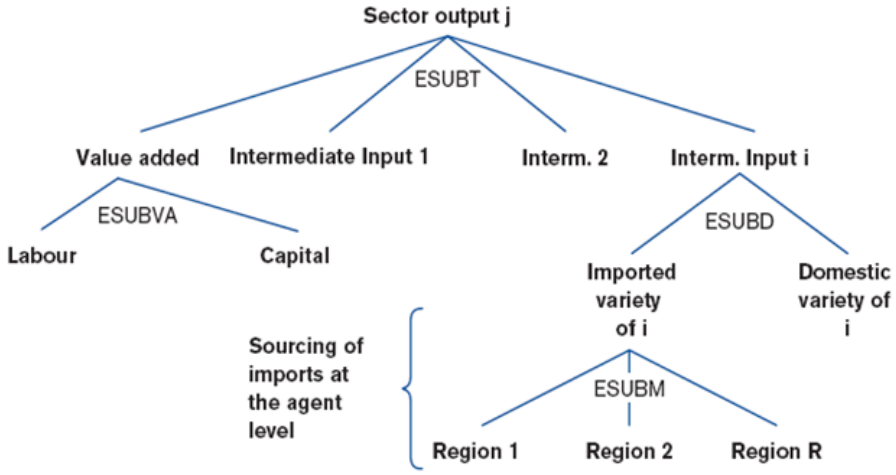

Figure 2 Armington assumption of GTAP-GVC model

2.1.2.1 Improvement in armington specification

2.1.2.2 Improvement in Non-Tariff Barriers (NTBS)

Tariffs and tariff revenues are explicit in the standard GTAP database, and therefore can be directly incorporated into the model used here directly from the standard database. However, NTBs affecting goods and services trade, as well as cost savings linked to trade facilitation are not explicit in the database and we need to take steps to capture these effects. Where NTBs leads to higher costs, we follow the standard approach to modelling NTBs costs in the GTAP framework, originally developed by Francois (1999, 2001) with support from the European Community (EC) to study the Doha Round.

2.2 Analysis Description

This analysis uses the impact of TTIP as an example to study how the EU's global FTA strategy is going to influence the global and the BRICS economy. For quantitative projection of the economic influence of TTIP, we need two preconditions. One is the quantitative level of traditional tariff barriers and NTBs between the EU and the America. And the other is the possible agreements of TTIP, which is the reduction of those barriers among the two economies. To explain how the analysis is conducted, these two perspectives are described as follows.

2.2.1 Tariff and Non-Tariff Barriers between the EU and the U.S.

In this section we focus on existing tariff barriers. Figure 3 shows that there is some

heterogeneity in terms of tariff protections between the EU and the US. While in most sectors, EU tariffs are slightly higher than those imposed by the US, they are still relatively low. However, there are two main exceptions: motor vehicles, and processed foods. The EU average tariffs on these products are substantially higher than the US tariffs. For motor vehicles[1] the EU applies an average tariff (8.0 per cent) that is almost eight times higher than the US. For processed food products, EU average tariffs (14.6 per cent) are more than four times higher than US average tariffs. For agriculture, forestry and fisheries average tariffs are also relatively high (about 3.7 per cent) but for these products there is no difference between the EU and the US. The tariffs for energy products and service sectors are generally 0%.

Given the current tariff structure, the scope for tariff reductions to have a significant impact on trade flows is limited. Indeed, for most sectors, a further reduction in tariffs implies very small absolute changes in the level of protection. Nevertheless, in some sectors, such as processed foods, agriculture, forestry and fisheries, and motor vehicles, the impact is likely to be more substantial. For other sectors, NTBs are the primary driver of potential impact as will be shown in the next section.

[1] Motor vehicles sector in this case includes also parts and components.

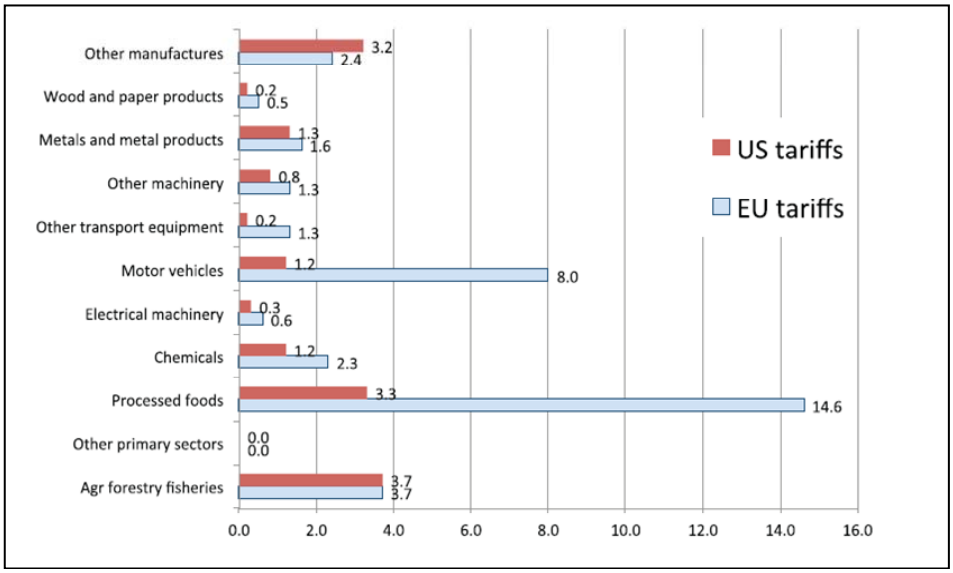

Figure 3: Tariff between the EU and the U.S.

Source of Data: GTAP 8 Data Base

Unlike traditional tariff, NTBs include price and quantity control (import quota, import certificate), technical standard specifications, testing and quarantine of animals and plants, import monopoly, etc. There are various types of NTBs, and compared with tariff barriers, NTBs exert greater influence, but are difficult to quantify. This study has adopted the research results from a European consultancy firm of Ecorys (2009)[2]. In terms of the NTB equivalents, the figures between the EU and the U.S. are relatively high, as is indicated in Table 1. In terms of arithmetic means, America imposes an NTB equivalent of 21.2% on products imported from the EU, while the EU level is 17.1% on American products. It is indicated that NTBs are much higher that traditional tariffs. Therefore, we can anticipate that reducing NTBs are going to be a focal point in the TTIP talks.

[2] Ecorys offered questionnaires to export businesses, and applied econometric models to estimate the equivalent tariff levels of NTBs.

With reference to specific products, we can see that agro-processing industries, which are set high tariffs, have even higher NTBs. For example, since the EU and the U.S. maintain different quality standards for farm produce, the NTB equivalent is above 50% accordingly. And in manufacturing industries, where the traditional tariff is relatively low, the NTBs are quite high. For example, for petroleum products and chemical industries, the traditional tariff is only 1%, but the NTB equivalents have reached a range between 13% and 19%. And in automobile manufacturing, where the traditional tariff is below 8%, the NTB equivalent is above 25%. For services and trade, where the traditional tariff is 0%, high NTBs are introduced. For example, financial service and insurance boast 0% of traditional tariff, but they are imposed NTB equivalents between 10% and 30%.

Table 1: NTB Equivalents between the EU and the U.S.

	US Customs Duty on EU-Imported Products（%）	EU Customs Duty on American Imported Products（%）
Agricultural Sector	73.3	56.8
Agro-processing	73.3	56.8
Wood Products	7.7	11.3
Pulp, Paper, Printing and Publishing	7.7	11.3
Petroleum Products	19.1	13.6
Chemical Industry	19.1	13.6
Non-metallic Mineral Products	17	11.9
Steel	17	11.9
Other Metal	17	11.9
Metal Products	17	11.9
Automobiles	26.8	25.5
Manufacturing of Other Transport Equipment	19.1	18.8
Office Machinery and Communication Equipment	14.7	12.8
Machinery and Equipment	25.4	21.5

Other Manufacturing Industries	25.4	21.5
Construction Work	2.5	4.6
Water Transport	8	8
Air Transport	2	2
Communications	1.7	11.7
Financial Service	31.7	11.3
Insurance	19.1	10.8
Average	21.2	17.1

Source of Data: Ecorys (2009)

2.2.2 Policy Scenario for Solid Achievements in TTIP

A. Base Case

Considering the fact that GTAP 8 Data Base only offers database and structures of various countries and sectors in 2007, the database cannot fully represent the current economy and trade. Therefore, as is shown in figure 4, this paper has adopted Walmsley's dynamic recursion to expand and update the GTAP 8 Data Base in terms of population, unskilled labor, skilled labor, natural endowments, capital stock and GDP growth. Then we develop a base case to represent the current situation for making reference and comparison to the simulation scenario.

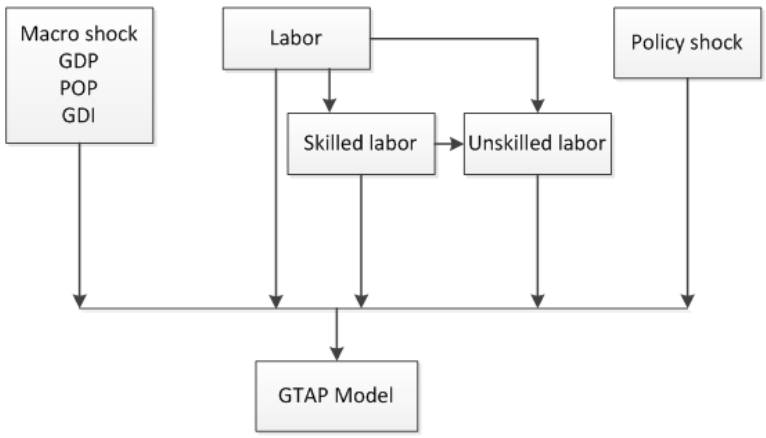

Figure 4 Base Case of GTAP

Besides the update in GDP, population, labor, capital stock, and other macroeconomic data, the new base case has been enhanced mainly as follows:

First, according to the Agreement on Trade in Goods of China-ASEAN FTA, by 2010, China and the six old members of ASEAN (Brunei, Indonesia, Malaysia, Philippine, Singapore, and Thailand) should reduce the tariffs of most normal goods down to zero. And the zero-tariff agreement shall be phased by China and the four new members of ASEAN (Cambodia, Laos, Burma, and Vietnam) by 2015.

Second, tariffs for all products among the 27 EU members have been reduced to zero.

Thirdly, the EU-South Korea FTA reached an agreement in the negotiation on July, 13th, 2009, which has entered into force since July, 2011. In accordance with its agreement, the EU should reduce 96% of the tariffs within the three years between 2011 and 2013. South Korea should reduce 99% of the tariffs within this period, and remove all tariffs for industrial products by 20153. In addition, the EU agrees that South Korea can still keep the export tax refund system4.

B. Policy Scenario

As is suggested in the previous analysis that tariffs between the EU and the U.S. are already low, it would be easy for them to agree on the tariff reduction. Therefore, the

[3] Usually there are two ways to phase the zero-tariff treatment. One is to apply an equal rate of tariff reduction each year. The other is dependent on an equal amount of reduction. Slight differences are indicated in the final results of the two methods. We have adopted the second method to reduce tariffs.

[4] In the reduction of tariffs, this paper didn't take sensitive products (special products) into consideration. The paper presumes that all products, including agricultural produce, industrial products, and products in the service sector, have all seen reduction in tariffs.

EU-America FTA talks shall focus on removing NTBs and improving investment environment. This study shall measure the impact of tariff barriers and NTBs. In conjunction with the progress and schedule of the EU-America talks, this study presumes that the talks shall be accomplished in 2016, and that TTIP shall be officially put into force before 2017. Specific results of the talks could be as follows. Comprehensive and ambitious FTA will be implemented, 99% of traditional tariffs are cut to zero. And NTBs could see solid achievements with 40% of them being reduced (mainly through removing import restrictions, setting uniform standards, breaking technical barriers, reducing quarantine standards, streamlining approval processes, as well as other methods to facilitate trade).

The policy simulations that are carried out also take into account concepts of spill-overs. More specifically, in setting up the experiments, we have included two sets of possible effects beyond bilateral liberalization. These are defined as follows. First, we have included direct spill-overs. These are based on the assumption that improved regulatory conditions negotiated between the EU and the US will also result in a limited fall in related trade costs for third countries exporting to the EU and US. This positive market access effect for third countries is modelled as being around 20 per cent of the bilateral fall in trade cost related to NTBs for the core scenarios. This concept was introduced in the EU-Japan study by Copenhagen Economics (2009). In practice, it means that if there is 5 per cent NTB-related trade cost reduction between the EU and US, there will also be a 1 per cent trade cost reduction for third countries

exporting to the EU and US. The logic is that firms in third countries may find it easier to meet either EU or US regulatory requirements if bilateral negotiations lead to simplifications that are not inherently discriminatory.

A second indirect effect involving third countries is considered as well: the indirect spillovers. These are meant to gauge the economic implications if third countries adopt some of the common standards agreed between the EU and the US. Given that, collectively, the EU and the US would stand as the biggest trading block in the world, there is a very real possibility that mutual agreement on regulations and standards would be adopted, partially, also by third countries. This implies that the bilateral agreement will give EU and the US improved market access in third markets from reduced NTBs. In addition, there will be scope for reductions in NTBs amongst third countries, as they converge further on common standards. Therefore, indirect spillovers will lead to lower costs and greater trade between third countries as well. We have modelled indirect spill-overs as 50 per cent of the direct spill-over rate. This means that for example for a 5 per cent trade cost reduction between the EU and US, and with 20 per cent corresponding direct spill-overs, we will have a 1 per cent (direct spill-over) reduction for third countries exporting to the US or EU, and a 0.5 percent (indirect spill-over) reduction for EU and US export costs to third countries, and for trade between third countries.

3. The measuring result

In this section we focus on the results of the GTAP-GVC modelling of bilateral trade liberalization. The results are reported with respect to an economic benchmark projected out to the year 2027, which implies that that they capture the impact of the agreement a full ten years after the implementation of the agreement, providing the longer-term impact of policy changes. First, we present results for the EU,US and the world. We then examine the results for BRICS, lastly, we present results for the South Africa.

3.1 Impact on US and EU

Resulting from a reduction of tariff and non-tariff barrier to trade between the EU and the US under a comprehensive FTA，US-EU FTA will promote the growth of trade between US and EU, which stimulates economic growth of the two regions. As shown in table 2, aggregate export and aggregate imports of US will respectively increase by 4.58% and 3.11%, aggregate exports and aggregate imports of EU will respectively increase by 3.17% and 2.02%, Real GDP of US and EU will respectively increase by 0.37% and 0.28%, which greatly promote economic recovery of US and EU.

3.2 Impact on global economy

US-EU FTA is the largest free trade zone in the world, which has significant effect on the global economy. According to the results of the GTAP model, As can be seen Table 4, led by the rapid economic growth of EU and US and its spillover effect，the global GDP and trade will respectively increase by 0.13% and 0.61%. The global welfare increases by $31.24 billion.

Table 2　Impact on macroeconomy of US and EU（%, 2027 benchmark）

	EU	US
Real GDP(%)	0.28	0.37
aggregate export（%）	3.17	4.58
aggregate imports（%）	2.02	3.11
US export to EU（%）	—	28
EU export to US（%）	21	—

Data source：GTAP simulation result

Table 3　Impact on industry-level bilateral trade of US and EU（%, 2027 benchmark）

Sector	US export to EU	EU export to US
agriculture	41.1	34.3
Coal	0.0	2.6
Oil	2.4	3.3
Natural Gas	8.8	11.5
Other Mining Industries	0.1	1.2
agriculturalprocessing	45.3	36.5
Clothes	13.1	4.8
Leather Products	15.3	2.2
Wood Products	20.5	11.7
Pulp, Paper, Printing and Publishing	12.9	8.9
Petroleum Products	14.5	12.5
Chemical Industry	24.6	19.2
Non-metallic Mineral Products	22.2	16.6
Steel	15.6	16.2
Other Metal	26.9	23.3
Metal Products	26.3	24.3

Automobiles	32.5	25.2
Manufacturing of Other Transport Equipment	30.8	26.1
Office Machinery and Communication Equipment	24.7	26.4
Machinery and Equipment	39.4	35.9
Other Manufacturing Industries	36.0	35.6
Electricity	0.3	2.4
Gas and Heat Supply	1.2	2.8
Tap Water Production and Supply	-0.2	2.3
Construction Work	6.6	4.2
Trade	-0.8	1.9
Inland Transport	0.6	1.4
Water Transport	11.8	11.7
Air Transport	3.2	2.8
Communications	15.9	3.2
Financial Service	14.5	30.4
Insurance	14.4	18.2
Renting Services	-0.6	1.4
Recreational, cultural and sporting services	6.3	3.9
Public Services	-0.8	1.2
Real Estate	0.8	1.7

Data source：GTAP simulation result

Table 4　Impact on global economy（%, 2027 benchmark）

	World
Real GDP(%)	0.13
volume of world trade（%）	0.61
welfare（0.1 billion）	312.44

Data source：GTAP simulation result

3.3 Impact on BRICS

As is shown in figure 5, there are two factors affecting the macro-economy of BRICS, the first is the trade substitution effect of TTIP, the second is the spillover effect of TTIP. Under the impact of these two factors, the BRICS suffer differently. As shown

in table 5, the most of BRICS export(India、Russia、South Africa、China) will also suffer negative effects because export substitution effect of US-EU FTA is greater than the spillover effect, which will make real GDP of India, Russia, South Africa and China respectively decrease by 0.09%、0.1%、0.08% and 0.12%.

For Brazil, because the spillover effect is greater than the export substitution effect of US-EU FTA, the aggregate export of Brazil to US and EU will increase, which is translated into improved growth in gross domestic product (GDP) for Brazil. As shown in table 5, aggregate export and real GDP of Brazil will increase by 0.33% and 0.1% respectively.

For the bilateral trade of BRICS, as shown in table 6, because the strengthened trade linkage between US and EU substitute the exports of BRICS to them, the most of BRICS export to US and EU go down. As shown in table 7, due to substitute effect and spillover effect, the which in turn strengthen trade linkage between BRICS and increase the bilateral trade of BRICS.

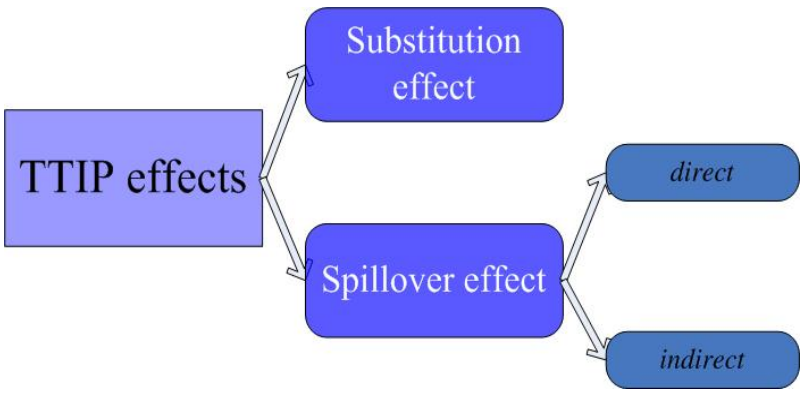

Figure 5　Effects of TTIP

Table 5 Impact on macroeconomy of BRICs（%, 2027 benchmark）

	India	brazil	Russia	South Africa	China
Real GDP(%)	-0.09	0.1	-0.1	-0.08	-0.12
aggregate export（%）	-0.12	0.33	-0.17	-0.14	-0.14
aggregate import（%）	-0.06	0.29	-0.11	-0.08	-0.05

Data source：GTAP simulation result

Table 6　Impact on BRICs export to US and EU（%, 2027 benchmark）

Importers / **Exporters**	US	EU
India	-3.1	-1.0
brazil	4.7	1.6
Russia	-4.3	-1.4
South Africa	-5.7	-1.9
China	-3.5	-1.2

Data source：GTAP simulation result

Table 7　Impact on bilateral trade of BRICs（%, 2027 benchmark）

Importers / **Exporters**	China	India	Brazil	South Africa	Russia
China	-	0.95	1.05	1.12	1.70
India	0.26	-	0.55	0.77	1.51
brazil	0.21	0.16	-	0.77	1.07
South Africa	0.31	0.57	1.06	-	1.08
Russia	1.27	0.36	0.63	0.22	-

Data source：GTAP simulation result

3.4 Impact on South Africa

3.4.1 South Africa's macroeconomy

Compared with the baseline scenario, South Africa's real GDP will decrease by 0.08%,

the social welfare decrease by $384 million; In general, the impact is not big, the main reason is that South Africa's total exports face lesser impacts (0.14%).There are two reasons for the lesser impacts, firstly, Due to the export structure of South Africa and Europe and the United States has certain complementary, therefore, only a few industry exports of South Africa are adversely affected，which mainly include Agricultural products, coal, metal products, and transportation equipment. Secondly, TTIP will increase the export of South Africa to other developed countries.

From the point of the price level, TTIP make South Africa's total economic demand decline, thus reduce the price of factors, and generate inhibitory effect on CPI.As shown in table 8, wages, capital price and land price will decline by 0.16%, 0.19% and 0.17% respectively, the consumer price index falls by 0.2%.

3.4.2 The industry in South Africa

There are two factors affecting the industrial output of South Africa, the first is that how the industrial export is affected, the second is the proportion of industry exports in total output. Taking these two factors together, as shown in table 9, Top ten industries whose outputs are adversely affected are also the top ten industries whose exports are adversely affected，which mainly include manufacturing of other transport equipment、construction、metal、non-metallic mineral products、automobiles、coal、real Estate、financial service、agriculture and public services，the output of top ten adversely affected industries will go down by between -3.6% and -0.05%. Top ten

industries whose outputs are positively affected mainly include Oil、Metal Products、Steel、Leather Products、Machinery and Equipment、Natural Gas、Pulp, Paper, Printing and Publishing、Office Machinery and Communication Equipment、Wood Products and Gas and Heat Supply, the output of top ten positively affected industries will go down by between 0.25% and 0.84%.

Table 8　Impact on macroeconomy of South Africa（%, 2027 benchmark）

	South Africa
Real GDP(%)	-0.08
aggregate export（%）	-0.14
aggregate imports（%）	-0.08
welfare（million dollar）	-384
Real wage（%）	-0.16
Capital price（%）	-0.19
Land price（%）	-0.17
CPI（%）	-0.2

Data source：GTAP simulation result

Table 9 Impact on industrial output of South Africa（%, 2027 benchmark）

Top ten benefited sectors		**Top ten suffering sectors**	
Sectors	**output（%）**	**Sectors**	**output（%）**
Oil	0.25	manufacturing of other transport equipment	-3.60
Metal Products	0.28	construction	-0.83
Steel	0.34	metal	-0.53
Leather Products	0.34	non-metallic mineral products	-0.22
Machinery and Equipment	0.44	automobiles	-0.18
Natural Gas	0.44	coal	-0.18
Pulp, Paper, Printing and Publishing	0.63	real Estate	-0.09
Office Machinery and Communication Equipment	0.67	financial service	-0.07
Wood Products	0.75	agriculture	-0.05
Gas and Heat Supply	0.84	public services	-0.05

Data source：GTAP simulation result

4. Conclusions

This paper quantitatively assesses the trade led impacts from a US-EU free trade area (FTA) agreement. In particular, the paper focuses on BRICs effects from the deal. According to the simulation results, we draw the following conclusions: Firstly, liberalizing trade between the EU and the US would have a positive impact on worldwide trade and economy, increasing global welfare by almost $31.2 billion. Secondly, a core message following from our results is that a focus on NTBs is critical to the logic of transatlantic liberalization, therefore, an ambitious and comprehensive transatlantic trade agreement could bring greatly increasing US-EU bilateral trade. This translates to significant economic gains as a whole for the EU and US. Thirdly，Most of BRICS exports to the EU and US would go down significantly, but the aggregate exports and GDP of BRICS suffer lesser impacts. The exceptional case occurs in Brazil of which aggregate exports and GDP benefits from TTIP. Fourthly, due to the indirect spillover effects that converge further on common standards in global trade, TTIP will increase the bilateral trade of BRICS.

5. References

Ianchovichina E, Martin W. Trade liberalization in China's accession to WTO[J]. Journal of Economic Integration, 2001, 16(4): 421-446.

Lewis J D, Robinson S, Thierfelder K. After the Negotiations: Assessing the Impact of Free Trade Agreements in Southern Africa[J]. Trade and Macroeconomic Division Working Paper No, 1999, 46.

Hertel T W, Walmsley T, Itakura K. Dynamic effects of the" new age" free trade agreement between Japan and Singapore[J]. Journal of Economic Integration, 2001, 16(4): 446-484.

Harbuzyuk O, Lutz S. Analyzing trade opening in Ukraine: effects of a customs union with the EU[J]. Economic Change and Restructuring, 2008, 41(3): 221-238.

Kouparitsas M A. Should trade barriers be phased-out slowly? A case study of North America[J]. Journal of Policy Modeling, 2001, 23(8): 875-900.

Manchin M. The economic effects of a Russia-EU FTA[R]. Tinbergen Institute, 2004.

Saha S K, Saha S, Shakur S, et al. Community-based cross-sectional seroprevalence study of hepatitis A in Bangladesh[J]. World journal of gastroenterology: WJG, 2009, 15(39): 4932.

Hartono D, Priyarsono D S, Nguyen T D, et al. Regional Economic Integration and Its Impacts on Growth, Poverty, and Income Distribution: The Case of Indonesia[J]. Review of Urban & Regional Development Studies, 2007, 19(2): 138-153.

Strutt A, Walmsley T. Trade and sectoral impacts of the global financial crisis: A dynamic CGE analysis[C]//Proceedings from ARTNet Asia-Pacific Trade Economists' Conference, Trade-Led Growth in Times of Crisis. Bangkok. 2009.

Kitou E, Philippidis G. A quantitative economic assessment of a Canada-EU Comprehensive Economic Trade Agreement[C]//Thirteenth Annual Conference on Global Economic Analysis. Bangkok. Available at: http://www. gtap. agecon. purdue. edu/resources/res_display. asp. 2010.

Elena Ianchovichina, Robert McDougall. Theoretical Structure of Dynamic GTAP. 2001, GTAP Working Paper No.17, Edition 1.1, 1-74.

Francois, J.F., B. McDonald and H. Nordstrom. Liberalisation and Capital Accumulation in the GTAP Model, 1996, GTAP Technical paper 7.

http://www.gtap.agecon.purdue.edu/resources/download/40.pdf. Accessed 6 December 2013.

Francois, J.F., van Meijl, H. and van Tongeren, F. Trade liberalisation in the Doha Development Round[J]. Economic Policy, 2005, 20(42), 349-391.

Ecorys. Non-Tariff Measures in EU-US Trade and Investment – An Economic Analysis. Report prepared by K. Berden, J.F. Francois, S. Tamminen, M. Thelle, and P. Wymenga for the European Commission, 2009, Reference OJ 2007/S180-219493.

Annex 1: Mapping of model sectors

Table A1 Mapping of Model Sectors to GTAP

NO.	GTAP Sector	Model Sector	NO.	GTAP Sector	Model Sector
1	pdr	1 agriculture	30	lum	9 Wood Products
2	wht	1 agriculture	31	ppp	10 Pulp, Paper, Printing and Publishing
3	gro	1 agriculture	32	p_c	11 Petroleum Products
4	v_f	1 agriculture	33	crp	12 Chemical Industry
5	osd	1 agriculture	34	nmm	13 Non-metallic Mineral Products
6	c_b	1 agriculture	35	i_s	14 Steel
7	pfb	1 agriculture	36	nfm	15 Other Metal
8	ocr	1 agriculture	37	fmp	16 Metal Products
9	ctl	1 agriculture	38	mvh	17 Automobiles
10	oap	1 agriculture	39	otn	18 Manufacturing of Other Transport Equipment
11	rmk	1 agriculture	40	ele	19 Office Machinery and Communication Equipment
12	wol	1 agriculture	41	ome	20 Machinery and Equipment
13	frs	1 agriculture	42	omf	21 Other Manufacturing Industries
14	fsh	1 agriculture	43	ely	22 Electricity
15	coa	2 Coal	44	gdt	23 Gas and Heat Supply
16	oil	3 Oil	45	wtr	24 Tap Water Production and Supply
17	gas	4 Natural Gas	46	cns	25 Construction Work
18	omn	5 Other Mining Industries	47	trd	26 Trade
19	cmt	6 agricultural processing	48	otp	27 Inland Transport
20	omt	6 agricultural processing	49	wtp	28 Water Transport
21	vol	6 agricultural processing	50	atp	29 Air Transport
22	mil	6 agricultural processing	51	cmn	30 Communications
23	pcr	6 agricultural processing	52	ofi	31 Financial Service
24	sgr	6 agricultural processing	53	isr	32 Insurance
25	ofd	6 agricultural processing	54	obs	33 Renting Services
26	b_t	6 agricultural processing	55	ros	34 Recreational, cultural and sporting services
27	tex	7 Clothes	56	osg	35 Public Services
28	wap	7 Clothes	57	dwe	36 Real Estate
29	lea	8 Leather Products			