Int. J. Hum. Capital Urban Manage., 7(3): 383-392, Summer 2022, Serial #27

International Journal of Human Capital in Urban Management
(IJHCUM)

Homepage: http://www.ijhcum.net/

ORIGINAL RESEARCH PAPER

Is there a connection between tariffs and economic growth? A computable general equilibrium analysis based on the Global Trade Analysis Project model

S.Sh. Hossain*, **H. Delin**, **M. Mingying**

Department of Agricultural Economics, The Institute of Agricultural Economics and Development, Graduate School of Chinese Academy of Agricultural Sciences, Beijing, China

ARTICLE INFO

Article History:
Received 28 Mrch 2022
Revised 30 May 2022
Accepted 20 June 2022

Keywords:
Computable general equilibrium model (CGE)
Economic growth
Policy
Sector

DOI: 10.22034/IJHCUM.2022.03.07

ABSTRACT

BACKGROUND AND OBJECTIVES: Tariff policy has a significant impact on a country's economic progress. The primary objective of this paper was to describe the construction of the Computable General Equilibrium (CGE) model and then analyze the economic impacts among simulated countries by introducing policy shocks like increases and decreases in tariffs.
METHODS: Tariff reductions resulted in an increase in intraregional and interregional trade, which is expected to spur long-term investment and economic growth. To examine the economic implications in multiple ways, this article initially used a tariff removal scenario and subsequently increased the tariff. The relationship between production, activity, elements, and other economic sectors of regions was depicted in this paper using a computational general equilibrium model based on the global trade analysis project model.
FINDINGS: The simulation resulted in a lower tariff having a beneficial influence on Korea's economic growth compared to other countries. In the agricultural and processed food sectors, Korea's trade balance improved dramatically, with exports and imports continuing high, while exports and imports in the manufacturing and service sectors declined. In contrast to other countries, Korea's processed food output surged by 198%. Finally, in comparison to other countries, Korea's welfare grew by $ US currency 17.56 billion. On the other hand, the trade balance between China and the United States fell by $US currency 6.25 billion and $US currency 7.95 billion, respectively. Korea's trade balance increased considerably, rising by $ 21.78 billion in US currency. Korea's GDP fell by about 0.8%, while China's dropped by nearly 0.3%. Other countries' gross domestic product changed slightly.
CONCLUSION: The influence of various tariff policies on countries is examined in this research paper. Computational general equilibrium analysis of tariff policies in the agriculture, processed food, infrastructure, manufacturing, and service sectors has gotten little attention in the past, so this paper used the Global trade analysis project model to try to fill in the gaps and find the benefits of mutual economic policy among countries.

NUMBER OF REFERENCES
36

NUMBER OF FIGURES
2

NUMBER OF TABLES
7

*Corresponding Author:
Email: *hossainsyedshoyeb@gmail.com*
Phone: +86-132-6946-3239
ORCID: 0000-0001-8282-8968

Note: Discussion period for this manuscript open until October 1, 2022 on IJHCUM website at the "Show Article.

INTRODUCTION

Agriculture, food, manufacturing, services, and infrastructure all play an important role in a country's economic development, promoting prosperity and growth while also improving quality of life (Srinivasu and Rao, 2013). By enhancing international trade, investment and tariff reduction in certain areas can improve regional economic performance. Computable General Equilibrium (CGE) model can analyze economic development of those sectors. CGE model has been widely used for policy analysis in many countries and has been successful (Ochuodho and Alavalapati, 2016). The CGE model can capture each economic agent's economic benefit, and computer-generated quantitative findings can help policymakers understand the economic shift following a shock (i.e. a new policy). To analyze the impact of tariff reduction, CGE models are now commonly used. To examine the effects of the free trade agreement, some articles utilized a static CGE model (Hossain and Delin, 2021; Dasgupta and Mukhopadhyay, 2017; Ganguly and Das, 2017; Jean *et al.,* 2014; Khorana and Narayanan, 2017; Shaikh, 2009); others assessed the effects of the free trade deal using a dynamic CGE model (Hossain and Delin 2021; Itakura and Lee, 2012; Thu and Lee, 2015). Lower tariffs boost welfare while also improving export value, household consumption, and gross fixed capital formation, according to Ahmed and O'Donoghue (2010), who utilized a CGE model to analyze the impact of tariff reductions on Pakistan's macroeconomic and welfare indicators. The impact of tariff reductions on the economies of India, Pakistan, and New Zealand was studied using a CGE model by Khorana and Narayanan (2017), Shaikh (2009), and Winchester (2009). They discovered that lowering tariffs enhances social welfare and strengthens gross domestic product (GDP) growth, the labor force, and production variables (capital and labor). The CGE model was developed by Mabugu and Chitiga (2007), and the findings suggest that trade liberalization reduces national employment while increasing formal employment, harming informal producers while benefiting informal traders due to lower import prices. On the other hand, Ganguly and Das (2017) developed a CGE model to assess the impact of foreign direct investment (FDI) and trade advancement in India, and discovered that any change in trade arrangements will affect not only the trade volumes of various parts, but also the level of GDP, the exchange rate, and government revenue. Tariff reduction has long been regarded to be beneficial to economic growth, and it has long been a cornerstone of most governments' regional development plans. Tariff reduction creates production facilities that stimulate economic activities; reduce transaction costs and trade costs and provides employment opportunities to the poor Hossain and Delin 2021. In previous literature (Hossain and Delin, 2021; Dasgupta and Mukhopadhyay, 2017; Ganguly and Das, 2017; Jean *et al.,* 2014; Khorana and Narayanan, 2017; Thu and Lee, 2015) also explained how the tariff reduction contribution to the economic growth of country/regions. Tariff reduction has been linked to increased national or regional economic growth in some of these studies. In addition, the Global Trade Analysis Project's (GTAP) model was chosen for this paper because of its comprehensive coverage of interregional trade, making it ideal for analyzing global trade policy. GTAP global computable general equilibrium (CGE) modeling framework is the best technique for undertaking an ex-ante analysis of the economic and trade ramifications of multilateral or bilateral trade agreements. As a result, the effects of a tariff change on GDP, output, export, import, and market price are explored in this study utilizing a Computable General Equilibrium (CGE) model. This paper's model is static, and the rest of the paper evaluates the core model and the study's findings. To meet the study's objectives, the current study was conducted in Beijing, China in 2022, throughout the world's major economies, utilizing the GTAP 9 database 2011 as a reference year.

MATERIALS AND METHODS

Background of the General Equilibrium Model

CGE models have become a standard tool for empirical analysis globally. A CGE model can capture all economic interactions using a price mechanism (Hosoe, 2014; Harrison *et al.*, 1997; Rutherford *et al.*, 1997). All economic linkages are logically included in the CGE model, which then are combines with the predict changes in variables such as prices, output, and economic wellbeing. The CGE model studied various economic shocks in various markets (Wang *et al.,* 2009). In all markets, including commodities, factors, foreign exchange, the CGE model's market clearing condition depicts supply equaling demand (Hertel *et al.*, 2013).

The Global Trade Analysis Project

GTAP model was created by Purdue University's Center for Global Trade Analysis, and the complete concept was introduced by the Center for Global Trade Hertel (1999). Production, consumption, global savings, and investment are all linked under the GTAP model. It also analyzes demand for local and foreign-produced goods, international transportation costs, global investment allocation, regional household demand, and welfare decomposition, in addition to substantial modeling of inter-regional links primarily through international trade (Hertel *et al.,* 2003; Aguira 2013). In the GTAP model, the behavioral and identity equations are typically presented in percentage-change format rather than level format. The model's household spending is governed by a utility function that allocates private, government, and savings expenditures. In the typical closure of regional families, the Cobb-Douglas function ensures stable budget shares. Cross-country and cross-market linkages are captured by the model's simulation design. Many international trade models, particularly computable general equilibrium models like GTAP, use the Armington structure (McDaniel and Balistreri, 2002). As a result, Armington elasticity is a measure of substitution and differentiation between domestic and imported goods, as well as between exporting countries. The model employs the Armington postulation to handle bilateral trade. To characterize regional economic ties, it uses detailed bilateral trade, transportation, and protection data, as well as individual nation input-output databases that account for cross-sectoral links. For each commodity in the model, ESUBD and ESUBM are the Armington elasticity. The ESUBD denotes the ease with which domestic and imported items can be substituted, whereas the ESUBM denotes the degree of substitution among different countries of origin for imports. In GTAP, there are four types of behavioral parameters: substitution elasticity's (in both consumption and production), transformation elasticities (which determine how mobile primary factors are across sectors), regional investment allocation flexibility, and consumer demand elasticities. In initial equilibrium, the parameters that describe the demand behavior of a representative private households are region-specific. In GTAP, the Constant Differences of Elasticities(CDE) expenditure is employed to describe consumer behavior, which is most naturally calibrated to income and own-price elasticities of demand. The CDE specification gives additional flexibility when it comes to expressing different levels of substitution between consumer goods purchases. The international trade elasticities, as well as the agricultural factor supply and demand elasticities, have been econometrically evaluated in the GTAP model. GTAP is a linearized model that assumes perfect market competition, constant returns to scale in all production and trade activities, and profit and utility-maximizing behavior in businesses and households. The GTAP model includes a number of equations. GTAP's mathematical equation system consists of two types of equations. The accounting relationships, which ensure that each agent's receipts and expenditures are balanced, are presented on one side, while the behavioral equations based on microeconomic theory are covered on the other. The input-out tables in the model summarize the relationships between all industries and agents. In the GTAP model, thousands of marketplaces are aggregated into groups.

Model Database

The Global Trade Analysis Project (GTAP) database version 9 was used in this paper's model. The database version 9 in the model covers 140 regional units and 57 sectors with three reference years such as 2004, 2007, and 2011 (Aguira *et al.,* 2016). Different groups around the world use the GTAP database for modeling, such as Multi-Region Input Output analysis (Hertel *et al.,* 2013), Global Social Accounting Matrix modeling (Scott *et al.,* 2007), modeling for Integrated Assessment (Elliott *et al.*, 2010), and complex network research (Ukkusuri *et al.*, 2016). The main GTAP database features a number of extensions that are intended to make the database more relevant to current policy challenges. The labor categories in the GTAP 9 database were determined by Walmsley and Carrico (2016). The accompanying files are given with two alternative aggregation tools, such as FlexAgg and GTAPAgg, which allow users to adapt sectoral and regional aggregation due to the huge size of the data source. Villoria and McDougall (2015), described about the FlexAgg command line data aggregation program. GTAPAgg is a Windows program with a convenient, graphical user interface that also aggregates the GTAP database and is described in Horridge (2015). The GTAPView design gives a more instinctive and easy to use approach to look at the GTAP Information Base (Bacou *et al.,* 1999). Another broadly utilized format is the global social accounting matrix (SAM), which is reliable with the GTAP model and is clarified in McDonald and Thierfelder (2004). The import and export duties calculated from the database are the extensive measures, portrayed in detail in Narayanan *et al.,* (2015). The latest reference year 2011 has been used for the model calibration in this paper. Land, capital, skilled and unskilled labor, and natural resources are among the production components included in the database. Global bilateral trade patterns, international transit margins, and protection matrices that connect different countries/regions are all described in the database. For each country/region, the database presents values of production and intermediate and final consumption of commodities and services in millions of U.S. dollars. To define all economic activities in each country included in the database, the GTAP database classifies agriculture, food, resource extraction, manufacturing, and service activities.

Structure of this Paper's Model

The Global Trade Analysis Project (GTAP) 9 database contained 140 regions, which were aggregated into 10 regions in this study like Germany, France, Italy, the United Kingdom, China, the United States, Australia, Japan, Korea, and the Rest of the World. The ten regions were chosen because they represent the world's most powerful economies. However, there is no independent agriculture, food, manufacturing, service, and infrastructural sector in the GTAP 9 database and it is necessary to separate those sectors from other sectors. With this GTAP database, this study added 5 new sectors into the GTAP 9 database. Sectors are aggregated into agriculture; processed food; manufacture; service; and infrastructure. Land, Skilled Labor, Unskilled Labor, Capital, and Natural Resources are the five categories of production factors. Land and natural resources have limited cross-sector mobility (Table 1). Aggregation of the model has been done by using the GTAP aggregation software tools.

The variable that simulates the impact of the policy change in the GTAP database is tms (i,r,s), which will affect the final policy results (where i,r,s denotes Value of exports of i from r evaluated at domestic market prices and destined for s). The structure of the GTAP model can be found in Hertel and Tsigas, 1997. The "shock" in this model is the introduction of tariffs into the agriculture, processed food, manufacturing, service, and infrastructure sectors. The model in this study reduces agricultural sector tariffs by -15%, processed foods sector tariffs by -25%, and infrastructure sector tariffs by -15% in response to a policy shock. On the other hand, the model of this paper increases tariff in manufacturing sectors by 30% and service sectors by 25%. This study utilized those tariff reduction and increase as an experiment purpose to know what will be the impact of the economy. The model's purpose is to calculate the region's overall economic impact. The GTAP model simulations are performed using runGTAP software, and Gragg's 2-4-6 stages solution approach is employed to get the highest level of accuracy. This study is a static model so there is no baseline scenario in the model calibration.

Table 1: Aggregation used in the model

Regions	Sectors	Factors
Germany	Agriculture	Land
France	Processed Food	Unskilled Labor
Italy	Manufacturing	Skilled Labor
United Kingdom	Service	Capital
China	Infrastructure	Natural Resources
USA		
Australia		
Japan		
Korea		
Rest of the World		

Note: Rest of the world means countries included in the GTAP database (excluded above mentioned simulated regions).

RESULTS AND DISCUSSION

In this study, all simulation results are in changes in the economy in the year 2011 because economic shock has been created in the year 2011 (Hossain and Delin, 2021). The tariff decrease and increase into agriculture, processed food, infrastructural, manufacturing, and service sectors result in changes to trade balances. Overall countries experience a decrease and increase in its trade balance. As shown in Table 2, trade balance decreases in Germany by $US currency 0.63 billion, Italy by $US currency 0.44 billion, China by $US currency 6.24 billion, USA by $US currency 7.95 billion, and the rest of the world by $US currency 10.49 billion. Interestingly, France, UK, Australia, Japan, and Korea experiences a $US currency 0.53 billion, $US currency 0.28 billion, $US currency 0.16 billion, $US currency 3.01 billion and $US currency 21.79 billion increase in its trade balance. The significance of the changes in the trade balance is better seen in Korea and remains the highest by comparing other countries (Table 2).

Table 2: Change in trade balances (US million of dollars)

Country	Change
Germany	-629
France	527
Italy	-439
UK	283
China	-6245
USA	-7953
Australia	161
Japan	3013
Korea	21778
Restof the World	-10496

As indicated in Table 3, the agriculture sector trade balance falls most of the countries except China, USA, and Japan increases by $US currency 1.65 billion, $US currency 22.74 billion, and $US currency 0.04 billion. Korea remains the lowest by decreasing $US currency 22.70 billion. Processed food sector trade balance follows the same pattern and remains France, Italy, UK, China, USA, Japan, and the rest of the world in decreasing trend significantly. Korea, Australia, and Germany's trade balance increase by $US currency 64.17 billion, $US currency 3.59 billion, and $US currency 0.23 billion. The manufacturing sector's trade balance increases

Table 3: Change in trade balances by sector (US millions of dollars)

Sectors	Germany	France	Italy	UK	China	USA	Australia	Japan	Korea	ROW
Agriculture	-671	-352	-222	-27	1646	22737	-1514	43	-27704	1868
Processed Food	225	-2472	-1367	-1054	-8168	-7128	3597	-11645	64174	-43695
Manufacturing	10628	7331	4977	5505	21396	2757	-943	16530	-168140	109267
Service	-2185	-352	-596	-614	-445	-5019	-158	1517	-1636	9486
Infrastructure	-8625	-3627	-3232	-3527	-20674	-21301	-823	-3432	155084	-87422

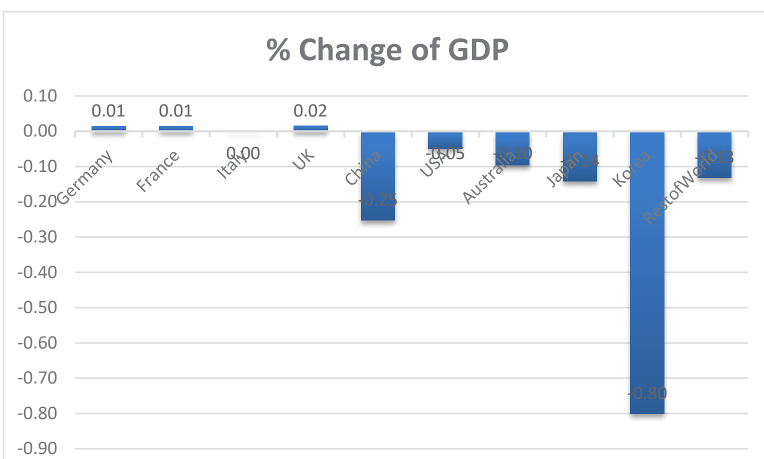

Fig. 1: Changes in gross domestic product (% Change)

most of the countries. Korea remains the lowest by decreasing $US currency 168.14 billion in trade balance and Australia by $US currency 0.94 billion. Service sector trade balance decreases in most countries and the USA remains lowest by decreasing $US currency 5.02 billion. Japan and the rest of the world's trade balance increase by $US currency 1.52 billion and $US currency 9.49 billion. On the other hand, the infrastructure sector trade balance also is in a decreasing trend almost all countries. Korea's trade balance in the infrastructure sector remains the best in the world, expanding by $US currency 155 billion (Table 3).

GDP is affected by changes in the trade balance. GDP falls in all simulated regions, indicating a drop in the economy's average interest rates. China, Australia, Japan, Korea, and the United States all saw their GDP fall. Korea continues to have the biggest GDP loss of 0.8%, while China's GDP decreases by 0.25%. Germany and France both had a 0.1% gain in GDP. Customer purchasing power and spending patterns will be impacted by the drop in GDP, which will have an impact on the overall business of the economy (Fig. 1).

The tariff shock has had a significant impact on agricultural and processed food exports in Korea. Exports in the manufacturing and service sectors fell by 89% and 56%, respectively, while infrastructure exports increased by 86%. In the agriculture, processed food, service, and infrastructure sectors, aggregate exports decreased in most nations, with France, Italy, and the United Kingdom remaining the lowest. On the other hand, agriculture export increases in China (9.5%), USA (21.9%); processed food export increase in Australia (42.2%), Japan (10%); manufacturing export increases in Germany (1.2%), France (2.1%), Italy (1.5%), UK (2%), Japan (1.6%); service sector export increase in Japan (0.4%); and infrastructure export increase in Japan. Changed in aggregate exports are presented in Table 4.

Aggregate import patterns are also affected. In Korea, while imports of the manufacturing and service sectors decrease, import increase in other sectors, including agriculture (215%), processed food (141%), and infrastructure (65%). Agriculture and processed food import increases in Italy, the UK, China, the USA, and Australia. Manufacturing and service sector import decreases in China, USA, Australia, Japan and Korea, and increases in a little amount in Germany, France, Italy, and the UK. An increase in aggregate imports will cause depreciation in the exchange rate. So the country will have to supply more money to be able to buy imports (Table 5).

In Korea, total domestic production increases in processed food and infrastructure sector, and decreases in agriculture, manufacturing sectors. Korea processed food production increases by 198%, while output falls in agriculture (28.9%), manufacturing (28.9%). In France, Italy, UK and China domestic production of agriculture, processed food, service, and infrastructure decrease, on the other hand, processed food and manufacturing production increases in Germany and Australia. USA and Japan also follow the same pattern (Table 6).

Table 4: Change in aggregate exports by sector (%)

Sectors	Germany	France	Italy	UK	China	USA	Australia	Japan	Korea	ROW
Agriculture	-2.33	-1.27	-1.82	-1.10	9.47	21.91	-4.95	-4.43	1693.30	0.02
Processed Food	0.71	-4.92	-4.69	-4.79	-0.66	-7.29	42.24	10.03	2475.85	-4.79
Manufacturing	1.20	2.08	1.45	2.00	-0.23	0.12	-1.04	1.63	-89.19	1.42
Service	-1.14	-0.40	-0.57	-0.27	-1.27	-1.92	-0.86	0.40	-56.07	0.33
Infrastructure	-3.36	-2.08	-3.65	-2.55	-0.64	-2.70	-1.37	0.49	86.38	-1.38

Table 5: Change in aggregate imports by sector (%)

Sectors	Germany	France	Italy	UK	China	USA	Australia	Japan	Korea	ROW
Agriculture	0.48	-0.08	0.24	0.07	0.13	5.18	2.19	-0.17	214.83	-0.78
Processed Food	0.65	-0.09	0.21	0.14	27.85	5.12	5.14	36.90	140.74	5.22
Manufacturing	0.42	0.06	0.20	0.07	-2.16	-0.05	-0.88	-1.24	-35.87	-0.36
Service	0.54	0.09	0.34	0.01	-0.41	-0.09	-0.45	-1.57	-27.89	-0.61
Infrastructure	0.08	-0.40	0.13	-0.14	5.42	1.83	0.77	1.66	65.50	2.65

Table 6: Change in output volume by sector (%)

Sectors	Germany	France	Italy	UK	China	USA	Australia	Japan	Korea	ROW
Agriculture	-0.75	-0.66	-0.55	-0.48	-0.07	3.93	-1.48	-0.35	-28.94	-0.25
Processed Food	0.16	-1.37	-0.96	-0.81	-1.10	-0.92	5.83	-2.35	198.08	-1.77
Manufacturing	0.63	0.92	0.54	0.91	0.65	0.15	0.07	1.20	-28.93	1.05
Service	-0.05	-0.01	-0.02	-0.03	-0.18	-0.04	-0.08	-0.09	1.02	-0.11
Infrastructure	-0.75	-0.39	-0.38	-0.48	-0.43	-0.32	-0.16	-0.15	18.25	-0.62

Table 7: Change in market price by sector (%)

Sectors	Germany	France	Italy	UK	China	USA	Australia	Japan	Korea	ROW
Land	-2.19	-2.10	-1.55	-1.54	-0.39	14.98	-5.11	-1.52	-76.34	-1.18
UnSkLab	0.23	-0.07	0.13	-0.05	-0.11	0.18	-0.15	-0.32	5.47	-0.32
SkLab	0.22	-0.01	0.13	-0.01	-0.21	0.23	-0.17	-0.39	5.23	-0.28
Capital	0.17	-0.07	0.08	-0.05	-0.11	0.23	-0.11	-0.41	4.49	-0.19
NatRes	0.67	0.22	0.59	0.91	0.53	0.63	-0.10	0.64	-28.41	0.94
Agriculture	-0.01	-0.14	0.01	-0.13	-0.16	1.62	-0.61	-0.47	-26.08	-0.37
Processed Food	0.11	-0.05	0.06	-0.04	-0.24	0.35	-0.18	-0.91	-28.94	-0.31
Manufacturing	0.16	0.01	0.11	0.04	0.17	0.25	-0.01	-0.10	12.16	0.01
Service	0.18	-0.03	0.10	-0.02	-0.09	0.22	-0.12	-0.36	4.22	-0.22
Infrastructure	0.17	-0.01	0.10	0.00	-0.01	0.20	-0.07	-0.27	6.87	-0.16

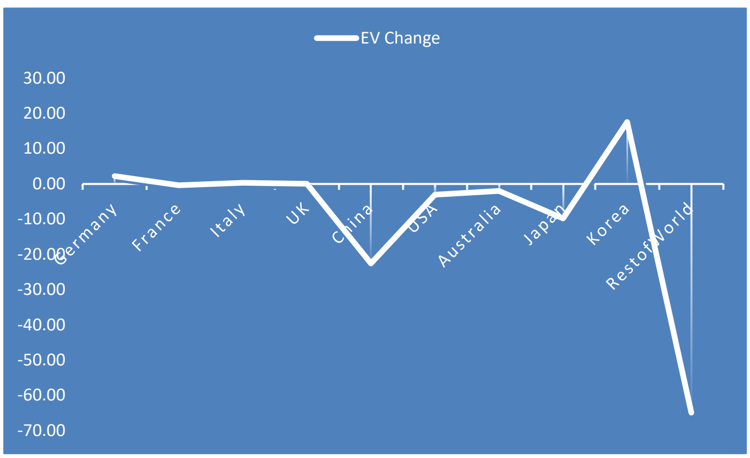

Fig. 2: Changes in welfare (in USD billion dollars)

Market prices are reflected through changes in output and trade. In Korea, the extra supply of agriculture and processed food products pushes the market price down by -26% and -29%; on the other hand, manufacturing, service, and infrastructure sectors market price increase by 12%, 4%, and 7% respectively. The market prices of all other factors and output increased marginally in Italy and the USA; market price in Japan and Australia decreases slightly. On the other hand, the market price of agricultural sectors decreases slightly in most countries. The consumer in France remains more benefited by decreasing market prices in all sectors. Meanwhile, the expanded supply of the agriculture and processed food sector pushes its market price down in all regions (Table 7)

Finally, a basic question for any shock to the economy is the overall welfare effect on the citizens of that region. Korea is the biggest winner compared to other regions by rising welfare index $US currency

17.56 billion. On the other hand, welfare index falls in France, China, USA, Australia Japan, and the rest of the world by$US currency 0.35 billion, $US currency 22.59 billion, $US currency 3.03 billion, $US currency 1.97 billion, $US currency 9.79 million, and$US currency 64.88 billion. The biggest losers include China and the rest of the world by decreasing welfare by $US currency 22.59 billion and $US currency 64.88 billion (Fig. 2).

CONCLUSION

This study employs a regional static CGE framework to investigate the effects of the tariff. For the economic growth and poverty reduction agriculture, processed food, manufacturing, service, and infrastructure sectors play an important role in the economy. The results of this experiment shows that a decrease in tariff in agriculture, processed food, and infrastructure sectors have the greatest impact on the economic growth and reduction of the general level of prices. Korea is the most benefited country among simulated regions. Agriculture and processed food export and import increase significantly which in term increases the supply of agriculture and processed food in Korea's domestic market which pushes the market price down. On the other hand, tariff increase in manufacturing and service sectors affects Korea's GDP in slight decrease. Both the manufacturing and service sectors have negative trade balances, indicating that a country's currency is in downward pressure. On the other hand, export and import both decreases in manufacturing and service sector and the result showed decrease in export higher than import. The output of the manufacturing sector decreases while a slight increase in the service sector observed. A decrease in the output of Korea's manufacturing sectors pushes an increase in market price in local economy. Finally, the result showed that the implemented tariff policy positively affects the overall welfare in Korea's economy compared to other countries. The results of this limited experiment suggest that all aggregated regions should consider taking a balanced approach to the development of their countries.

AUTHOR CONTRIBUTIONS

S.S. Hossain performed the review, experimental design, analyzed and interpreted the data, prepared the manuscript text, and manuscript edition. H. Delin performed the review and manuscript preparation. M. Mingying performed the editing and model data analysis of this paper.

ACKNOWLEDGEMENTS

The authors would like to thank to all lab mates and mentors for various suggestions for the economic model building in this paper.

CONFLICTS OF INTEREST

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

PUBLISHER'S NOTE

Tehran Urban Planning and Research Center remains neutral with regard to jurisdictional claims in published maps and institutional afflictions.

ABBREVIATIONS

CGE	Computable General Equilibrium
ESUBD	Elasticity of substitution between domestic and imported goods
ESUBM	Elasticity of substitution among imports from different destinations
GDP	Gross domestic product

GTAP	Global Trade Analysis Project
NATRES	Natural Resources
SKLAB	Skilled labor
runGTAP	Visual interface to various General Equilibrium Modelling PACKage programs.
TMS (i,r,s)	Import tariff
UNSKLAB	Unskilled labor

REFERENCES

Aguira, A.; Narayanan, B.; Mcdougall, R., (2016). An outline of the gtap 9 database. J. Global Econ. Anal., 1(1): 181- 208 **(28 pages)**.

Ahmed, V.; O'Donoghue, C., (2010). Global economic crisis and poverty in Pakistan. Int. J. Microsimulation, 3(1): 127-129 **(3 pages).**

Aguiar, A., (2013). GDP consistency in GTAP 8. Center for global trade analysis, Purdue University, GTAP Res. Memorandum25: **(19 pages)**.

Bacou, M.; Hertel, T.; Yu, W., (1999). GTAP 4 dataBase Documentation - Chapter 10, (**5 pages).**

Dasgupta, P.; Mukhopadhyay, K., (2017). The impact of the TPP on selected ASEAN economies. J. Econ. Struct., 6(1):1-34 (**34 pages**).

Elliott, J.; Foster, I.; Kortum, S.; Munson, T.; Cervantes, F.P.; Weisbach D., (2010). Trade and carbon taxes. Am. Econ. Rev., 100(2): 465–469 (**5 pages**).

Ganguly, A.; Das, K., (2017). Multi-sectoral analysis of foreign investment and trade liberalization in India: A CGE modelling approach. Glob. Bus. Rev., 18(5): 1345-1372 **(28 pages)**.

Hosoe, N., (2014). Japanese manufacturing facing post-Fukushima power crisis: a dynamic computable general equilibrium analysis with foreign direct investment. Appl. Econ., 46(17):2010–2020 **(11 pages).**

Hossain, S.S.; Delin, H., (2021). Measuring economic impact in Korea, Japan, India, China, and ASEAN considering agricultural sectors: a dynamic CGE approach based on GAMS., Rev. World Econ., **(43 pages).**

Hossain, S.S.; Delin, H. (2021). Comparison and analysis of tariff reduction of infrastructural sectors and its economic impact: ACGE approach. Int. J. Hum. Capital Urban Manage., 6(3): 253-262(**10 pages**).

Hertel, W.T., (1999). Future directions in global trade analysis. Working papers 283437, Purdue University, center for global trade analysis, global trade analysis project **(20 pages)**.

Hertel, T.W.; Tsigas, M.E., (1997). Structure of GTAP. Chapter 2, Global Trade Analysis: Modeling and Applications, Cambridge University Press **(63 pages)**.

Hertel, T.; Hummels, D.; Ivanic, M.; Keeney, R., (2003). How confident can we be of CGE-based assessments of free trade agreements? GTAP working paper no. 26 **(42 pages)**.

Hertel, T.; Hummels, D., Walmsley, T., (2013). Developing a multi-region input-output framework from GTAP for analyzing the vulnerability of the Asia-Pacific supply chain to natural disasters **(2 pages)**.

Horridge, M., (2015). GTAPAgg data aggregation program. In global trade, assistance, and production: The GTAP 9 database, edited by B.G. Narayanan, A. Aguiar, and R. McDougall. Center for Global Trade Analysis, Purdue University, chap. 5 **(5 pages)**.

Harrison, G.W., Rutherford, T.F., Tarr, D.G., (1997). Economic implications for Turkey of a customs union with the European Union. Eur. Econ. Rev., 41(3-5): 861-870 **(10 pages)**.

Itakura, K.; Lee, H., (2012). Welfare changes and sectoral adjustment of Asia-Pacific countries under alternative sequencings of free trade agreement. Glob. J. Econ., 01(02): 1250012-22 **(22 pages).**

Jean, S.; Mulder, N.; Ramos, M.P., (2014). A general equilibrium, ex-post evaluation of the EU–Chile free trade agreement. Econ. Model., 41: 33-45 **(13 pages).**

Khorana, S.; Narayanan, B.G., (2017). Modelling effects of tariff liberalisation on India's key export sectors: Analysis of the EU–India free trade agreement. J. Appl. Econ. Res., 11(1): 1–22**(22 pages)**.

McDaniel, C.A.; Balistreri, E.J., (2002). A review of Armington trade substitution elasticities. **(19 pages).**

Mabugu, R.; Chitiga, M., (2007). South Africa Trade Liberalization and Poverty in a Dynamic Microsimulation CGE Model, Working Papers 200718, University of Pretoria, Department of Economics **(44 pages)**.

McDonald, S.; Thierfelder, K., (2004). Deriving a global social accounting matrix from GTAP versions 5 and 6 data **(52 pages)**.

Ochuodho, T.O.; Alavalapati, J.R., (2016). Integrating natural capital into system of national accounts for policy analysis: An application of a computable general equilibrium model. For. Policy Econ., 72: 99-105 **(7 pages)**.

Rutherford, T.F.; Rutström, E.E.; Tarr, D., (1997). Morocco's free trade agreement with the EU: a quantitative assessment. Econ. Model,14(2): 237-269 **(33 pages)**.

Shaikh, F.M., (2009). Analysis of bilateral trade liberalization and South Asian free trade agreement (SAFTA) on Pakistan's economy by using CGE model. J. Int. Trade Law Policy, 8(3): 227–251 **(25 pages).**

Srinivasu, B.; Rao, P.S., (2013). Infrastructure development and economic growth: Prospects and perspective. J. Bus. Manage. Soc. Sci. Res., 2(1): 81-91 **(11 pages)**.

Scott McDonald, S.; Thierfelder, K.; Robinson, S., (2007). Globe: A SAM Based Global CGE Model using GTAP Data **(108 pages)**.

Thu, M.; Hiro Lee, H., (2015). Assessing the impact of deeper trade reform in Vietnam Using a general equilibrium framework. J. Southeast Asian Econ., 32(1): 140-162 (**23 pages).**

Ukkusuri, S.V.; Mesa-Arango, R.; Narayanan, B.; Sadri, A.M.; Qian, X., (2016). Evolution of the commonwealth trade network. International trade working paper 2016/07, Commonwealth secretariat, London **(48 pages)**.

Villoria, N.; McDougall, R., (2015). FlexAgg2.0: An improved version of the data aggregation program FlexAgg. Center for global trade analysis, Purdue University, chap., 4 **(6 pages)**.

Winchester, N., (2009). Is there a dirty little secret? Non-tariff barriers and the gains from trade. J. Policy Model., 31(6): 819-834 **(16 pages).**

Wang, K.; Wang, C.; Chen, J., (2009). Analysis of the economic impact of different Chinese climate policy options based on a CGE model incorporating endogenous technological change. Energy Policy., 37(8): 2930-2940 **(11 pages).**

Walmsley, T.; Carrico. C., (2016). Disaggregating labor payments. In global trade, assistance, and production: The GTAP 9 database, edited by B. G. Narayanan, A. Aguiar, and R. McDougall. chap. 12.B **(17 pages)**.

HOW TO CITE THIS ARTICLE

Hossain, S.Sh.; Delin, H.; Mingying, M., (2022). Is there a connection between tariffs and economic growth? A computable general equilibrium analysis based on the Global Trade Analysis Project model. Int. J. Hum. Capital Urban Manage., 7(3): 383-392.

DOI: 10.22034/IJHCUM.2022.03.07

url: http://www.ijhcum.net/article_252819.html