A Korea-GCC FTA and Its Economic Impact:
A CGE Approach

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한-걸프협력회의 자유무역협정의 경제적 영향:
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This paper aims to measure the potential effects of a Korea-GCC FTA using a Computable General Equilibrium (CGE) model. We use the Global Trade Analysis Project (GTAP) model and GTAP database version 9 with aggregated 19 regions and 21 sectors. Our primary objective is to measure the effects of two scenarios of a Korea-GCC FTA on GDP, welfare, total exports, terms of trade, and production by sector. The first scenario is 100 percent cuts of tariffs for the bilateral trade between Korea and the GCC countries. The second scenario is 100 percent cuts of tariffs and an increase in the Total Factor Productivity (TFP) as a result of the FTA. The simulation results show that technological changes have an obvious impact on Korea and the GCC countries. In addition, the FTA has a small effect on the GDP of Korea and the GCC countries. Moreover, Korea gains the most in welfare, followed by the UAE, Saudi Arabia, Kuwait, Qatar, Oman, and Bahrain. Additionally, the FTA has a positive effect on the total bilateral exports for Korea and the GCC countries. Kuwait gains the most in terms of trade followed by Qatar, Oman, the UAE, Saudi Arabia, Bahrain, and Korea. Finally, the FTA motivates the production of Korea's main exporting sectors to

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the GCC countries (automobiles, transportation equipment, construction products, and metal products), and the GCC countries' main exporting sectors to Korea (oil, gas, and petroleum products).

I. Introduction

In March 2007, the talks about establishing a Free Trade Agreement (FTA) between Korea and the Gulf Cooperation Council (GCC) countries started during the visit of the Korean president Moo-Hyun Roh to the Middle East. The talking continued later in November in Riyadh, Saudi Arabia. The first negotiating round was held in Seoul in July 2008. The negotiations continued in the following year by holding two more rounds in Riyadh and Seoul. However, for no apparent reason, the negotiation stopped.

Korea's exports to the GCC countries are diverse. Its main exports to the GCC countries are automobiles, transportation equipment, machinery, construction products metal products, and electronics. Among the GCC countries, Korea's top exporting destination is Saudi Arabia (USD 8,674 million), followed by the UAE (USD 7,214 million), Kuwait (1,566), Oman (USD 952 million), Qatar (USD 612 million) and Bahrain (USD 199 million) (Aguiar, Narayanan and McDougall, 2016).

The GCC countries are some of the leading exporting countries in the world for crude oil, natural gas, and petroleum products. Therefore, their exports to Korea are mainly from these three sectors[1]. In addition, the GCC member that exports the most to Korea is Saudi

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[1] According to Aguiar, Narayanan and McDougall (2016), the GCC countries' exports to Korea are characterized as follows: out of Kuwait's total exports to Korea, oil is 84% and petroleum products are 13%. Out of Saudi Arabia's total exports to Korea, oil is 87% and petroleum

Arabia (USD 32,246 million), followed by the UAE (USD 18,798 million), Kuwait (USD 15,566 million), Qatar (USD 10,046 million), Oman (USD 4,150 million) and Bahrain (USD 893 million) (Aguiar, Narayanan and McDougall, 2016). Therefore, signing an FTA between Korea and the GCC countries may play a key role in securing Korea's energy demand for its sustained economic growth. The purpose of this study is to quantify the potential effects of a Korea-GCC FTA using a CGE model on the economies of its partners as well as the combined economy of EU-28.

This paper is structured as follows: After Section I for the introduction, Section II discusses the methodology and data used in this study. Section III provides a description of the two scenarios of a Korea-GCC FTA. Section IV shows the empirical findings of the simulated scenarios. The paper ends with Section V for the conclusion and policy implications.

. The CGE Model and Data

1. The CGE Model

The model used in the study is the static Global Trade Analysis Project (GTAP) model (Hertel, 1997). The GTAP model is a multi-region, multi-sector global Computable General Equilibrium (CGE) model. The model includes five factors of production that are fixed: land, capital, skilled labor, unskilled labor and natural resource. The model assumes the perfect competition, constant return to scale production technology, and the products

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products are 8%. Out of Bahrain's total exports to Korea, petroleum products are 70%. Out of Qatar's total exports to Korea, oil is 34%, natural gas is 40% and petroleum products are 21%. Out of the UAE's total exports to Korea, oil is 88% and petroleum products are 8%. Out of Oman's total exports to Korea oil is 50% and natural is gas 40%.

are differentiated by their origins. The GTAP model can trace the effects of a potential change in trade policy that is caused by the changes in the tariffs and the non-tariff barriers on the trade, economic growth, welfare and other variables.

<Figure 1> shows the structure of the GTAP model. In the GTAP model, it is assumed the regional household gathers all the income and the taxes in the economy. The income is distributed to private household consumption (PRIVEXP), government expenditure (GOVEXP) and savings (SAVE) by Cobb-Douglas utility function. The PRIVEXP consists of the domestic purchases (VDPA) from the producers, and the imports (VIPA) from the ROW. The GOVEXP consists of the domestic purchases (VDGA) from the producers, and the imports (VIGA) from the rest of the world (ROW). Moreover, the producers purchase intermediate goods (VDFA) from other firms, import (VIFA) from the ROW, and export to the ROW (VXMD). The regional household collects taxes on commodities consumed by private household and government, taxes on intermediate inputs by producers, import duties (MTAX) and export tax (XTAX).

<Figure 2> is the production tree in the GTAP (the producer's behavior). The producer possesses the technology in the model. The relation between intermediate inputs (qf) and the value added (qva) to the total output (qo) are driven by Leontief production function. The total output's nest is irrelevant in the model because of the notion of the constant return to the scale (Hertel, 1997). The value added (the factors of production) nest contains the land, labor and capital (qfe). Also, their demand is presented by the Constant Elasticity of substitution (CES). In addition, the producer purchases intermediate inputs domestically (qfd) and internationally imported (qfm). Their demand is presented by the CES as well. Finally, the imported intermediate inputs are differentiated by their origins (qxs), and their demand is presented by the CES as well.

<Figure 1> The GTAP Structure
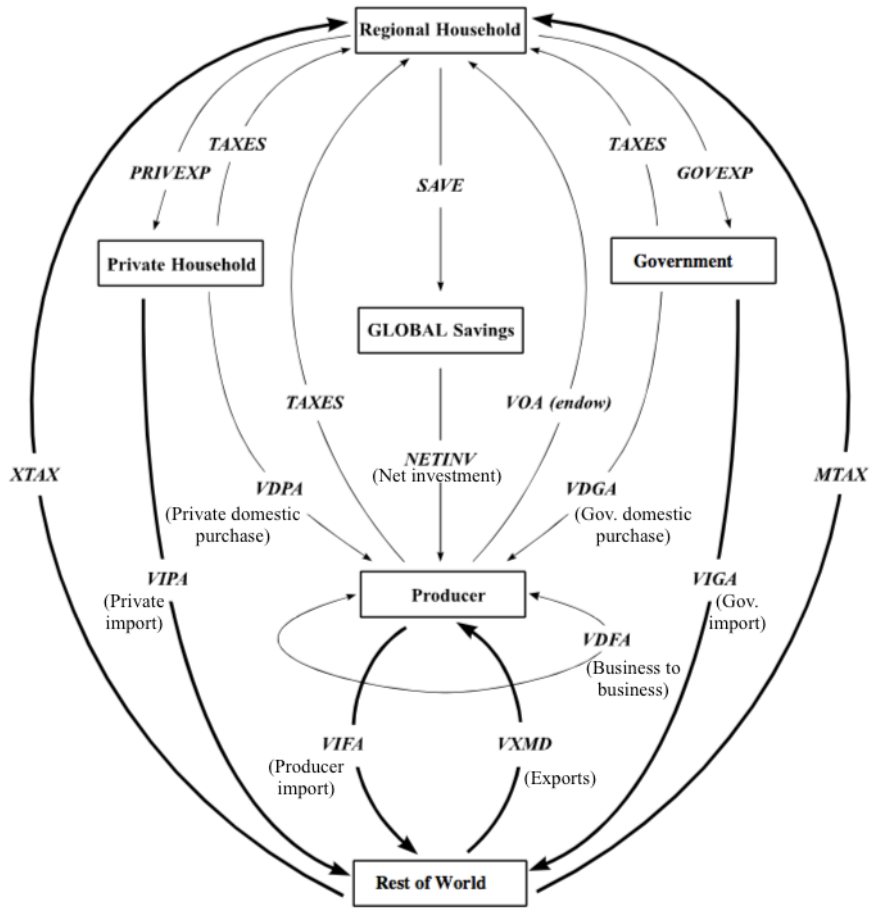
Source: Brockmeier (2001)

Note: The arrows show the monetary flows.

<Figure 2> The Structure of Producer's Behavior in the GTAP Model
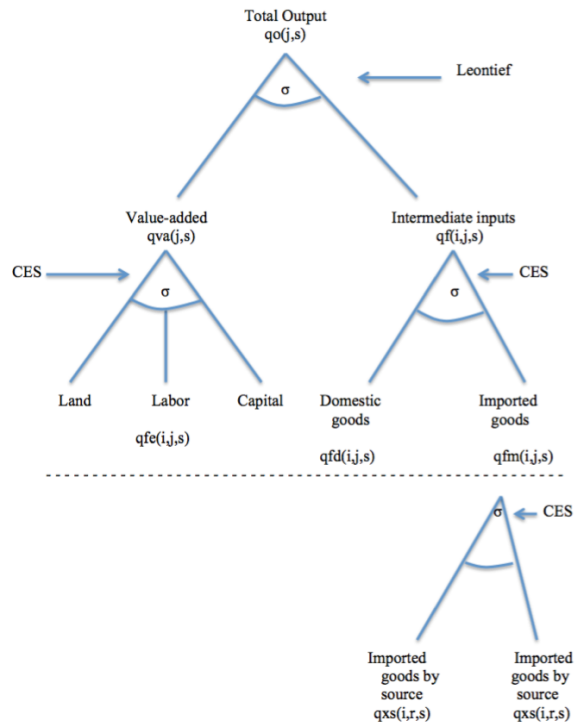
Source: Hertel (1997)

2. Data

The GTAP 9 database (Aguiar, Narayanan, and McDougall, 2016) is used for this study. The database whose base year is 2011 includes a total of 140 regions[2] and each of them consists of 57 sectors. <Table 1> shows the aggregated 19 regions and 21 sectors for the purpose of the study. The regions were selected according to their economic size and their shares of the oil exports in the world market. In addition to the oil, gas and petroleum products, the sectors were selected according to their importance and volume in the bilateral trade between the GCC countries and Korea. The selected sectors are diversified between the heavy manufactures, light manufactures, services and agriculture.

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[2] The corresponding author of this paper is responsible for the dataset for Korea in the GTAP DB version 9 (Ko, 2015).

<Table 1> Regional and Sectoral Classifications

Region	Description		Sector	Description
KOR	Korea		Agriculture	Agriculture
KWT	Kuwait (GCC Member)		OIL	OIL
SAU	Saudi Arabia (GCC Member)		GAS	Gas
BHR	Bahrain (GCC Member)		OthMining	Other Mining
QAT	Qatar (GCC Member)		PrcFood	Processed food
ARE	United Arab Emirates (GCC Member)		TextWapp	Textiles and Wearing Apparel
OMN	Oman (GCC Member)		PetroCoalPrd	Petroleum, coal products
USA	United States of America		OthChem	Chemical, rubber, plastic products
CHN	China		MetalPrd	Metal products
EU28	European Union 28		Automobiles	Motor vehicles and parts
JPN	Japan		OthTrnsEq	Other Transport Equipment
OthOPEC	Other OPEC members[3]: Ecuador, Iran, Nigeria and Venezuela		Electronics	Electronic equipment
RUS	Russia		Machinery	Machinery and equipment
CAN	Canada		OthMnf	Manufactures
BRA	Brazil		Utilities	Utilities
MEX	Mexico		Construction	Construction
NOR	Norway		Trade	Trade
KAZ	Kazakhstan		Transport	Transport
ROW	Rest of the World		Communic	Communications
			Financial	Financial services
			OthServ	Other Services

Source: Authors' classification

[3] OPEC includes seven members (regions) that are not included in the GTAP database: Algeria, Angola, Equatorial Guinea, Gabon, Iraq and Libya. They are captured in the ROW.

. Scenarios for a Korea-GCC FTA

Two scenarios are carried out in this study. The first scenario is based on a 100 percent cut of tariffs for the bilateral trade between Korea and the GCC countries to reach a full trade liberation between both parties. The second scenario is about a 100 percent cut of tariffs for the bilateral trade between Korea and the GCC countries and an increase of the total factor productivity (TFP) as a result of the FTA between Korea and the GCC countries. It is assumed that the TFP of Korea and the GCC countries increases by 0.15%, as trade openness defined as a ratio of a sum of exports and imports to GDP rises by 1% as a result of the Korea-GCC FTA (Cabinet Secretariat Office for TPP Government Strategy, 2015).

The ad valorem tariff rates that are applied to the bilateral trades between both parties are shown in <Table 2> and <Table 3>. <Table 2> shows Korea's tariffs on imports from the GCC countries. The table shows that Korea levies tariff rates of 3% on imports of oil from Kuwait, Saudi Arabia, Qatar, the UAE, and Oman. In addition, it imposes tariff rates of 3% on imports of gas from Qatar, the UAE, and Oman. Also, the highest tariff rates are imposed on Korea's imports of agricultural commodities from Saudi Arabia. On the other hand, <Table 3> shows the GCC's tariffs on imports from Korea. The table shows that in general, the GCC countries impose higher tariff rates on imports from Korea than the tariffs that Korea levies on imports from the GCC countries.

<Table 2> Korea's ad valorem tariff rates on imports from the GCC countries by sector (%)

	Sector	KWT	SAU	BHR	QAT	ARE	OMN
1	Agriculture	0.00	129.00	0.00	0.47	19.30	0.00
2	OIL	3.00	3.00	0.00	3.00	3.00	3.00
3	GAS	0.00	0.00	0.00	3.00	3.00	3.00
4	OthMining	0.00	0.11	0.00	3.00	3.80	0.30
5	PrcFood	0.00	14.50	18.30	0.00	19.30	9.97
6	TextWapp	11.20	8.52	10.30	11.50	9.14	10.60
7	PetroCoalPrd	3.24	3.26	3.32	3.22	3.25	3.33
8	OthChem	3.06	2.52	1.13	3.38	4.95	2.71
9	MetalPrd	0.10	0.30	2.33	1.39	0.93	1.02
10	Automobiles	7.91	8.53	7.97	7.96	8.44	7.58
11	OthTrnsEq	0.00	0.10	0.00	0.00	0.03	0.00
12	Electronics	1.11	1.71	1.78	1.40	2.59	2.14
13	Machinery	2.87	6.93	5.91	5.29	5.16	6.87
14	OthMnf	0.14	3.13	1.93	4.53	2.19	2.56

Source: Authors' calculation using GTAP DB version 9 (Aguiar, Narayanan and McDougall, 2016)

<Table 3> The GCC countries' ad valorem tariff rates on imports from Korea by sector (%)

	Sector	KWT	SAU	BHR	QAT	ARE	OMN
1	Agriculture	1.24	1.96	1.53	3.23	1.97	0.01
2	OIL	0.00	0.00	0.00	0.00	0.00	0.00
3	GAS	0.00	0.00	0.00	0.00	0.00	0.00
4	OthMining	5.00	5.00	5.00	5.00	5.00	5.00
5	PrcFood	4.80	3.86	9.01	4.54	88.10	7.28
6	TextWapp	5.00	5.00	5.00	5.00	5.00	5.00
7	PetroCoalPrd	5.00	5.00	5.00	5.00	5.00	5.00
8	OthChem	4.45	3.98	4.92	4.81	4.53	3.19
9	MetalPrd	5.00	5.00	5.00	5.00	5.00	5.00
10	Automobiles	5.00	5.00	5.00	5.00	5.00	5.00
11	OthTrnsEq	0.00	0.21	4.85	4.99	0.13	0.12
12	Electronics	0.56	0.95	0.83	0.71	1.09	0.29
13	Machinery	3.91	4.22	4.80	4.66	4.24	4.61
14	OthMnf	5.00	4.99	5.33	4.98	4.98	5.00

Source: Authors' calculation using GTAP DB version 9 (Aguiar, Narayanan and McDougall, 2016)

Ⅳ. Simulation Results

The macroeconomic and microeconomic effects of the Korea-GCC FTA are presented in this section. The macroeconomic effects are presented in terms of real GDP, welfare, total exports, total imports and terms of trade. The microeconomic impacts are presented in terms of domestic production by sector.

<Table 4> shows the effect of the FTA on the GDP and welfare. The simulation results show that there is a noticeable impact on the GDP of Korea (0.09%) and the UAE (0.16%) in Scenario 1. However, Kuwait, Saudi Arabia, Bahrain, Qatar and Oman show a negligibly small effect on their GDP. Besides, the non-FTA members show no effect on their GDP in the first scenario. On the other hand, the second scenario shows more apparent effects on the GDP. Korea's GDP rises the most (0.37%), followed by the UAE (0.24%), Qatar (0.09%), Kuwait (0.08%), Saudi Arabia and Oman (0.07%), and Bahrain (0.02%). In addition, the non-FTA members show no effect on their GDP in the second scenario, except for Russia that has an adverse effect on its GDP (-0.01%).

<Table 4> also shows the impact on the welfare in terms of equivalent variation (EV), which represents the money metric equivalent to the utility change brought about by the price change as a result of the Korea-GCC FTA. The simulation results show that Korea gains the most (USD 1,246 million), followed by the UAE (USD 798 million), Saudi Arabia (USD 602 million), Kuwait (USD 244 million), Qatar (USD 168 million), Oman (USD 89 million) and Bahrain (USD 8 million). In addition, the non-FTA members show positive and negative effects on welfare. Norway, Kazakhstan, Canada, and China are affected positively, while Mexico, the other OPEC members, Brazil, the EU28, Russia, Japan, the USA and the ROW are affected negatively in the first scenario. On the other hand, the second scenario shows more substantial effects on welfare. The simulation results show that Korea would gain the most (USD 4,945 million), followed by Saudi Arabia (USD 1,092 million), the UAE (USD 1,028 million), Kuwait (USD 397 million), Qatar (USD 364 million), Oman (USD 140 million) and Bahrain (USD 13 million). In addition, all of the non-FTA members show an adverse effect on their welfare.

<Table 4> The effects of the Korea-GCC FTA on Welfare (US$ million)
and Real GDP (% change)

	Region	Scenario 1		Scenario 2	
		Welfare	Real GDP	Welfare	Real GDP
1	KOR	1,246	0.09	4,945	0.37
2	KWT	244	0.00	397	0.08
3	SAU	602	0.00	1,092	0.07
4	BHR	8	0.00	13	0.02
5	QAT	168	0.00	364	0.09
6	ARE	798	0.16	1,028	0.24
7	OMN	89	0.00	140	0.07
8	USA	-188	0.00	-186	0.00
9	CHN	48	0.00	-23	0.00
10	EU28	-173	0.00	-108	0.00
11	JPN	-503	0.00	-463	0.00
12	OthOPEC	-97	0.00	-174	0.00
13	RUS	-248	0.00	-357	-0.01
14	CAN	18	0.00	-9	0.00
15	BRA	-114	0.00	-146	0.00
16	MEX	-4	0.00	-23	0.00
17	NOR	2	0.00	-19	0.00
18	KAZ	4	0.00	-8	0.00
19	ROW	-1,021	0.00	-1,130	0.00

Source: Authors' calculation

<Table 5> and <Table 6> show the welfare decomposition for the two scenarios. The simulation results for Scenario 1 in Table 5 show that the welfare originates from the resource allocation, the terms of trade and the investment trade. In addition, Korea gains the most from the resource allocation effect (USD 1,082 million) then the terms of trade (USD 221 million), yet the investment-trade has a negative effect on its welfare (USD -57 million). Kuwait gains mostly from the terms of trade (USD 295 million), yet the

investment-trade has a negative effect on its welfare (USD -51 million). Saudi Arabia gains the most from the terms of trade (USD 578 million), then the investment-trade (USD 41 million), yet the resource allocation effect has a negative effect on its welfare (USD -18 million). Bahrain gains the most from the terms of trade (USD 8 million), then the investment-trade (USD 1 million), yet the resource allocation effect has a negative effect on its welfare (USD -1 million). Qatar gains mostly from the terms of trade (USD 295 million), then the resource allocation effect (USD 2 million), yet the investment-trade has a negative effect on its welfare (USD -56 million). The UAE gains the most from the resource allocation effect (USD 564 million) then the terms of trade (USD 259 million), yet the investment-trade has a negative effect on its welfare (USD -25 million). Oman gains mostly from the terms of trade (USD 94 million), yet the resource allocation has a negative effect (USD -2 million), and the investment-trade has a negative effect as well on its welfare (USD -56 million).

<Table 5> The welfare decomposition effect of the Korea-GCC FTA for Scenario 1 (US$ million)

Region	Allocation effect	Endow. effect	Tech. change	Pop. growth	Terms of trade	Investme nt-trade	Preference change	Total
KOR	1,082	0	0	0	221	-57	0	1,246
KWT	0	0	0	0	295	-51	0	244
SAU	-18	0	0	0	578	41	0	601
BHR	-1	0	0	0	8	1	0	8
QAT	2	0	0	0	221	-56	0	167
ARE	564	0	0	0	259	-25	0	798
OMN	-2	0	0	0	94	-3	0	89
USA	-25	0	0	0	-127	-36	0	-188
CHN	-83	0	0	0	68	63	0	48
EU28	-23	0	0	0	-160	9	0	-173
JPN	-209	0	0	0	-297	2	0	-503
OthOPEC	-18	0	0	0	-109	30	0	-98
RUS	-79	0	0	0	-213	44	0	-248
CAN	-2	0	0	0	14	5	0	18
BRA	-34	0	0	0	-89	5	0	-117
MEX	-6	0	0	0	-2	3	0	-4
NOR	0	0	0	0	0	2	0	2
KAZ	-1	0	0	0	4	1	0	4
ROW	-271	0	0	0	-770	21	0	-1,021
Total	877	0	0	0	-4	0	0	873

Source: Authors' calculation

The simulation results for Scenario 2 in <Table 6> show that the welfare is originated from the resource allocation, the terms of trade and the investment trade in addition to the technological change that is caused by the increase in TFP. Moreover, Korea gains the most from the technological change (USD 3,003 million), then the resource allocation effect (USD 1,502 million), and the terms of trade (USD 505 million), yet the investment-trade has a negative effect on its welfare (USD -64 million). Kuwait gains mostly from the terms of trade (USD 265 million), then the technological change (USD 133 million), and the resource allocation effect (USD 1 million), yet the investment-trade has a negative effect on its welfare (USD -1 million). Saudi Arabia gains the most from the terms of trade (USD 578 million), then the technological change (USD 482 million), and the investment-trade (USD 119 million), yet the resource allocation effect has a negative effect on its welfare (USD -14 million). Bahrain gains the most from the terms of trade (USD 7 million), then the technological change (USD 6 million), and the investment-trade (USD 1 million), yet the resource allocation effect has a negative effect on its welfare (USD -1 million). Qatar gains mostly from the terms of trade (USD 203 million), then the technological change (USD 158 million), the resource allocation effect (USD 2 million), and the investment-trade (USD 1 million). The UAE gains the most from the resource allocation effect (USD 567 million) then the technological change (USD 269 million), and terms of trade (USD 231 million), yet the investment-trade has a negative effect on its welfare (USD -39 million). Oman gains mostly from the terms of trade (USD 84 million), then the technological change (USD 50 million), and the investment-trade (USD 7 million), yet the resource allocation has a negative effect (USD -2 million).

<Table 6> The welfare decomposition effect of the Korea-GCC FTA for Scenario 2 (US$ million)

Region	Allocation effect	Endow. effect	Tech. change	Pop. growth	Terms of trade	Investment-trade	Preference change	Total
KOR	1,502	0	3,003	0	505	-64	0	4,945
KWT	1	0	133	0	265	-1	0	397
SAU	-14	0	481	0	505	119	0	1,091
BHR	-1	0	6	0	7	1	0	13
QAT	2	0	158	0	203	1	0	364
ARE	567	0	269	0	231	-39	0	1,028
OMN	-2	0	50	0	84	7	0	139
USA	-23	0	0	0	-135	-27	0	-186
CHN	-111	0	0	0	120	-32	0	-23
EU28	16	0	0	0	-111	-12	0	-108
JPN	-205	0	0	0	-256	-2	0	-463
OthOPEC	-29	0	0	0	-175	29	0	-175
RUS	-109	0	0	0	-294	46	0	-357
CAN	-5	0	0	0	-3	-1	0	-9
BRA	-46	0	0	0	-105	2	0	-149
MEX	-11	0	0	0	-10	-2	0	-23
NOR	-1	0	0	0	-16	-2	0	-19
KAZ	-1	0	0	0	-9	2	0	-8
ROW	-297	0	0	0	-810	-23	0	-1,130
Total	1,232	0	4,100	0	-5	0	0	5,327

Source: Authors' calculation

<Table 7> The effect of the Korea-GCC FTA on the bilateral trade in Scenario 1 (US$ million)

Region	KOR	KWT	SAU	BHR	QAT	ARE	OMN	USA	CHN	EU28	JPN	OthOPEC	RUS	CAN	BRA	MEX	NOR	KAZ	ROW	Total
KOR	0	270	2,164	61	160	4,775	270	-826	-760	-942	-45	-127	-153	-84	-59	-146	-43	-16	-1,073	3,425
KWT	1,683	0	-9	-1	0	0	-2	-237	-261	-168	-138	-2	-1	-1	-5	0	0	-1	-876	-18
SAU	4,035	-16	0	-8	-9	-157	-6	-914	-436	-887	-79	-4	-1	-25	-36	-2	-1	-1	-1,155	296
BHR	97	-1	-25	0	0	-16	-3	-1	-3	-9	-9	0	0	0	0	0	0	0	-30	-1
QAT	3,278	-18	-14	-1	0	-47	-3	-80	-88	-1105	-648	-2	-2	-31	-17	-39	0	0	-1,119	61
ARE	1,992	3	16	3	3	0	-5	-21	-96	-31	-725	37	1	0	-2	0	0	-1	-763	410
OMN	798	4	-12	0	0	-21	0	-31	-183	-31	-295	-1	0	0	-1	0	0	0	-210	8
USA	374	-24	-252	-7	-2	-310	-21	0	46	11	4	-9	-4	46	-31	72	5	1	57	-46
CHN	181	-18	-203	-4	-2	-351	-11	11	15	-99	-8	0	-20	-3	-22	18	1	0	56	-458
EU28	284	-34	-414	-12	-10	-944	-37	126	229	419	12	1	-10	18	-25	22	25	7	290	-52
JPN	42	-19	-128	-7	-6	-144	-59	124	296	67	0	3	11	9	2	15	1	1	207	413
OthOPEC	-1,616	0	0	0	0	-32	0	479	87	166	241	2	1	3	24	10	0	0	628	-6
RUS	-1,123	0	-8	0	0	-11	1	96	93	734	125	6	0	2	1	1	3	3	195	117
CAN	57	-1	-16	0	0	-25	-1	-1	-3	-10	-1	-3	-1	0	-3	3	-1	0	-8	-14
BRA	58	1	0	1	0	-370	-1	55	48	70	15	8	5	6	0	8	2	0	144	51
MEX	7	0	-6	0	0	-8	0	26	2	-13	0	-2	0	1	-1	0	0	0	7	12
NOR	-28	0	-1	0	0	-7	0	9	1	17	0	0	0	2	-1	0	0	0	2	-7
KAZ	0	0	0	0	0	0	0	0	-6	-45	1	0	0	0	0	0	0	0	54	4
ROW	-4,233	-7	-317	-10	-4	-1,460	-36	688	-334	-868	1,053	-5	20	54	-3	45	8	16	1,673	-843
Total	5,886	130	775	14	131	870	83	-498	-334	-868	-498	-98	-155	-3	-179	6	-1	9	-1,920	3,350

Source: Authors' calculation

<Table 8> The effect of the Korea-GCC FTA on the bilateral trade in Scenario 2 (US$ million)

Region	KOR	KWT	SAU	BHR	QAT	ARE	OMN	USA	CHN	EU28	JPN	OthOPEC	RUS	CAN	BRA	MEX	NOR	KAZ	ROW	Total
KOR	0	267	2,146	60	158	4,759	268	-1,042	-1,041	-1,186	-117	-156	-187	-103	-81	-174	-53	-21	-1,417	2,078
KWT	1,684	0	-8	-1	-0	-0	-2	-234	-258	-162	-135	-2	-1	-1	-4	-0	-0	-1	-852	24
SAU	4,032	-15	0	-8	-10	-157	-6	-896	-434	-875	-83	-4	-1	-25	-36	-2	-1	-1	-1,151	325
BHR	96	-1	-24	0	-0	-16	-3	-2	-3	-9	-9	-0	-0	-0	-0	-0	-0	0	-30	-1
QAT	3,280	-18	-13	-0	0	47	-3	-78	-86	-1,092	-643	-2	-2	-30	-17	-39	-0	-0	-1,099	111
ARE	1,996	3	18	3	3	0	-3	-21	-95	-31	-714	36	1	-0	-2	-0	-0	-1	-751	440
OMN	797	-4	-10	-0	-0	-20	0	-29	-181	-30	-296	-1	-0	-0	-1	-0	-0	-0	-204	20
USA	504	-19	-224	-7	-1	-301	-20	0	71	42	19	-14	-8	49	-36	84	6	0	102	247
CHN	286	-16	-189	-3	-2	-337	-11	-6	22	-120	-2	-7	-32	-6	-29	20	0	-2	69	-363
EU28	442	-25	-357	-11	-8	-918	-33	135	274	443	22	-7	-48	17	-34	23	24	4	344	286
JPN	101	-18	-120	-7	-6	-139	-56	116	332	61	0	1	8	8	1	15	1	1	213	512
OthOPEC	-1,617	0	1	0	0	-29	-0	493	85	180	238	3	2	4	25	11	0	0	627	24
RUS	-1,124	-0	-5	0	1	-10	1	104	96	765	125	8	0	3	2	1	3	4	222	197
CAN	69	-0	-14	-0	0	-25	-0	11	0	-3	0	-3	-1	0	-3	4	-0	0	-2	33
BRA	62	1	4	1	1	-368	-0	65	56	83	17	9	5	7	0	10	3	0	169	124
MEX	8	0	-5	-0	-0	-8	-0	47	3	-11	1	-2	-0	1	-1	0	-0	0	10	43
NOR	-19	0	-0	-0	0	-7	0	10	2	19	0	-1	0	2	-1	0	0	0	4	9
KAZ	-1	0	0	0	0	-0	0	1	-5	-41	1	-0	0	0	-0	0	-0	0	55	10
ROW	-4,161	-1	-284	-10	-3	-1,430	-33	710	756	1,014	1,055	-16	10	54	-9	47	8	14	1,696	-582
Total	6,435	155	917	17	132	947	98	-616	-406	-952	-520	-159	-254	-21	-226	-0	-10	-2	-1,996	3,538

Source: Authors' calculation

<Table 7> shows the FTA's effects on the total exports in Scenario 1. The simulation results show that the FTA has a positive effect on the total exports for the GCC countries and Korea in both scenarios. In Scenario 1, the most beneficial country for its exports increase to Korea is Saudi Arabia (USD 4,035 million), followed by Qatar (USD 3,278 million), the UAE (USD 1,992 million), Kuwait (USD 1,683 million), Oman (USD 798 million), and Bahrain (USD 79 million). On the other hand, the highest GCC country that Korea expect to exports to is the UAE (USD 4,775 million), followed by Saudi Arabia (USD 2,164 million), Kuwait and Oman (USD 270 million), Qatar (USD 160 million) and Bahrain (USD 61 million). In addition, Korea's and the GCC's exports to the non-FTA members expect to have a negative impact.

<Table 8> shows the FTA's effects on the total exports in Scenario 2. The simulation results show that the FTA has a positive impact on the total exports for the GCC countries and Korea in both scenarios. In Scenario 1, the most beneficial country from its increase in exports to Korea is Saudi Arabia (USD 4,032 million), followed by Qatar (USD 3,280 million), the UAE (USD 1,996 million), Kuwait (USD 1,684 million), Oman (USD 797 million), and Bahrain (USD 96 million). On the other hand, the highest GCC country that Korea expect to exports to is the UAE (USD 4,759 million), followed by Saudi Arabia (USD 2,146 million), Kuwait and Oman (USD 268 million), Qatar (USD 158 million) and Bahrain (USD 60 million). Besides, Korea's and the GCC's exports to the non-FTA members expect to have a negative impact.

<Table 9> shows the Korea-GCC FTA's effect on the production by sector in Scenario 1. The simulation results show that the FTA has an impact on Korea and the GCC on many of their production sectors. Korea experiences a positive effect on the production in the sectors of agriculture, other mining, processed food, textile and wearing apparel, petroleum and coal products, other chemicals, metal products, automobile, utilities, construction, trade, and transports, yet it has a negative effect on the production in the sectors of oil, gas,

other transport equipment, electronics machinery, other manufactures, communications, financial and other services.

The Korea-GCC FTA is predicted to have a positive effect on the production of oil, gas, other mining, other chemicals, other transport equipment, utilities, construction, trade and other services of Kuwait, but a negative effect on the production of agriculture, processed food, textiles and wearing apparels, petroleum and coal products, metal products, automobiles, electronics, machinery, other manufactures, transportation and communications, with no changes in the production of the financial sector.

The Korea-GCC FTA is to have has a positive effect on production of agriculture, oil, other mining, other chemicals, utilities, construction, trade, communication, financial and other services of Saudi Arabia, but a negative effect on the production of gas, processed food, textiles and wearing apparels, petroleum and coal products, metal products, automobiles, electronics, machinery, other manufactures, and transportation, with no changes in the production of the other transport equipment.

The Korea-GCC FTA is predicted to have a positive effect on the production of oil, gas, petroleum and coal products, metal products, utilities, construction, and trade of Bahrain, but a negative effect on the production of agriculture, other mining, processed food, textiles and wearing apparels, other chemicals, automobiles, electronics, machinery, other manufactures, transportation, communications and financial, with no changes in the production of the transport equipment and other services

The Korea-GCC FTA is to have has a positive effect on production of oil, gas, petroleum products, other chemicals, and construction of Qatar, but a negative effect on the production of agriculture, other mining, processed food, textile and wearing apparel, metal products, automobiles, other transport equipment, electronics, machinery, other manufactures, utilities, transportation, financial, communications and other services, with no changes in the production of the trade.

The Korea-GCC FTA is predicted to have a positive effect on the production of agriculture, oil, gas, petroleum and coal products, utilities, construction, trade, transportation, communication, financial and other services of the UAE, but a negative effect on the production of agriculture, oil, gas, petroleum and coal products, utilities, construction, trade, transportation, communication, financial and other services.

The Korea-GCC FTA is predicted to have a positive effect on the production of oil, gas, automobiles, constructions, trade, communication, financial and other services of Oman, but a negative effect on the production of agriculture, other mining, processed food, textile and wearing apparel, petroleum and coal products, other chemicals, metal products, other transport equipment, electronics, machinery, other manufactures, utilities, and transportation.

The Korea-GCC FTA is to have has a positive effect on production of gas, automobiles, other transportation equipment, electronics, machinery, transportation of the EU, but a negative effect on the production of agriculture, processed food, other chemicals and utilities, with no changes in the production of the oil, other mining, textile and wearing apparel, petroleum and coal products, metal products, other manufactures, construction, trade, communication, financial and other services.

<Table 9> The impact of the Korea-GCC FTA on the production by sector
in case of Scenario 1 (% change)

Region	KOR	KWT	SAU	BHR	QAT	ARE	OMN	EU28
Agriculture	0.37	-0.07	0.42	-0.06	-0.08	0.40	-0.12	-0.03
OIL	-0.83	0.06	0.08	0.07	0.08	0.18	0.01	0.00
GAS	-0.66	0.01	-0.02	0.01	0.08	0.05	0.46	0.01
OthMining	0.18	0.01	0.04	-0.02	-0.05	-0.07	-0.14	0.00
PrcFood	3.30	-0.08	-0.41	-0.48	-0.16	-2.57	-1.08	-0.05
TextWapp	0.35	-0.63	-0.54	-0.03	-0.29	-0.16	-0.44	0.00
PetroCoalPrd	2.24	-0.37	-0.06	0.02	0.29	0.10	-0.41	0.00
OthChem	0.77	0.10	0.03	-0.14	0.05	-0.19	-1.13	-0.02
MetalPrd	0.11	-0.77	-0.72	0.07	-0.31	-0.48	-0.46	0.00
Automobiles	0.30	-0.41	-0.45	-0.39	-0.23	-0.46	0.15	0.01
OthTrnsEq	-1.75	0.01	0.00	0.00	-0.25	-0.15	-0.29	0.13
Electronics	-1.22	-0.29	-0.05	-0.04	-0.10	-0.13	-0.24	0.08
Machinery	-0.57	-0.40	-0.94	-0.74	-0.17	-0.37	-3.15	0.01
OthMnf	-0.26	-0.30	-0.05	-0.05	-0.15	-0.16	-0.36	0.00
Utilities	0.26	0.03	0.02	0.03	-0.06	0.06	-0.26	-0.01
Construction	0.42	0.25	0.11	0.12	0.04	0.21	0.15	0.00
Trade	0.06	0.06	0.05	0.02	0.00	0.34	0.10	0.00
Transport	0.16	-0.06	-0.08	-0.10	-0.13	0.04	-0.04	0.01
Communic	-0.03	-0.33	0.06	-0.01	-0.02	0.09	0.08	0.00
Financial	-0.09	0.00	0.03	-0.02	-0.10	0.01	0.07	0.00
OthServ	-0.04	0.01	0.01	0.00	-0.04	0.02	0.06	0.00

Source: Authors' calculation

<Table 10> shows the Korea-GCC FTA's effect on the production by sector in Scenario 2. The simulation results show that the FTA has an impact on Korea and the GCC on many of their production sectors. Korea experiences a positive effect on the production in the sectors of agriculture, other mining, processed food, textile and wearing apparel,

petroleum and coal products, other chemicals, metal products, automobile, utilities, construction, communications, trade, other services, and transports, yet it has a negative effect on the production in the sectors of oil, gas, other transport equipment, electronics machinery, other manufactures and financial.

Kuwait gets a positive effect on the production in the sectors of oil, gas, other mining, processed food, other chemicals, other transport equipment, utilities, construction, trade, financial and other services, yet it has a negative effect on the production in the sectors of agriculture, textiles and wearing apparels, petroleum and coal products, metal products, automobiles, electronics, machinery, other manufactures, and communications, however the transportation sector show no changes.

Saudi Arabia has a positive effect on the production in the sectors of agriculture, oil, gas, other mining, other chemicals, electronics, other manufactures, utilities, construction, trade, transportation, communication, financial and other services, yet it has a negative effect on production in the sectors of processed food, textiles and wearing apparels, petroleum and coal products, metal products, automobiles, other transport equipment and machinery.

Bahrain has a positive effect on production in the sectors of oil, gas, petroleum and coal products, metal products, utilities, construction, trade and other services, yet it has a negative effect on the production in the sectors agriculture, other mining, processed food, textiles and wearing apparels, other chemicals, automobiles, electronics, machinery, other manufactures, transportation, and financial, however the communications and other transport equipment sectors show no changes.

Qatar has a positive effect on production in the sectors of oil, gas, petroleum products, other chemicals, construction, trade communications, and other services, yet it has a negative effect on the production in the sectors of agriculture, other mining, processed food, textile and wearing apparel, metal products, automobiles, other transport equipment, electronics, machinery, other manufactures, transportation and financial, however the utilities sector show no changes.

The UAE has a positive effect on the production in the sectors of agriculture, oil, gas, petroleum and coal products, utilities, construction, trade, transportation, communication, financial and other services, yet it has a negative effect on the production in the sectors of agriculture, oil, gas, petroleum and coal products, utilities, construction, trade, transportation, communication, financial and other services.

Oman has a positive effect on the production in the sectors of oil, gas, automobiles, constructions, trade, transportation, communication, financial and other services, yet it has a negative effect on the production in the sectors of agriculture, other mining, processed food, textile and wearing apparel, petroleum and coal products, other chemicals, metal products, other transport equipment, electronics, machinery, other manufactures, and utilities.

The EU-28 has a positive effect on production in the sectors of gas, automobiles, other transportation equipment, electronics, machinery and transportation, yet it has a negative effect on the production in the sectors of agriculture, oil, processed food, other chemicals, metal products and construction. However, the rest of the sectors show no effect by the Korea-GCC FTA.

<Table 10> The impact of the Korea-GCC FTA on the production by sector in case of Scenario 2 (% change)

Region	KOR	KWT	SAU	BHR	QAT	ARE	OMN	EU28
Agriculture	0.41	-0.02	0.43	-0.05	-0.03	0.41	-0.08	-0.03
OIL	-0.86	0.09	0.09	0.06	0.13	0.20	0.03	-0.01
GAS	-0.65	0.05	0.01	0.02	0.13	0.07	0.49	0.01
OthMining	0.15	0.10	0.12	-0.02	-0.03	-0.07	-0.09	0.00
PrcFood	3.47	0.08	-0.37	-0.44	-0.06	-2.49	-0.93	-0.05
TextWapp	0.29	-0.64	-0.58	-0.07	-0.25	-0.15	-0.38	0.00
PetroCoalPrd	2.34	-0.28	-0.01	0.03	0.26	0.11	-0.31	0.00
OthChem	0.76	0.21	0.11	-0.11	0.11	-0.15	-0.96	-0.02
MetalPrd	0.01	-0.67	-0.67	0.07	-0.26	-0.48	-0.43	-0.01
Automobiles	0.29	-0.32	-0.42	-0.37	-0.14	-0.39	0.26	0.02
OthTrnsEq	-2.05	0.08	-0.09	0.00	-0.15	-0.15	-0.21	0.16
Electronics	-1.43	-0.19	0.01	-0.03	-0.01	-0.11	-0.07	0.09
Machinery	-0.83	-0.29	-0.98	-0.74	-0.15	-0.36	-2.94	0.01
OthMnf	-0.42	-0.22	0.02	-0.04	-0.07	-0.09	-0.23	0.00
Utilities	0.27	0.15	0.10	0.05	0.00	0.12	-0.16	0.00
Construction	0.97	0.50	0.31	0.19	0.12	0.30	0.30	-0.01
Trade	0.19	0.17	0.14	0.05	0.07	0.41	0.18	0.00
Transport	0.11	0.00	0.06	-0.07	-0.05	0.09	0.07	0.01
Communic	0.08	-0.30	0.14	0.00	0.06	0.15	0.14	0.00
Financial	-0.01	0.04	0.05	-0.02	-0.04	0.06	0.11	0.00
OthServ	0.16	0.07	0.05	0.02	0.02	0.06	0.09	0.00

Source: Authors' calculation

. Conclusion

This paper aims to analyze the economic impacts of a potential FTA between Korea and the GCC countries by using the GTAP model and the GTAP database version 9. Two scenarios of the Korea-GCC FTA are conducted: Scenario 1 with a 100 percent cut of tariffs on all bilateral trade between two parties and Scenario 2 with a 100 percent cut of tariffs on all bilateral trade between two parties in addition to the total factor productivity. The simulation results are presented in terms of macroeconomic effects such as real GDP, welfare, total exports, total imports and terms of trade, as well as microeconomic effects in terms of domestic production by sector.

The simulation results show that the Korea-GCC FTA is expected to lead to changes in the structure of the economies of the GCC countries more than Korea. Scenario 2 has a more considerable effect on the real GDP, welfare, total exports, terms of trade and the production by sector due to the consideration of the increased total factor productivity.

The country that is expected to benefit the most from the Korea-GCC FTA in the real GDP is Korea, followed by the UAE, Qatar, Kuwait, Saudi Arabia, Oman, and Bahrain in the two scenarios. The country that witnesses the most significant increase in its welfare is Korea, followed by Saudi Arabia, the UAE, Kuwait, Qatar, Oman, and Bahrain. The country that benefits the most in terms of trade is Kuwait, followed by Qatar, Oman, the UAE, Saudi Arabia, Korea, and Bahrain.

Correspondingly, the FTA affects the production by sector for Korea and the GCC countries in a positive way. Korea's production will witness growth in the sectors of agriculture, other mining, processed food, textile and wearing apparel, automobiles, utilities, construction, trade, and transport. Kuwait's production will increase in the sectors of oil, gas, other mining, other chemicals, utilities, construction, trade, the financial and other services. Saudi Arabia's production will rise in the sectors of agriculture, oil, other mining, other chemicals, utilities, construction, trade, communication, financial, and other

services. Bahrain's production will face growth in the sectors of oil, gas, petroleum and coal products, metal products, utilities, construction, trade and other services. Qatar's production will go up in the sectors of oil, gas, petroleum and coal products, other chemicals and the construction. The UAE's production will boost in the sectors of agriculture, oil, gas, petroleum and coal products, utilities, construction, trade, transport, communication, the financial and other services. Oman's production will see growth in the sectors of oil, gas, automobiles, construction, trade, communication, financial and other services.

The results of the simulation show that the Korea-GCC FTA is expected to make limited changes in the structure of the economy of the EU. The FTA has a small negative effect on the welfare, terms of trade, total exports and the production by sector of the EU due to the consideration of the increased total factor productivity in the second scenario, with no impact on the real GDP of the EU. In addition, the EU's production will experience slight growth in some sectors such as gas, automobiles, other transportation equipment, electronics, machinery and transportation.

With the impacts mentioned above, the GCC countries' exports value will increase more than Korea's exports to the GCC countries. The reason for such an impact is because the GCC countries export oil, gas and petroleum products demanded by Korea. Therefore, the Korea-GCC FTA can play a significant role for Korea to secure its needs for oil, gas and petroleum products, and become the key to sustain its economic progress. The FTA will drive Korea and the GCC countries towards deeper economic integration, which will lead to mutually beneficial gains. Therefore, signing the Korea-GCC FTA is highly recommended due to its potential economic benefits to both parties.

[Key Words: A Korea-GCC FTA, CGE Model, Tariffs, Total Factor Productivity, Economic Impact]

References

Abizadeh, S. & Pandey, M. (2009). "Trade Openness, Structural Change and Total Factor Productivity", *International Economic Journal*, 23(4), 545–559

Adams, P. D. (2005). "Interpretation of Results From CGE Models Such as GTAP", *Journal of Policy Modeling*, 27(8), 941–959.

Aguiar, A., Narayanan, B., & McDougall, R. (2016). "An Overview of the GTAP 9 Data Base", *Journal of Global Economic Analysis*, 1(1), 181–208

Andrew, R. M. & Peters, G. P. (2013). "A Multi-Region Input–Output Table Based on the Global Trade Analysis Project Database (Gtap-Mrio)", *Economic Systems Research*, 25(1), 99–121.

Brockmeier, M. (2001). "A Graphical Exposition of the GTAP Model", *GTAP Technical Paper No. 5*.

Burfisher, M. E. (2017). *Introduction to Computable General Equilibrium Models*, 2nd ed., Cambridge University Press.

Hertel, T. (1997). *Global Trade Analysis : Modeling and Applications*. Cambridge University Press.

Hwang, I. & Wang, E. (2004). "Does Openness to Trade Affect Total Factor Productivity Growth: Evidence from 45 Japanese Manufacturing Industries", *Journal of economic research*, 9, 147–173.

Jin, H., Koo, W. & Sul, B. (2006). "The Effects of the Free Trade Agreement Among China, Japan and South Korea", *Journal of Economic Development*, 31(2), 55–72.

Ko, J.-H. (1993). *Ökonomische Analyse von Energie- und Volkswirtschaft auf der Basis allgemeiner Gleichgewichtsmodelle*, Europäische Hochschulschriften, Vol. 1420, Verlag Peter Lang: Frankfurt/Wien/Paris/New York.

Ko, J.-H. (2015). "Korea", in Narayanan, G, Badri, Angel Aguiar and Robert McDougall (eds.), *Global Trade, Assistance, and Production: The GTAP 9 Data Base*, Center for Global Trade Analysis, Purdue University.

Ko, J.-H. & S. Ito (2017). "Simulation for Japan-Korea FTA and Its Economic Impacts on Agriculture: A CGE Approach", *Journal of Faculty of Agriculture, Kyushu University*, 62 (1), 283-294.

Majeed, S. & Ahmed, Q. M. (2014). "Trade Liberalization and Total Factor Productivity Growth (1971-2007)", *Pakistan Economic and Social Review*, 48(1), 61–84.

Mold, A. & Mukwaya, R. (2017). "Modeling the Economic Impact of the Tripartite Free Trade Area : Its Implications for the Economic Geography of Southern, Eastern and Northern Africa", *Journal of African Trade*. Elsevier B.V., 3(1-2), 57–84.

Mukhopadhyay, K., Thomassin, P. J. & Chakraborty, D. (2012). "Economic Impact of Free Trade in Latin America and the Caribbean: A GTAP Analysis", *Latin American Journal of Economics*, 49(2), 147–183.

Japan Cabinet Secretariat Office for TPP Government Strategy (2015). *An Analysis of the Economic Impact of TPP Negotiations*

Siddig, K., Grethe, H. & Abdelwahab, N. (2016). "The Natural Gas Sector in Post-Revolution Egypt", *Journal of Policy Modeling*, 58(5), 941–953.

Yu, W., Cheng, G & Yang, J. (2010). "Impact of Sino-Australia Free Trade Agreement's Talks on China's Dairy Industry", *Agriculture and Science Procedia,*1, 469–476.