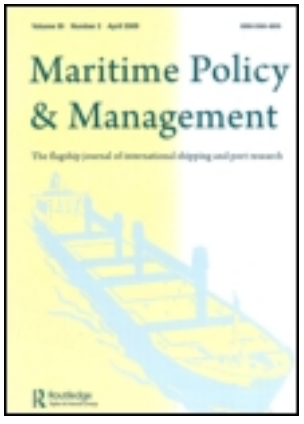

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The impact of Korea's FTA network on seaborne logistics

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The impact of Korea's FTA network on seaborne logistics

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Few studies have examined Free Trade Agreements (FTAs) in the context of logistics, reflecting a lack of hybrid studies involving trade economists and logistics researchers. This paper attempts to examine the impact of Korea's FTAs on the flow of international trade, the volume of seaborne trade, and the creation of additional demand for logistics services for port and containerized cargoes. The implementation of Korea's FTAs is expected to increase port and containerized cargoes, an additional 90 million tons and an additional 893 095 TEUs in the long run. Although the demand for seaborne logistics is expected to increase, the impacts are likely to vary widely across sectors and FTAs. Increased imports of agricultural and chemical/rubber/plastic products are likely to be the most important contributor to the creation of additional demand for seaborne logistics. This paper tries to draw implications for the logistics industry and the port authority.

1. Introduction

Korea has successfully implemented Free Trade Agreements (FTAs) with its major trading partners. As of April 2012, the country had eight FTAs, including those with the US (March 2012), the EU (July 2011), India (January 2010), and ASEAN (an agreement on goods, June 2007). In addition, the country is promoting FTAs with China and Japan. Since Cheong and Cho [1] identified Korea's logistics industry as one of the major beneficiaries of the country's active promotion of the FTA network, the logistics industry has started to recognize the potential for new business opportunities.

One of the immediate impacts of implementing these FTAs is the increase in trade volume. Korea has a highly trade-oriented industrial and economic structure that depends on international trade for approximately 90% of its GDP. Growing trade volume has led to steady increases in international cargoes and containers to and from the country in the past several decades. In addition, to facilitate international trade, Korea has expanded its capacity for handling international logistics by investing in infrastructure projects such as ports and airports.

Many quantitative studies have estimated the economic impacts of FTAs in Korea, but very few have analyzed the impacts of FTAs on international logistics by focusing on the increase in trade volume and the creation of additional demand for

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port cargoes. Some studies have taken a descriptive approach to analyze the impacts of FTAs on the international logistics industry.

This paper tries to estimate the impacts of Korea's FTAs on the creation of additional demand for logistics services for port and containerized cargoes. The rest of this paper is organized as follows: Section 2 reviews previous research on FTAs in the context of logistics. Section 3 discusses the research design by focusing on trade volume–cargo logistics conversion. Section 4 presents the simulation results for the trade impacts of Korea's FTAs on the flows of port cargoes and containerized cargoes (in TEUs). Section 5 concludes by discussing important policy implications for the logistics industry.

2. Literature review

Few studies have examined FTAs in the context of logistics, reflecting the logistics community's lack of interest in the global trend toward FTA-based regionalism and a lack of hybrid studies involving trade economists and logistics researchers. In this section, we review previous research on FTAs in the context of logistics in Korea.

2.1. *Descriptive approach*

In Korea, national think tanks such as the Korea Institute for International Economic Policy and the Korea Development Institute have made large-scale efforts to examine the economic impacts of FTAs to formulate appropriate policies and develop effective strategies for official negotiations. However, these efforts have focused mainly on macroeconomic impacts and negotiation topics. In addition, they have depended heavily on descriptive methods to address various FTA issues but generally ignored various FTA-related logistics issues.

Several researches provided a comprehensive evaluation of Korea's efforts to expand its FTA network, with estimates for the impact of FTAs on Korea's industrial production and implications for international transport sector [1, 2], pointing out that the international logistics industry would expand sharply through the Korea–US FTA (Table 1). Seo [3] and Kim [4] reviewed various issues of the Korea–US FTA in the context of FTA policies and international logistics.

Ha and Jung [5] explored various logistics issues surrounding the negotiations for the EU–Korea FTA, including maritime cabotage services, criteria for national flagships, rules and regulations for port use, among others. Lee [6] suggested a regional logistics cooperation scheme involving ASEAN countries in the context of trade liberalization through the ASEAN–Korea FTA. In addition, others have considered postal logistics and open sky policies and related air logistics for national policymaking and negotiation support.

2.2. *Quantitative approach*

Few quantitative studies have examined the impacts of FTAs on logistics. Logistics experts have paid less attention to the increase in trade volume from the implementation of FTAs, and trade economists have not explored the impacts of FTAs on international logistics in a systematic manner.

The Korea Transport Institute [7] was the first to provide a comprehensive report on the FTA–logistics linkage by using an econometric model, estimating that Korea could export USD 2 billion worth of logistics services to China and Japan, producing USD 0.9 billion in value added and creating 7933 new jobs in Korea when

Table 1. Previous studies of FTA-related logistics issues.

Author	Year	Main issue	Approach
Cheong and Cho	2006	The international logistics industry to benefit from the expansion of FTA networks	Descriptive approach
FTA Research Group	2007	Increased business demand for international logistics from the Korea–US FTA	
Seo	2007	The maritime industry to benefit from the Korea–US FTA	
Ha and Jung	2007	Logistics issues surrounding the EU–Korea FTA	
Kim	2008	Improving Korea's logistics system to address the implementation of the Korea–US FTA	
Lee	2008	Maritime cooperation in the ASEAN–Korea FTA	
Korea Transport Institute	2009	Macroeconomic impacts of a China–Japan–Korea FTA on Korea's logistics industry	Quantitative approach
Lee *et al.*	2011	Impacts of China–Taiwan FTA on Taiwan's logistics industry through the adoption of trade value–cargo logistics conversion	
Lee and Lee	2012	Impacts of the FTA among India, Brazil, and South Africa on shipping geography and logistics development strategies	

Source: Authors' summary.

a China–Japan–Korea FTA is established. Because the research employed an econometric regression model without a trade policy mechanism, it had analytical limitations in considering the linkage between trade volume and logistics demand by industry. In particular, FTAs can change the structure of export composition because of differences in trade barriers, and econometric models have limitations in capturing this change, failing to provide a detailed quantitative analysis.

Recently, Lee *et al.* [8] and Lee and Lee [9] stated that "a scientific approach is developed to convert the estimated cargo value flows into volume flows." Lee *et al.* [8] estimated that the ECFA would induce 0.56 million tons of uncontainerizable cargoes and 0.49 million TEUs of containerizable ones. Lee and Lee [9] estimated the impacts of the proposed India–Brazil–South Africa FTA, namely the IBSA, by focusing on shipping geography and logistics development strategies.

Korea has actively promoted FTAs, but few analytical studies have examined the linkage between Korean FTAs and logistics, despite the important role that FTAs play in increasing trade volume and international logistics. Although Korea's recent port cargo volume has been far below the target because of the construction of major ports in China and a global recession driven by a financial crisis, trade creation through the implementation of FTAs with major trading partners such as the US, the EU, ASEAN, and India is expected to solve the recent slump in Korea's maritime logistics industry.

3. Simulation model and the research design

Given the overcapacity of ports and the slow increase in the demand for logistics in Korea since the outbreak of the global financial crisis, the derived demand for international logistics from trade creation through the implementation of FTAs with major trading partners may be a new growth opportunity for the logistics industry in Korea, which has been more active in pursuing FTAs than other countries in East Asia. This paper analyzes the impacts of Korea's four FTAs with the US, the EU, ASEAN, and India on the demand for international port logistics. As of 2012, about 88% of bilateral trades with FTA partners are liberalized, and more than 93% of trade will be free of tariffs in 2015 under the four FTAs considered in this paper.

3.1. *Simulation model and the database*

A number of studies have provided macroeconomic and microeconomic analyses of specific FTAs, but until recently, few have provided fusion analyses of FTAs and logistics to estimate the changes in the cargo value from trade creation based on the implementation of FTAs. In addition, these studies have generally failed to fully assess the impacts of FTAs on the logistics industry (including the additional demand for logistics services) and provide useful implications for logistics policies. Given that maritime transportation accounts for approximately 75% of international trade in terms of the value of goods, the increasing popularity of FTAs may draw more attention to port policies, including the improvement of port efficiency and the implementation of port infrastructure projects.

As the implementation of FTAs implies trade liberalization for member countries, one of the major objectives of this paper is to estimate the impacts of FTAs on sectoral trade expansion by adopting a quantitative analysis model that allows for the estimation of sectoral impacts. Here we note that FTAs can change the trade structure because of differences in tariff barriers. Unlike econometric models, Computable General Equilibrium (CGE) models are useful for estimating the impacts of FTAs on sectoral trade expansion.

The Global Trade Analysis Project (GTAP) CGE model and its recent database (Version 8, released in March 2012) are useful in terms of simulation costs and communication between researchers [10, 11]. The GTAP CGE model assuming perfect competition and constant returns to scale can be modified for diverse simulation studies. The GTAP model provides users with a wide range of choices for exogenous variable and endogenous variables, the so-called "closure" in CGE works, enabling researchers to test the impacts of policy options numerically.

Trade data and information on logistics are compiled with different sectoral classifications, and the GTAP database is built on its own sectoral grouping. For a quantitative analysis, all the data sets need to be compatible with one another and harmonized into a single classification. Each economy is disaggregated into relevant numbers of sectors for research purposes and simulation costs. In this paper, we deliberately design various sectors to Korea's trade data in the Harmonized System format by using data on port logistics in Korea. In addition, we disaggregate each economy into 18 sectors to make them compatible with the sectoral classification of the GTAP database and the port trade database provided by Korea's Shipping and Port Internet Data Center (SP-IDC). We disaggregate the world into 12 countries/regions to make them compatible with this paper's research purposes while reflecting Korea's FTA performance thus far, as seen in Table 2.

Table 2. Sectoral and regional disaggregation.

Sectoral disaggregation		Regional disaggregation		
Sector	GTAP code	Region	Status of the FTA with Korea	Description
Agriculture	1–9, 11–14, 19, 23	Korea		
Processed food	10, 20–22, 24–25	Chile	2004 (implemented)	
Beverages and tobacco	26	EFTA	2006 (implemented)	European Free Trade Association
Textiles and apparel	27–28	ASEAN	2007 (implemented)	10 ASEAN countries
Leather products	29	India	2010 (implemented)	
Wood products	30–31	The EU	2011 (implemented)	
Petroleum, oil, coal, and gas	15–17, 32	The US	2012 (implemented)	
Chemicals, Rubber, and Plastics (CRP)	33	Peru	2011 (implemented)	
Mineral products	18, 34	China	Negotiation	
Iron and steel	35	Hong Kong		
Non-ferrous metals	36	Japan		
Metal products	37	ROW		Rest of the world
Automobiles and parts	38			
Other transport equipment	39			
Electronic equipment	40			
Machinery and equipment	41			
Other manufacturing	42			
Services	43–57			

Source: Compiled by authors.

3.2. *Research design*

Although FTA economists have developed quantitative simulation models based on the CGE approach, one additional step for capturing the impacts of trade expansion on maritime logistics is still needed, noting that CGE models estimate the impact of FTAs in terms of trade value. This paper can be divided into two parts: in the first part, we estimate the impacts of FTAs on the bilateral trade flow between partner countries, and in the second part, we explore the relationship between trade volume in monetary units and the container cargo flow, which interests the logistics industry more than changes in port cargoes.

Although multiregional CGE models are generally useful for estimating the value of trade created through the implementation of FTAs, we cannot convert sectoral estimates into the demand for port logistics without devising trade value–cargo conversion coefficients. Lee *et al.* [8, 9] calibrated conversion coefficients linking value data to weight data and estimated containerization ratios for exports and imports. Following their approaches, three coefficients are necessary for converting

trade values into port and containerized cargoes. The trade volume–cargo logistics conversion approach in Lee *et al*. [8] was slightly modified by calibrating sectoral port utilization ratios by dividing the trade value by the value of exports via ports.

The GTAP CGE model estimates the impacts of FTAs in terms of the trade value (in million USD), and we convert trade values into weight equivalents based on the coefficients of sectoral containerization ratios. Parts of port cargoes are transported in containers based on their weight. In the case of Korea, the average containerization ratios for exports and imports across industries are 43.27% and 12.72%, respectively, reflecting Korea's heavy dependence on the import of agricultural products and natural resources, large portions of which are imported through uncontainerized bulk shipments. In addition to the fact that containerization of port cargo steadily increases over time [12], wide differences in the ratios of sectoral containerization can be expected, as presented in Table 3. In general, petroleum, mineral products, and iron are difficult to containerize, whereas textiles/apparel, leather products, and electronic products can be easily containerized for both exports and imports.

4. Impacts on port and containerized cargoes

We use the set of coefficients in Table 3 to convert trade growth from FTAs into containerized cargoes. We estimate the impacts of Korea's major FTAs on trade volume, and then, apply conversion application into sectoral estimated volume for the derived demand for maritime logistics services.

4.1. *CGE simulation results*

CGE simulations require quite complicated and time-consuming work, especially large-scale works like calculating the effects of FTA trade liberalization. Since this paper places a higher significance on the impacts of FTAs on port cargo and containerized logistics flows, the impacts of FTAs on the growth of exports and imports should be simulated as the first step for research.

4.1.1. *Korea's exports to FTA partners*. Korea's four major FTAs are expected to increase its exports to FTA partners, and long-term impacts are expected to exceed short-term ones (Table 4). Surprisingly, the Korea–US FTA is likely to lead to only modest increases in Korea's exports. Regardless of the time span, the ASEAN–Korea FTA is most likely to facilitate Korea's export growth. Korea's exports to ASEAN countries are expected to increase by USD 14.8 billion in the short run and by USD 18 billion in the long run. The EU–Korea FTA follows as the second most important contributor to Korea's export growth.

Although most sectors are expected to realize export growth, some may lose their market share to FTA partners because of differences in international competitiveness and the tariff structure. In addition, FTA impacts on exports are expected to vary widely across sectors. Textiles and apparel are winners under the ASEAN–Korea FTA and the Korea–US FTA, and automobiles and parts gain under the EU–Korea FTA. On the other hand, agricultural products, beverages/tobacco, and mineral products, among others, are not likely to be impacted by Korea's FTA network because Korea is a net importer of these products.

Table 3. Sectoral containerization ratios (in thousand tons).

	Korea's exports			Korea's imports		
	Total port cargoes	Containerized cargoes	Containerization ratio	Total port Cargoes	Containerized cargoes	Containerization ratio
Agriculture	601	516	85.76	12 721	1701	13.37
Processed food	2573	2320	90.18	11 799	3236	27.43
Beverages and tobacco	1153	1093	94.82	8257	2624	31.77
Textiles and apparel	40 036	39 572	98.84	27 913	27 118	97.15
Leather products	521	518	99.39	1184	1183	99.91
Wood products	2157	2050	95.07	7663	1437	18.76
Petroleum, oil, coal, and gas	54 038	683	1.26	333 400	371	0.11
CRP	27 120	9749	35.95	20 662	4216	20.40
Mineral products	7387	3	0.04	1488	29	1.96
Iron and steel	1845	275	14.91	82 973	662	0.80
Non-ferrous metals	2028	1684	83.01	3463	2273	65.64
Metal products	24 435	3633	14.87	28 118	1476	5.25
Automobiles and parts	35 225	5613	15.94	1954	701	35.87
Other transportation equipment	1432	971	67.77	3088	2799	90.64
Electronic equipment	7042	6876	97.64	8622	8467	98.20
Machinery and equipment	12 923	8548	66.15	8446	5612	66.45
Other manufacturing	25 125	22 195	88.34	12 035	9087	75.51
Services	–	–	–	–	–	–
Total	245 641	106 298	43.27	573 786	72 992	12.72

Source: Trade data from KITA KOTIS and port data from SP-IDC (authors' calculation).
Note: Conversion coefficients are in cargo tons per million USD.

Table 4. Impacts of Korea's FTAs on its exports (in million dollars).

	Short-run impacts					Long-run impacts				
	USA	EU	ASEAN	India	Subtotal	USA	EU	ASEAN	India	Subtotal
Agriculture	175	8	15	5	203	175	7	18	5	205
Processed food	655	111	271	25	1062	683	115	293	26	1117
Beverage and tobacco	15	4	9	4	32	16	5	9	4	34
Textiles and apparel	1775	984	5375	209	8343	1990	1087	5865	220	9162
Leather products	91	51	172	4	318	100	56	197	5	358
Wood products	51	2	191	127	371	97	10	224	134	465
Energy and natural resources	707	137	1954	1641	4439	709	153	2346	1710	4918
CRP	676	1042	1112	1133	3963	883	1167	1311	1189	4550
Mineral products	9	18	54	16	97	17	23	67	17	124
Iron and steel	−6	2	1070	735	1801	67	60	1304	772	2203
Non-ferrous metals	55	52	496	591	1194	67	57	664	621	1409
Metal products	77	163	394	314	948	167	230	459	332	1188
Automobiles and parts	515	6295	1647	643	9100	1094	6869	1796	673	10 432
Other transport equipment	−24	439	81	729	1225	41	857	204	779	1881
Electronic equipment	54	2481	42	190	2767	957	3330	806	235	5328
Machinery and equipment	553	1583	1018	2562	5716	1298	2256	1392	2729	7675
Other manufacturing	96	61	989	47	1193	141	81	1060	49	1331
Total	5474	13 435	14 890	8974	42 773	8503	16 362	18 017	9500	52 382

Source: Authors' simulation results.

4.1.2. *Korea's imports to FTA partners*. Increases in imports from FTA partners are expected for most sectors (Table 5). Because Korea depends heavily on the import of agricultural products, processed food products, and machinery, import growth is expected for these sectors, particularly for agricultural products from the US, processed food products from the EU, and machinery from both the US and the EU. As in the case of exports, long-term FTA impacts on imports are likely to exceed short-term ones. Although energy products and natural resources account for approximately 40% of Korea's imports, the simulation results indicate no substantial impacts on these products because the major sources of these products are the Middle East, Canada, Oceania, and South America, although some are imported from ASEAN and India.

Imports from the US are expected to increase by USD 20.2 billion in the short run and by USD 22.9 billion in the long run, whereas those from India are expected to increase by less than USD 2 billion. The ASEAN–Korea FTA is more likely to impact Korea's exports, whereas the Korea–US FTA, Korea's imports because of sharp increases in the import of agricultural products from the US. The EU–Korea FTA is expected to bring about a balanced increase in Korea's exports to and imports from the EU, whereas the India–Korea FTA is likely to lead to unbalanced bilateral trade, strengthening one-way trade (i.e. more cargoes to India than to Korea).

4.2. *Impacts on port cargoes and demand for containerized cargoes*

We convert the impacts of Korea's FTAs on exports and imports based on the CGE simulations into port and containerized cargoes in four steps: first, we multiply the port utilization ratios by industry by the estimates of exports and imports across all sectors. Second, we derive port cargoes by applying the trade value–cargo weight conversion coefficients. Third, we apply the sectoral containerization ratios to port cargoes. Finally, the coefficients of tonnage per TEU will be divided by the values in the third stage.

4.2.1. *Trade value–port cargo conversion*. Korea's major four FTAs are expected to create 15.7 million tons of port cargoes in the short run and 18 million tons in the long run. These cargoes are containerizable. Therefore, some are expected to be containerized shipments. Because of differences in port utilization ratios and port cargo conversion coefficients, port cargo creation is expected to vary widely across sectors in terms of the pattern of export and import value growth. The ASEAN–Korea FTA is most likely to have a positive impact on the total value of increased exports, followed by the EU–Korea FTA, the India–Korea FTA, and the Korea–US FTA. On the other hand, the ASEAN–Korea FTA is most likely to impact the creation of port cargoes, followed by the India–Korea FTA, the EU–Korea FTA, and the Korea–US FTA. This implies that a large portion of export growth to the EU will be transported via airborne logistics, while a larger amount of exports to India will be transported via seaborne shipment.

The impacts of Korea's FTAs on the increase in port cargoes for exports are expected to be concentrated in a few industries (e.g. CRP, energy/natural resources, and automobiles/parts). These products account for three-fourths of newly created port cargoes in terms of their weight. Basically, these products are internationally transported via seaborne shipments and represent Korea's major exports.

Table 5. Impacts of Korea's FTAs on its imports (in million dollars).

	Short-run impacts					Long-run impacts				
	USA	EU	ASEAN	India	Subtotal	USA	EU	ASEAN	India	Subtotal
Agriculture	11 582	70	4360	0	16 012	12 227	79	4319	0	16 625
Processed food	1087	4304	1106	55	6552	1180	4485	1192	60	6917
Beverage and tobacco	30	80	10	0	120	35	95	11	0	141
Textiles and apparel	302	921	461	132	1816	325	981	567	147	2020
Leather products	33	280	114	3	430	37	300	139	5	481
Wood products	−8	101	155	0	248	24	128	245	0	397
Energy and natural resources	424	252	970	1203	2849	463	289	1274	1286	3312
CRP	1879	2054	503	116	4552	2285	2372	832	136	5625
Mineral products	55	136	31	4	226	114	168	123	19	424
Iron and steel	2	48	−4	11	57	55	120	31	23	229
Non-ferrous metals	218	356	42	17	633	321	428	166	23	938
Metal products	213	430	5	59	707	233	466	30	72	801
Automobiles and parts	383	1259	61	32	1735	423	1381	78	37	1919
Other transport equipment	150	58	13	0	221	263	72	29	0	364
Electronic equipment	143	195	73	0	411	537	284	748	1	1570
Machinery and equipment	3671	4961	895	50	9577	4272	5506	1205	59	11 042
Other manufacturing	128	159	23	7	317	151	176	36	9	372
Total	20 291	15 664	8818	1690	46 463	22 946	17 329	11 026	1878	53 179

Source: Author's simulation results.

As agricultural products account for a large portion of Korea's imports as well as seaborne transport in international trade, increases in port cargoes from import growth are expected to be four times as large as those from export growth. On the other hand, imports and exports are expected to show similar increases in terms of their value. Port cargoes are expected to increase by 66 million tons in the short run and by 72 million tons in the long run under the four FTAs. These increases are derived mainly from agricultural products, CRP, energy/natural resources, and processed food products, which together account for 95–96% of the increase in port cargoes.

As in the case of exports and imports, the Korea–US FTA is more likely to impact port cargoes through import growth than through export growth, creating 41.28 million tons in the short run and 44.47 million tons in the long run, which exceed those created through the combined implementation of the EU–Korea FTA, the ASEAN–Korea FTA, and the India–Korea FTA. Although the EU–Korea FTA is more likely to facilitate import growth than the Korea–US FTA, port cargo creation through the former is less than one-fourth of that through the latter because the latter entails substantial agricultural imports. In addition, the Korea–US FTA increases port cargoes by 36–38 million tons.

4.2.2. *Demand for containerized cargoes from trade growth.* Port cargoes created through the implementation of Korea's FTAs are transported in containers based on the sectoral containerization ratio. We convert containerizable port cargoes into containerized cargoes in two steps. We apply the sectoral containerization ratios to Tables 6 and 7 for exports and imports, respectively. We then divide the results from the first step by the average weights per TEU. Korea's Forecast Center for Port Demand [13] analyzed the tonnage per TEU to be 18.5 tons for imports and 20.7 tons for exports for 2008 and forecasted 18.9 tons and 20.7 tons, respectively, for 2011. We adopt these values for 2011. Korea's containers are much heavier than Taiwan's 12 tons per TEU in Lee *et al.* [8].

The additional demand for containerized cargoes is expected to reach 245 258 TEUs in the short run and 290 692 in the long run. In terms of export growth, the ASEAN–Korea FTA is expected to create 75 604–93 137 TEUs, and 56 123–69 771 with the US, 56 169–67 305 with the EU, and 57 362–60 479 with India. It is also expected that a similar number of container logistics will be created across the other FTAs, noting that vast differences are anticipated for the growth rates of the values of exports and imports and port cargo. This similarity can also be found in the sectoral impacts. The growth rate for containerized cargo of exports will be spread out over all of the industrial sectors, with the exception of mineral products. Although CRP cover a large share of the created container logistics, the remaining industries will also occupy some portions with variations.

Import growth has slightly different impacts on the demand for containerized logistics from exports. Although all products are transported via containerized shipments with different ratios across sectors, the Korea–US FTA is expected to account for more than 50% of newly created containerized cargoes because of Korea's heavy dependence on US agriculture and the high containerization ratio for agricultural products. If agricultural products are excluded, then import growth is likely to have similar impacts on all sectors, and similar impacts on containerized logistics are expected from the implementation of Korea's major FTAs except for the

Table 6. Demand for containerized logistics from export growth through Korea's FTAs (in TEUs).

	Short-run impacts					Long-run impacts				
	USA	EU	ASEAN	India	Subtotal	USA	EU	ASEAN	India	Subtotal
Agriculture	14 451	687	1247	444	16 829	14 433	611	1517	450	17 011
Processed food	15 727	2668	6513	600	25 508	16 383	2753	7042	615	26 794
Beverage and tobacco	149	45	87	36	317	163	48	94	37	342
Textiles and apparel	4908	2721	14 858	578	23 064	5502	3004	16 212	607	25 325
Leather products	388	218	735	19	1361	429	238	842	20	1528
Wood products	484	17	1833	1214	3548	934	97	2149	1283	4463
Energy and natural resources	483	94	1336	1122	3035	485	105	1604	1169	3363
CRP	16 093	24 782	26 445	26 962	94 282	20 996	27 755	31 178	28 295	108 223
Mineral products	0	0	1	0	1	0	0	1	0	1
Iron and steel	−13	5	2479	1702	4172	156	138	3021	1788	5102
Non-ferrous metals	1432	1341	12 899	15 369	31 042	1747	1487	17 278	16 148	36 661
Metal products	76	163	393	312	945	167	229	458	331	1184
Automobiles and parts	618	7556	1977	772	10 923	1313	8244	2155	808	12 521
Other transport equipment	−97	1772	325	2938	4939	165	3455	821	3141	7583
Electronic equipment	244	11 277	190	863	12 575	4348	15 136	3665	1068	24 217
Machinery and equipment	930	2663	1712	4309	9614	2184	3795	2342	4590	12 910
Other manufacturing	250	160	2572	122	3104	367	210	2758	128	3464
Total	56 123	56 169	75 604	57 362	245 258	69 771	67 305	93 137	60 479	290 692

Source: Author's simulation results.

Table 7. Demand for containerized logistics from import growth through Korea's FTAs (in TEUs).

	Short-run impacts					Long-run impacts				
	USA	EU	ASEAN	India	Subtotal	USA	EU	ASEAN	India	Subtotal
Agriculture	257 303	1548	96 856	0	355 706	271 651	1746	95 943	0	369 340
Processed food	6211	24 586	6317	315	37 429	6739	25 620	6810	344	39 513
Beverage and tobacco	143	382	46	0	571	166	452	54	1	672
Textiles and apparel	952	2909	1455	418	5735	1028	3098	1790	465	6379
Leather products	172	1474	601	15	2262	196	1576	729	25	2526
Wood products	−149	1926	2951	3	4732	459	2435	4654	7	7555
Energy and natural resources	30	18	69	85	202	33	20	90	91	235
CRP	37 332	40 796	9994	2314	90 436	45 388	47 110	16 536	2711	111 744
Mineral products	25	62	14	2	103	52	76	56	9	193
Iron and steel	1	21	−2	5	25	24	52	13	10	99
Non-ferrous metals	7254	11 869	1407	563	21 093	10 688	14 281	5541	756	31 265
Metal products	83	168	2	23	276	91	182	12	28	313
Automobiles and parts	992	3263	158	83	4496	1096	3579	202	97	4974
Other transport equipment	336	130	29	0	494	590	162	66	0	819
Electronic equipment	1013	1381	519	3	2917	3807	2013	5310	9	11 140
Machinery and equipment	4982	6733	1215	68	12 998	5798	7473	1635	79	14 986
Other manufacturing	224	277	41	12	553	264	307	63	15	649
Total	316 905	97 542	121 672	3910	540 029	348 071	110 184	139 503	4645	602 403

Source: Author's simulation results.

Table 8. Summary of FTA impacts on seaborne logistics.

	Port cargo (thousand tons)		Containerized cargo (TEUs)	
	Short term	Long term	Short term	Long term
Exports: Korea → FTA partners	15 747	18 158	245 258	290 692
Imports: FTA partners → Korea	66 925	72 658	540 029	602 403
Total	82 672	90 816	785 287	893 095

Source: Author's simulation results.

India–Korea FTA because this FTA is not expected to bring about large increases in containerized shipments based on the small increase in imports from India.

5. Conclusion and policy implications

As the implementation of FTAs affects the macroeconomic and microeconomic elements of the member countries, it will also have a substantial impact on port cargo and containerized cargo with an additional 90 million tons and 893 095 TEUs, respectively, over the long term (Table 8). Import growth is expected to have substantial impacts on both port and conta inerized cargoes, and the demand for seaborne logistics is more likely to increase in the long run than in the short run. The results for impacts on port and containerized cargoes indicate that these FTA are more likely to impact port cargoes than containerized ones.

Although the demand for seaborne logistics is expected to increase sharply, there are large differences in the creation of port logistics across sectors and FTAs. Agricultural and CRP imports are most likely to increase the demand for seaborne logistics. Energy products/natural resources and automobiles/parts are most likely to increase the demand for port cargoes, whereas textiles/apparel, processed food products, and non-ferrous metals, for containerized cargoes.

The results have important implications for the logistics industry, port authorities, and policymakers. First, the impacts of Korea's FTAs are likely to vary according to the sector and the type of international logistics. This indicates that logistics firms should focus on those sectors that are most likely to benefit from the implementation of Korea's FTAs.

Second, in forecasting the demand for port logistics, FTAs should be included as an important independent variable. In addition, the efficiency of port logistics should be improved to better facilitate the effects of FTAs and thus to increase the demand for logistics. Korea port authority should improve the international competitiveness of its ports, considering that of Chinese ports [14] and the development of Asian logistics [15].

Third, the Korean government should continue to promote its FTAs and strengthen its global FTA network as soon as possible. One of the most urgent tasks is to conclude its FTA negotiations with China, which is Korea's largest trading partner, to increase the demand for logistics. An FTA with China is expected to result in a sharp increase in demand for seaborne logistics in Korea.

Finally, future research should provide more accurate estimates of the impacts of Korea's FTAs on exports and imports by employing CGE models reflecting a diverse range of market conditions (e.g. monopolistic competition). If a market is assumed

to be not perfectly competitive in the CGE model, higher impacts tend to be produced. Therefore, this study's simulation results should be interpreted as the minimum estimates of the impacts of Korea's FTAs. In addition, future research should develop more diverse approaches for trade volume–cargo conversion to provide more accurate estimates.

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10. Regarding the structure of the GTAP model, refer to Hertel [16].
11. Information on GTAP database can be found in the webpage of the GTAP, https://www.gtap.agecon.purdue.edu/
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