Graduate School of Asia-Pacific Studies, Waseda University
Journal of the Graduate School of Asia-Pacific Studies
No.43 (2022.3) pp.17-33

Japanese Automobile Industry in the AfJEPA: Economic Impacts of Deep Integration Policy[1]

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AfJEPAにおける日本の自動車産業
― 深い統合政策の経済的影響 ―

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Abstract

This study aims to investigate participation and sectoral interconnections in a hypothetical economic partnership agreement between Japan and African countries. Particularly, the analysis is on (deep) economic integration for the African Continental Free Trade Area-Japan Economic Partnership Agreement (AfJEPA) which not only contributes to participants' (existing) free trade agreement but also enhances their trade in production networks under regulation policies. Estimating this integration with a modified global trade analysis project model by employing the computable general equilibrium, this paper presents real Gross Domestic Product (GDP) and Welfare outcomes under alternative trade policy actions and therefore provides certain policy-oriented findings. Based on the estimated results, there are two main outcomes. First, AfJEPA boosts partners' outputs due to the productivity gains through Non-Tariff Barriers (NTBs) reduction. Specifically, the automobile industry in Japan and the electronics industry in Africa see the largest gains which significantly contribute to their real GDP through regulation policies. Second, gains from tariff reductions are smaller than NTB reductions. Thus, potential growth relies on how deep the (economic) integration policies are.

Key Words : AfJEPA, GDP, Welfare, Value-Added, CGE Modeling
JEL No: C68, D58, F13, F17

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1. Introduction

Regional integration plays an important role in global cooperation (Drysdale & Armstrong 2010, pp.157-173) and Japan and countries in Africa strive to do so, despite the anti-globalization and state-capitalism sentiments. On the one hand, Japan is not only shaping and leading the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) but also promoting the Regional Comprehensive Economic Partnership (RCEP). On the other hand, African countries have started increasing their FTAs and lastly completed the African Continental Free Trade Area (AfCFTA) agreement. As a result, Japan and African countries have been strengthening the links between their economies and with the world economy.

Japanese trade relationship with the US, China, ASEAN, and the EU is already covered by Economic Partnership Agreements (EPAs) through which Japan tries to expand new sources of growth outside of traditional regions. Looking into the future of the Japanese market and its trade with the world, Africa is one of the regions where Japan has not reached its full potential since Japanese trade with aggregated African countries as a group (hereafter Africa) is roughly 4% in its total trade (Biyik 2021, pp.26-27). Most African countries are still listed as the least developed countries. In order for African countries to develop further in the future, they need to accelerate their industrialization and integration into international trade. As an example of the trade flow and interconnection between Japan and Africa, while Africa supplies energy-related products for Japanese market needs, Japan also plays an economically vital role as a high-tech supplier for the African manufacturing market/needs.

Furthermore, backward and forward linkages between Japanese and African economies can enhance Japanese and African outputs by 0.14% and 0.55%, respectively (Biyik 2021, p.28). Thus, to dilate African integration and integrate it more into the global economy, Japan plays a crucial role in helping Africa's economic integration throughout intersectoral connections by acting as a bridge to strengthen the links between Africa and Asia-Pacific. In general, while the EU has been the major partner of African development, Japan has contributed significantly to the development of African countries. In this regard, a partnership between Japan and African countries can meet both objectives of their markets' needs/targets.

This paper proposes (deep) economic integration policies[2] in the African Continental Free Trade Area-Japan Economic Partnership Agreement (AfJEPA as a hypothetical EPA) by using a comparative statics model that can most appropriately capture the Japan-Africa integration (Hertel 1997, pp.3-10). The focus of this study is to investigate to what extend AfJEPA promotes trade of goods and services, investment, and productivity-enhancing efficiency and facilitates trade in production networks between Japan and African countries.

Quantitative Free Trade Agreements (FTAs) studies estimate by employing the Computable General Equilibrium (CGE) model, the most advanced tool for evaluating trade agreements at the regional, national, and broad sector levels. Past literature focuses on the impact of the CPTPP, RCEP, and European Union-Japan Economic Partnership Agreement (EUJEPA) (Grübler et al 2019,

pp.17-25; Ji et al. 2018, pp.177-215). Empirical studies show that non-tariff barriers (NTBs) reduction, compared to tariffs elimination, has a strong impact on income gain because local market regulation can play a crucial process in economic growth from EPAs (Grübler et al 2019, pp.20-25).

Besides, the World Bank (WB) (2020a, pp.41-55) demonstrates that the AfCFTA has obtained significant benefits from a reduction in NTBs and provides many opportunities and potential gains through a degree of openness and an initial level of trade barriers to each country (Abrego et al. 2019, pp.25-27). Precisely, the main contribution is that African markets improve the production of the manufacturing-related sectors in total export (WB 2020a pp.41-55).

The objective of this study is to estimate potential outcomes of the (hypothetical) AfJEPA under capital flow between primarily Japan and countries in Africa by using the GCE model which relies on the Global Trade Analysis Project version 10A Multi-Region Input-Output (GTAP-MRIO) database for the first time. At the same time, few studies consider the model of trade cost, the endogenous structure of capital, and the exogenous trade balance. This paper answers the following pertinent policy questions: Why should Japan consider joining the EPA? Which sectors will benefit the most? And how do deep integration/regulation policies affect each member country's welfare/GDP?

Estimated results indicate that AfJEPA reinvigorates the participants' markets in which the automobile industry in Japan and the electronics industry in Africa, above all, boost value-added, factor output, and export under the (deep) regulation policies. In particular, the trade facilitation and productivity gain, compared to only tariff policy, considerably stimulate this integration, as expressed in the output of welfare/GDP. Thus, building a strategy for potential growth/integration relies on how deep the integration policies are. To conclude, this article extends a principle of open regionalism (more open is better) (Ji et al. 2018, p.204) to participating in regionalism with (deep) regulation policies.

This paper is organized as follows: After the introduction, the second section provides an explanation of the methodology and the GTAP-MRIO data. The third section portrays the framework of the aggregation, tariffs and NTBs, trade facilitation and productivity gain, and policy scenarios. The fourth section displays the empirical results of the AfJEPA. The fifth section discusses and critiques empirical results. The sixth section concludes the paper.

2. Methodology and Data Sources

This study uses the CGE model[3] relying on the GTAP-MRIO Database to present the impact of a designed trade policy, which allows scholars to broadly evaluate the effect of a reducing tariff shock in trade studies (Hertel 1997, pp.3-10). The recent development of the GTAP-MRIO model extends the standard GTAP by distinguishing bilateral trade and trade flow such as introducing agents (end-user as firms, consumers, and investors), by offering the source code and structure of the model written in Corong et al. (2017, pp.1-119) and Carrico et al. (2020, pp.1-14). Therefore, the CGE model, in which Armington, Krugman, and Melitz approaches are embedded in the GTAP framework (Akgul, Villoria, & Hertel 2016, pp.111-180), is the appropriate approach employed to

estimate the effect of AfJEPA on Japanese and African markets.

This paper modified closure under alternative long-run closure rules, such as capital accumulation and (perfect) capital mobility following Walmsley (1998, pp.1-52) and Francois et al., (1996, pp.1-19). By allowing capital shocks to propagate across regions over time, the effect calculated in this model is a cumulative long-term effect. Particularly, the capital flow to members of (i) Mega Regional Free Trade Agreements (MRFTAs) (Japan and all selected FTAs such as RCEP and AfJEPA) and (ii) AfJEPA (Japan and countries in Africa) is separately examined. Since the AfJEPA is a hypothetical EPA, the integration is explained by implementing the comparative static model with minimizing unnecessary distortion. That is, this study considers the contribution of economic impacts of various EPA scenarios relying on the quantitative comparison of economic impacts of different technical measurements which provide/demonstrate the most possible outcomes.

The GTAP database provides available data for African countries (see Table A1). Data sources representing trade flows (value and tons) are extracted from International Trade Center (ITC)-TradeMAp regarding each party's importer. For example, monetary units are presented at the 8-digits level of the Harmonized System (HS) and the tons at the 6-digits level of the HS to estimate quotas for goods of a sensitive nature. Tariffs are calculated using commercial weighted averages for 8-digit tariff lines adherent of each 6-digit group. Lastly, the Ad-Valorem Equivalent (AVE) as a percentage corresponds to the Most Favored Nation (MFN) tariff that is consulted at the 6-digits level of the HS in ITC-MAcMap (Carrico et al. 2020, pp.1-14). The information in HS codes is converted to the sectors in the GTAP database (Aguiar et al. 2019, pp.1-27). The GTAP-MRIO database, which was launched in 2020 and accounts for 65 sectors in each of the 141 countries/regions, relies on the linkage model by implementing the GTAP 10A with the 2014 base year (Carrico et al. 2020, pp.1-14).

3. The Architecture of Policy Simulation Scenarios

3.1 Regional and Sectoral Aggregation

First of all, to examine economic integration of the Japanese and African economies, their existing MRFTAs should be taken into account. ASEAN-Japan Comprehensive Economic Partnership Agreement (AJCEPA) took effect in 2008. Mega FTAs such as CPTPP and EUJEPA came into force in 2018, and 2019, respectively. Lastly, RCEP (excluding India) was finally signed in November 2020 and entered into force on 1 January 2022. Likewise, there are multiple Regional Economic Communities (RECs) in Africa. For example, the common market for Eastern and Southern Africa and the East African community came into force in December 1994 and July 2000, respectively. African countries signed the AfCFTA agreement that came into effect on 1 January 2021, to achieve deep economic integration, liberal intra-African trade, and more importantly, continental customs union membership in RECs. Regional and sectoral aggregations, which stand for 12 regions (countries) and 18 sectors (see Table A1; A2), rely on the Japanese and African MRFTAs.

3.2 Tariffs and Nontariff Barriers

The trade volume and tariff rate between Japan and the average of aggregated African countries was calculated based on the 2014 base year (see Table 1). Overall, the African import tariff level is higher than the Japanese ones. Africa heavily protects its manufacturing industries, for which average tariffs are close to 8%. Conversely, Japanese tariffs on the manufacturing industries are around 1% while Japanese tariffs on agriculture, processed food, and textile industries are comparatively higher than other industries of Japan (see Table 1). Nonetheless, the impact of trade-in service is difficult to capture by tariff levels, but it is instead affected by behind-the-border regulations and technical measurements.

Moreover, Technical Barrier to Trade (TBT) and Sanitary and Phytosanitary (SPS) standards, known as NTBs[4] (UNCTAD & WB 2018, pp.2-5), simulate growing concerns on health and quantity and environmental attributes (Herghelegiu 2018, pp.266-285). Implementing NTBs in GTAP, this paper first translated NTBs to AVE to be incorporated into the tariffs and export taxes by using the Cobb-Douglas model[5]. This process modified the original database to minimize disturbances among countries. It is assumed that GDP gain from NTBs reduction relies on (assuming) a 50% of NTBs reduction with a 50% Spillover Effect (SE). This is due to the reduction of the cost of compliance

Table 1: Trade Flow, AVE Tax Rate, and Self-Sufficiency Ratio

	Bilateral Trade Flow of Japan and Africa				**Sectoral Self-Sufficiency**	
	Japanese Export to Africa		*African export to Japan*		**Japan**	**Africa**
	Tariff (%)	*Value ($)*	*Tariff (%)*	*Value ($)*		
Agriculture	3.9	$ 7	2.1	$ 697	0.765	0.995
Fossilfuels	0.1	$ 0	0	**$ 9,003**	0.010	**3.380**
Minerals	0.4	$ 2	0	$ 1,210	0.215	**1.690**
ProcFood	4.7	$ 79	6.3	$ 538	0.850	0.885
WoodPro	6.9	$ 25	0.1	$ 227	0.909	0.819
TextWapp	7.1	$ 273	7.3	$ 159	0.463	0.765
EnergyIPro	6	$ 1,045	0.2	**$ 3,452**	1.060	1.060
PetCoal	6.3	$ 235	0.7	$ 954	0.927	0.663
CheRuPla	8.3	$ 1,018	0.1	$ 255	1.090	0.661
Manufactures	7.4	$ 271	0.2	$ 31	0.971	0.709
Electronic	6	$ 953	0	$ 32	**1.130**	0.473
Automobile	13.3	**$ 9,340**	0	$ 723	**1.430**	0.496
Construct	0	**$ 1,275**	0	$ 180	1.000	0.978
TradeServic	0	$ 540	0	$ 429	1.000	0.995
TransComm	0	$ 488	0	$ 1,426	1.030	1.060
FinanServ	0	$ 71	0	$ 64	0.983	0.982
BusiServ	0	$ 1,015	0	$ 714	0.976	0.888
PublicServ	0	$ 391	0	$ 407	0.996	0.991

Source: GTAP 10A, author's calculations.

with foreign standards and regulations (Hummels and Schaur 2013, pp.2935-2959; WB 2020a, pp.31-38). Estimating the quantification of NTBs from the Word Integrated Trade Solution (WITS) relies on Kee, Nicita, and Olarreaga's (2009, pp.172-199) study. Moreover, service sectors in NTBs are documented by Jafari and Tarr (2017, pp.544-571).

Regarding sectoral self-sufficiency which presents a domestic share in total use, the electronic and automobile industries in Japan are highly self-sufficient sectors to export. However, the Japanese market heavily depends on the import of energy resources and agricultural goods. The African market on the aggregated level shows a highly self-sufficient economy to export in fossil fuels and minerals sectors but needs to meet mainly foreign manufacturing parts and components due to the low self-sufficient rate (see Table 1). As a result, Japanese industries import energy resources from the African economy whose industries import more motor vehicles and transport equipment from Japan (see Table 1). In other words, while Africa as a group supplies energy-related products for Japanese needs, Japan plays an important role as a high-tech supplier for the African market needs.

3.3 Trade Facilitation and Productivity Gain

Trade facilitation interacts with the cost of time delay at the border. FTA partners aim to improve reciprocal trade facilitation provisions that lead to the smooth flow of commercial goods. This represents advanced ruling such as defining a harmonized standard, tariff classification, valuation criteria, and rules of origin. ADB and UNESCAP (2013, pp.15-28) show that the trade facilitation measurement has a positive impact on enhancing trade performance and competitiveness, FDI, and GDP. Thus, it is assumed that implementing the WTO's Trade Facilitation Agreement (TFA) under EPAs has the benefit of average trade cost reduction of 0.9% for imports and 1.2% for export relying on Hillberry and Zhang (2018, pp.452-466) study, roughly 7% for AfCFTA regarding WB (2020a, pp.97-105).

In addition, WB (2020b, pp.1-58) reports that multinational firms relocating their productions such as designing, producing, and assembling parts and components due to the most cost-effective location can/should exchange knowledge when their products meet border restrictions. Empirical studies show that international trade stimulates the cross-border flow of technology (Nabeshima et al. 2018, pp.1058-1061) because knowledge is embodied in goods (Coe et al. 1997, pp.134-149); thus, a country importing commodities and receiving FDI is directly influenced by technology depending on its absorption capacity and its structural similarity (Halpern et al. 2015, pp.3660-3703; Keller 2010, pp.793-829). Therefore, FTAs not only enhance productivity through technology-intensive intermediate and capital goods and but also increase the quality and variety of intermediate inputs available to domestic producers (Amiti & Khandelwal 2013, pp.476-490). It is assumed that the productivity improvement/gain (PI) has the benefit of reducing an average of up to 0.2% of input cost in trade commodities due to the degree of knowledge regarding the percentage of export and import in total bilateral trade, increasing productivity (Ahn et al. 2019, pp.130-154) in the three sectors: manufacturing, automobile, and electronics.

3.4 Scenarios

In general, these scenarios, as defined above, are the standard set of scenarios for assessing the economic impacts of hypothetical EPA. To summarize all of these policies estimations of the overall impact of the EPA on the Japanese and African economies, the simulations are divided into (1) tariffs and quotas reduction, (2) non-tariff measures reduction, (3) TFA, and (4) PI (see Table 2), as explained above. These assumptions used in this study are in line with previous studies on tariff elimination performance of CPTPP, RCEP, and AfCFTA (Petri & Plummer 2016, pp7-9; WB 2020a, pp.31-38). Specifically, to capture the reality of the selected FTAs and to evaluate the quantitative impacts of selected FTAs compiled by the International Trade Centre, series of trade-related shocks are implemented: (1) up to full tariff elimination; (2) 50% of reduction in NTBs with 50% of a SE to third countries; (3) up to 7% of reduction of time in customs due to the TFA and up to 0.2% of the PI (see Table 2).

Table 2: Summary of Simulation Assumptions

Regional Integration		**MRFTAs**	**Removal of Tariffs and NTBs on Selected FTAs/EPAs**		**FTAs Impact in Long-Run**	
			Tariff Reduction	***SE***	***TFA***	***PI***
Base Elimination	*Asia-Pacific Integration*	AJCEPA	Up to full removal of import tariff and export subsidies	No	1%	–
		CPTPP				
		RCEP				
	Japan-EU Integration	EUJEPA				
	African Integration	AfCFTA	97% of import tariff and export subsidies	No	3.5%	–
Paper Focus	*Japan-Africa Integration*	AfJEPA in NTBs	50% of import tariff and export subsidies in NTBs	Yes	2.1% in AfJEPA, 7% in AfCFTA	0.2% for there-sector[a]
		AfJEPA	94% by Japan, 94% by African	No	1% in AfJEPA, 3.5% in AfCFTA	0.1% for there-sector

Note: [a] : The three sectors are manufacturing, automobile, and electronics.
Source : Author's assumptions.

Essentially, these scenarios for AfJEPA help to investigate how Japan reinvigorates trade in a production network with African countries under existing MRFTAs. In this regard, tariff levels of existing MRFTAs of Japan and African countries are first eliminated. Thereafter, import tariffs and export subsidies for AfJEPA in NTBs and trade liberalization are removed.

Scenario of the base condition*: I applied up to full removal of tariff and subsidies and 1% TFA (%3.5 in AfCFTA) for AJCEPA, CPTPP, RCEP, EUJEPA, and AfJEPA.*

Scenario 1*: I applied the removal of 50% of import tariff and export subsidies in NTBs, 2.5% SE, 2.1% TFA (%7 in AfCFTA), and 0.2% PI in three-sector for AfJEPA.*

Scenario 2*: I applied removal of 94% of import tariff and export subsidies in trade liberalization, 1% TFA (%3.5 in AfCFTA), and 0.1% PI in three-sector for AfJEPA.*

4. Result of the CGE Estimations

In the policy experiment and simulation design, the AfJEPA in NTBs and trade liberalization through standard (SC) and long-rung closure (L-RC) change is first analyzed. Second, the long-term macroenvironment, referring to a sufficiently long period for capital to move from one country to another, is investigated by mobilizing capital movement across regions. Overall, this study focuses on (deep) economic integration as a form of allowing capital flow between Japan and countries in Africa and contribution of AfJEPA to Japan and countries in Africa under their existing EPAs/FTAs, presenting the percent change in equivalent variation (EV), defined as utility representative regional household, and real GDP[6].

4.1 GDP and Welfare impacts of the AfJEPA

A reduction in tariff level leads to reducing the price of imports and benefiting customers of final (household) and intermediate (firms) goods; hence, trade liberalization or reduction in NTBs deliver gains for partner countries. While there are countries with a higher level of MFN border protection and trade-to-GDP ratio that gain more, imposing a low level of prevailing MFN tariff rates has modest benefits through EPA. Typically, a small country with a high trade-to-GDP ratio sees a high percent growth, as explained profit distribution of African countries in WB (2020a, pp.32-78).

Table 3 shows the results of the reduction in NTBs and tariff reduction separately. The results of the empirical analysis show that long-run closure compared to standard closure enhances partners' output by more than twice the growth of real GDP and welfare. In terms of trade regulation effect, reduction in NTBs vs trade liberalization under capital movement significantly boosts real GDP and welfare. Regarding capital movement, different capital flows such as MRFTAs and AfJEPA in NTBs have a stronger (positive) impact on real GDP than this effect on trade liberalization concerning Japan and countries in Africa through Armington CES. However, the capital flow of AfJEPA compared to MRFTAs harms non-members of AfJEPA countries such as China and the US. Lastly, the TFA and PI compared to tariff removals have a substantial increase in real GDP and welfare (see Table 3).

Since Japanese and African economic structures differ in relation to their sectors' input cost of land and labor, what is estimated separately is only tariffs, tariffs with TFA, and tariffs with PI effect. To recapitulate the finding of the different experiments, whereas the tariffs with PI have a comparatively higher impact on African real GDP and welfare than tariffs with TFA, Japan gains more benefit from tariffs with PI than tariffs with TFA (see Table 3). This is because technological change directly increases the amount of production, but tariff elimination affects saving and allocative effects. In detail, tariff elimination under capital movement gains relies on mainly the term of trade effect in Japan and capital effect in Africa (see Table 4).

To summarize the key points here, NTBs stimulate economic and social welfare such as better health (SPS and TBT), quality of environment (SPS), and advantage FDI policy (e.g., productivity enhancement, innovation, and intellectual property rights). In the detail of the results, African markets get a higher total welfare change because the contribution of capital and the allocation

Table 3: NTBs and Trade Liberalization Impact on Real GDP and Welfare (%) by AfJEPA

NTBs (Scenario 1)										
	Standard Closure *Real GDP*	***Long-Run Closure***								
		MRFTAs *Real GDP*	AfJEPA (Capital movement between Japan and countries in Africa)							
			Real GDP (%)				*Welfare* (%)			
	Total	*Total*	*Total*	*Tariffs only*	*Tariffs with TFA*	*Tariffs with PI*	*Total*	*Tariffs only*	*Tariffs with TFA*	*Tariffs with PI*
Japan	**0.0927**	**0.2**	**0.1965**	***0.0084***	***0.0382***	***0.1666***	**0.1574**	***0.0304***	***0.0564***	***0.1314***
Africa	**0.4143**	**1.1134**	**1.1067**	***0.0598***	***1.0357***	***0.1308***	**0.8083**	***0.0469***	***0.7609***	***0.0943***
Korea	0.0019	0.0339	0.0017	0.0032	0.0017	0.0032	0.0155	−0.0082	0.0073	−0.0001
China	0.001	0.0231	−0.0006	0.0021	−0.0008	0.0024	0.0207	−0.0012	0.0112	0.0083
USA	0.0002	0.0062	−0.0001	0.0002	−0.0002	0.0003	0.0048	−0.0043	0.0009	−0.0004
India	−0.0001	0.0488	−0.0006	0.0004	−0.0005	0.0003	0.007	−0.0252	0.0018	−0.02
EU	0.0011	0.0247	0.0029	0.0012	0.0026	0.0015	0.0251	0.0008	0.0206	0.0053
Trade Liberalization (Scenario 2)										
	SC	*L − RC*								
Japan	**0.0399**	**0.1316**	**0.1316**	***0.0134***	***0.0332***	***0.1118***	**0.0863**	***0.0012***	***0.0244***	***0.0631***
Africa	**0.2007**	**0.5291**	**0.5308**	***0.067***	***0.4985***	***0.0993***	**0.5658**	***0.0342***	***0.5333***	***0.0667***
Korea	−0.0023	0.0109	0.0036	0.0004	0.0029	0.0012	−0.0105	−0.0011	−0.0075	−0.004
China	−0.0039	0.0105	0.0021	0.0002	0.0012	0.0011	−0.0092	−0.0021	−0.0091	−0.002
USA	−0.0002	0.0009	0.0002	0	0.0001	0.0001	−0.0013	−0.0003	−0.0014	−0.0003
India	−0.005	−0.0026	−0.0001	0.0004	−0.0008	0.0011	−0.0145	−0.0015	−0.0143	−0.002
EU	−0.0027	0.0188	0.0006	0	0.0003	0.0003	−0.007	−0.0009	−0.0065	−0.001

Note: Standard closure references to standard GTAP model (RORDELTA=1).
Source: GTAP 10A MRIO Database, author's estimation.

Table 4: Source of Income Gaining from the AfJEPA with Capital Movement (US$ millions)

	Tariffs only		***Tariffs with TFA***		***Tariffs with PI***	
	Japan	Africa	Japan	Africa	Japan	Africa
Allocation Eff	−$ 215	$ 131	−$ 32	$ 839	−$ 18	$ 251
Capital Effect	−$ 815	$ 1,291	−$ 313	$ 5,886	−$ 96	$ 1,718
Technical Change	$ 0	$ 0	$ 210	$ 5,684	$ 1,583	$ 285
Term of Trade	$ 942	−$ 248	$ 994	$ 1,256	$ 844	−$ 206
I − S Effect	$ 137	−$ 324	$ 110	$ 37	$ 194	−$ 366

Source: GTAP 10A MRIO Database, author's estimation.

effect is positive. Conversely, capital and allocation effect under only tariff elimination harms the Japanese market since this negative effect causes to factor movement into the distorted sectors. In other words, the Japanese tax revenues under the tariff elimination decrease in production, factor, input, and income, which adversely create a negative allocation effect in Japan.

4.2 Effect on Sectoral and Factor Outcome

Table 5 shows AfJEPA's contribution to value-added in the Japanese and African markets. Value-added in these countries increases due to the positive impact of capital, allocative, and technological improvements on factories (see Table 4). These improvements more significantly drive up the automobiles in Japan and electronics in Africa (see Table 5). This is because the assumption of different distributions regarding iceberg cost and productivity gain directly amplifies productivity impact by reducing the cost of (importer) rents and subsequently boosts value-added growth (Strutt & Walmsley 2021, pp.1-30).

Table 5: Value－Added in Japan and Africa (%) by the AfJEPA

	Africa				Japan			
	Total	***Tariffs only***	***Tariffs with TFA***	***Tariffs with PI***	***Total***	***Tariffs only***	***Tariffs with TFA***	***Tariffs with PI***
TextWapp	0.8858	0.0223	0.8627	0.0454	0.2072	0.2245	0.2458	0.186
EnergyIPro	1.5804	0.1014	1.5415	0.1403	0.2735	0.1769	0.1528	0.2976
PetCoal	***1.9346***	0.0742	1.9093	0.0996	0.1163	0.0375	0.0696	0.0842
CheRuPla	***2.1549***	−0.0027	2.1172	0.0349	0.2112	0.1368	0.1468	0.2012
Manufacturing	***1.062***	***0.155***	***0.9501***	0.2669	−0.0228	−0.0771	−0.069	−0.0309
Electronics	***3.603***	***0.1346***	***3.25***	***0.4876***	0.5147	0.0292	0.0052	0.5387
Automobile	1.2757	−0.4847	1.0605	−0.2695	***0.978***	***0.5899***	***0.635***	***0.9329***

Source: GTAP 10A MRIO Database, author's estimation.

As for import and export industrial production/consumption performance, the Japanese and African industrial export share of total production increases due to the decreased trade-related input cost and increased trade flow of commercial goods. Japanese electronics, manufacturing, and automobile sectors take the lead, increasing by 0.3%, 0.8%, and 1.0%, respectively (see Table 6). The results of increased exports drive energy-intensive production in Japan to demand more imported products due to limited Japanese energy resources (see Table 1); however, the electronics, manufacturing, and automobile sectors comparatively consume less import-related goods under tariffs with PI effect (see Table 6).

Moreover, the African export share of total production rises considerably in the electronics, manufacturing, and automobile sectors, increasing by 8.8%, 9.2%, and 9.0%, respectively, through tariffs with TFA (see Table 6). Because of increased export volume, the textile and chemical industries demand more import-related goods; in contrast, the manufacturing and electronics industries in Africa reduce the consumption of import goods (see Table 6).

Lastly, to portray this integration distribution to factor output, Table 7 provides the real return to factors of production through AfJEPA. In general, mobile factors (labor within a country and capital among countries) increase; for example, on the one hand, high-skilled workers and capital in the African electronic sector increase through the tariffs with TFA, and on the other hand, low-skilled

Table 6: Trade Dependence of Industrial Production and Consumption Change (%)

	Export Share of Industrial Production[a]						Import Share of Industrial Consumption[b]					
	Africa			Japan			Africa			Japan		
	Tariffs only	*Tariff with TFA*	*Tariff with PI*	*Tariffs only*	*Tariff with TFA*	*Tariff with PI*	*Tariffs only*	*Tariff with TFA*	*Tariff with PI*	*Tariffs only*	*Tariff with TFA*	*Tariff with PI*
TextWapp	0.067	4.682	0.053	0.353	0.384	0.29	0.07	**1.148**	0.071	0.017	0.019	0.018
EnergyIPro	−0.035	2.658	−0.027	0.138	0.169	0	0.177	0.472	0.173	0.134	0.278	0.234
PetCoal	0.016	4.302	0.008	0.185	0.307	0.14	0.03	−0.418	0.03	0.039	−0.032	0.022
CheRuPla	0.023	6.93	0.013	0.085	0.079	−0.013	0.077	0.697	0.079	0.091	0.078	0.129
Manufacturing	−0.046	***9.173***	0.371	0.296	0.29	***0.787***	0.205	0.311	−0.032	−0.194	−0.18	−0.668
Electronics	−0.008	***8.796***	0.333	0.075	0.058	0.3	0.241	−0.189	0.084	−0.091	−0.093	−0.363
Automobile	0.409	***8.966***	0.735	***0.615***	***0.645***	***1.007***	0.677	0.081	0.511	0.045	0.096	−0.52

Note: [a]: I calculated by total export percent (including FOB) change minus total output percent change.
[b]: I calculated by total import percent (including CIF) change minus private consumption percent change.
Source: GTAP 10A MRIO Database, author's estimation.

Table 7: Impact on Japanese and African real wages/returns of AfJEPA (%)

	African Market							
	Total		*Tariffs only*		*Tariffs with TFA*		*Tariffs with PI*	
	Electronic	*Auto.*	*Electronic*	*Auto.*	*Electronic*	*Auto.*	*Electronic*	*Auto.*
Land	1.0177	−0.0174	*−0.0102*	*−0.286*	0.8954	−0.0788	0.1121	−0.225
Technicians and associate professionals	2.9249	0.5568	0.0539	−0.5722	2.6135	0.3856	0.3653	−0.401
Clerks	**2.9601**	0.5912	0.0543	−0.5719	2.6475	0.4189	0.3669	−0.4
Service and shop workers	***2.9468***	0.5782	0.061	−0.5652	2.6357	0.4074	0.3721	−0.394
Office Managers and professionals	***2.9494***	0.5807	0.0525	−0.5737	2.6373	0.409	0.3645	−0.402
Agricultural and low skilled workers	2.928	0.5599	−0.0039	−0.6293	2.6157	0.3878	0.3085	−0.457
Capital	**4.0809**	1.6862	0.2113	−0.4204	**3.6986**	**1.4457**	0.5935	−0.18
	Japanese Market							
Land	0.2075	0.4103	0.0276	0.275	0.0409	0.3185	0.1943	0.3668
Technicians and associate professionals	0.4513	***0.9112***	0.0209	0.5814	−0.0142	0.6148	0.4863	0.8778
Clerks	0.4622	***0.9222***	0.0255	0.5861	−0.0081	0.6209	0.4959	0.8874
Service and shop workers	0.4401	0.9	0.0148	0.5753	−0.0214	0.6076	0.4763	0.8677
Office Managers and professionals	0.4013	0.861	−0.0032	0.5571	−0.0404	0.5883	0.4385	0.8298
Agricultural and low skilled workers	*0.4725*	**0.9326**	0.0424	0.6031	0.0068	**0.6359**	0.5081	**0.8997**
Capital	0.593	**1.0536**	0.0291	0.5901	0.0205	**0.65**	0.6016	**0.9937**

Source: GTAP 10A MRIO Database, author's estimation.

workers and capital in the Japanese automobile sector increase through the tariffs with PI (see Table 7).

To conclude, predicted results show that Japan and Africa increase their production in total export under the deeply regulated policies. Africa demands high-skilled workers because of the access to capital and high-tech from Japan; likewise, Japanese industries reinvigorate capital and agriculture

and demand more low-skilled workers due to the type of imported parts and components from countries in Africa.

5. Policy Discussion

In general, reducing tariff levels leads to comparatively cheaper input, which constitutes the competitiveness of local goods. Therefore, AfJEPA has a positive impact on partners' outcomes (see Table 3; 5) due to the (positive) impact of capital, allocative, and technological improvements on factors (see Table 4; 7) that boost partners' sectoral output (see Table 8). In the same line with the literature regarding FTAs analysis, this paper also documents that RCEP emcees more efficient outcomes and has a higher economic benefit impact than other MRFTAs due to the number of countries and comparatively (higher) tariff rate elimination (see Table 8). In other words, RCEP has a strong influence over others because of the number of members in an FTA and the distribution of Japanese trade in production networks with East Asia.

Table 8: Industrial Output by the MRFTAs

	Japanese Market					African Market	
	AJCEPA	***CPTPP***	***EUJEPA***	***RCEP***	***AfJEPA***	***AfCFTA***	***AfJEPA***
TextWapp	0.887	0.443	0.171	−0.107	0.212	1.134	1.335
EnergyIPro	0.785	0.566	0.193	2.389	0.208	1.731	1.986
PetCoal	0.264	0.256	0.155	1.284	0.101	3.024	3.307
CheRuPla	0.600	0.224	0.495	3.462	0.224	3.302	3.448
Manufacturing	0.373	0.069	0.036	0.650	−0.051	0.909	1.079
Electronics	0.321	−0.035	0.588	2.649	0.075	**4.708**	**4.918**
Automobile	**0.839**	**1.047**	**0.727**	**4.295**	**0.802**	2.447	2.036

Source: GTAP 10A MRIO Data Base, author's calculations.

Adding a new EPA to Japanese MRFTAs has a comparatively small impact on Japanese output due to the regional and sectoral integration through export/import percent, yet it contributes a positive impact on Japanese (industrial) output (see Table 3; 8). The auto industry sees the greatest growth among any other industry (see Table 8). This is because the automobile in Japan is the dominant sector for exports and thereby has the (multi-connected) firms-linkages within Japan as well as across countries. Moreover, this effect also applies to the African market, in which the positive output comes from energy-related and electronics industries (see Table 8) due to sectoral linkages and export competitive advantages. Overall, on the one hand, the AfJEPA constitutes a strategy for growth for Japan suffering from long-term economic stagnation and allows Japan to integrate the effect of growth outside of traditional networks. On the other hand, Africa enhances its economic development strategy and accelerates its industrialization by learning from Japanese MRFTAs' experiments and accessing the Japanese high-tech market and capital.

The final point to stress is that the pathway of expanded MRFTAs under regulatory policies such as standardization and internalization leads to participation in mergers with other MRFTAs. This means that a (regulated) EPA, which complements each other, is the key stepstone of establishing a framework for global economic cooperation.

6. Conclusion

This study investigates (deep) economic participation of Japan and African countries in AfJEPA. The methodology employed is the CGE model integrated with the GTAP MRIO database. This research examines the AfJEPA through comparative statics under several EPAs scenarios relying on different technical measurements.

Stated briefly, a roadmap of trade (regulation) policies is created for AfJEPA to establish (deep) economic integration. First, in line with previous studies, this study finds that the AfJEPA provides a sustainable growth strategy for member countries under regulation policies. The Japanese automobile sector sees large gains which thereafter significantly contribute to the Japanese real GDP. Similarly, the electronics industry in Africa sees high growth through sectoral linkages with Japanese high-tech suppliers. Second, compared to only tariff policy, the EPA-related trade facilitation and productivity gains lead to large gains. Overall, this paper supports the (deep) regulation policies in FTA because the results prove that deeper economic integration policies create greater gains

Nevertheless, this paper faced the difficulty of addressing (i) ownership of capital movement correlated with welfare change and (ii) productivity shock-related real trade volume change. Therefore, further studies should consider separately examining the EPA integrated exporter and importer cost in NTBs. Moreover, the unemployment (closure) for the African market, which is not implemented in our model due to the capital flow (closure), should be taken into account.

（Received 19th October, 2021）
（Accepted 2nd February, 2022）

Endnotes

[1] Author wishes to thank to Dr. Corong, E. and Dr. Marksym, G. for their diligent assistance and suggestions in terms of modified long-run GTAP closure used in this paper. I am also grateful for feedback and suggestions from Dr. Nabeshima, K., Dr. Saito, K., Dr. Hosoe, N., and Dr. Itakura, K. and from participations at the 24th Annual Conference on Global Economic Analysis. Lastly, I very much appreciate for the detailed feedback and suggestions provided by anonymous reviewers from the journal.

[2] A (deep) economic integration, referring to strong trade relationships in production networks under regulation policies (e.g., common standards agreements and mutual recognition of different standards under NTBs), leads to a decrease in firm average costs and then boosts the country's value-added (Kowalski et al. 2015, p.31) due to the productivity-enhancing effect (Ahn et al. 2019, pp.130-154).

[3] See more information for the CGE model: https://www.gtap.agecon.purdue.edu/models/default.asp.

[4] Non-technical measures account for (D-P) quotas, price controls, non-automatic licensing, intellectual property, and rules of origin being to reduce or eliminate among them. Technical measures correspond (A-C) SPS, and TBT related to the protection of human, animal, plant and environmental health which cannot be eliminated by fulfilling a specific function but can instead converge to a common regulation that reduces the costs and time of these measures (UNCTAD & WB, 2018, p.3).

[5] The calculation is done through the Altertax procedure (Malcolm 1998, pp.1-14). However, trade liberalization method relies on Armington CES.

[6] I calculated real GDP growth-focused variables with "*rorc (r) closure*" and welfare gain-related variables with "*expand (e, r) closure*" due to their own different condition (Francois et al. 1996, pp.1-19; Walmsley 1998, pp.1-52).

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Appendix

Table A1: Regional Aggregation

Region		GTAP concordance
Japan (JPN)		Japan (JPN)
Korea (KOR)		Republic of Korea (KOR)
China (CHN)		China (CHN)
United States (USA)		United States of America (USA)
India (IND)		India (IND)
ANZ		Australia (AUS), New Zealand (NZL)
ASEAN6		Cambodia (KHM), Indonesia (IDN), Lao PDR (LAO), Philippines (PHL), Thailand (THA), rest of Southeast Asia-Myanmar (XSE)
ASEAN4		Malaysia (MYS), Singapore (SGP), Brunei Darussalam (BRN), Vietnam (VNM)
CMCP		Canada (CAN), Mexico (MEX), Chile (CHL), Peru (PER)
The European Union (EU)		Austria (AUT), Belgium (BEL), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), Ireland (IRL), Italy (ITA), Latvia (LVA), Lithuania (LTU), Luxembourg (LUX), Malta (MLT), Netherlands (NLD), Poland (POL), Portugal (PRT), Slovakia (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Bulgaria (BGR), Croatia (HRV), Romania (ROU)
African Continental Free Trade Area (AfCFTA) Countries	***Northern Africa***	Egypt, Arab Rep. (EGY), Morocco (MAR), Tunisia (TUN), Rest of North Africa (XNF)
	Central African	Cameroon (CMR), Central Africa (XCF), Congo, Dem. Rep. (COD=XAC)
	Southern Africa	Botswana (BWA), Namibia (NAM), South Africa (ZAF), Rest of South African Customs Union (XSC)
	East African	Ethiopia (ETH), Kenya (KEN), Madagascar (MDG), Malawi (MWI), Mauritius (MUS), Mozambique (MOZ), Rwanda (RWA), Tanzania (TZA), Uganda (UGA), Zambia (ZMB), Zimbabwe (ZWE), Rest of East Africa (XEC)
	Western Africa	Burkina Faso (BFA), Côte d'Ivoire (CIV), Ghana (GHA), Benin (BEN), Guinea (GIN), Nigeria (NGA), Senegal (SEN), Togo (TGO), Rest of West Africa (XWF)
Rest of World (ROW)		Hong Kong, SAR, China (HKG), Mongolia (MNG), Taiwan, China (TWN), rest of East Asia (XEA), United Kingdom (GBR), Switzerland (CHE), Norway (NOR), rest of EFTA (XEF), rest of Oceania (XOC), Bangladesh (BGD), Nepal (NPL), Pakistan (PAK), Sri Lanka (LKA), rest of South Asia (XSA), rest of North America (XNA), Argentina (ARG), Bolivia (BOL), Brazil (BRA), Colombia (COL), Ecuador (ECU), Paraguay (PRY), Uruguay (URY), Venezuela (VEN), rest of South America (XSM), Costa Rica (CRI), Guatemala (GTM), Honduras (HND), Nicaragua (NIC), Panama (PAN), El Salvador (SLV), rest of Central America (XCA), Dominican Republic (DOM), Jamaica (JAM), Puerto Rico (PRI), Trinidad and Tobago (TTO), rest of Caribbean (XCB), Albania (ALB), Belarus (BLR), Russian Federation (RUS), Ukraine (UKR), rest of East Europe (XEE), rest of Europe (XER), Kazakhstan (KAZ), Kyrgyzstan (KGZ), Tajikistan (TJK), rest of former Soviet Union (XSU), Armenia (ARM), Azerbaijan (AZE), Georgia (GEO), Bahrain (BHR), Iran, Islamic Rep. (IRN), Israel (ISR), Jordan (JOR), Kuwait (KWT), Oman (OMN), Qatar (QAT), Saudi Arabia (SAU), Turkey (TUR), United Arab Emirates (ARE), rest of Western Asia (XWS), rest of the world (XTW)

Note: [a] See more information: https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=10.131 for the GTAP countries and regions.

[b] In the current GTAP Database, Myanmar and Timor-Leste are bundled in 'Rest of Southeast Asia (xse)'. This study used 'xse' to represent Myanmar. Likewise, South centrical Africa (XAC) represents Congo.

Source: Author's aggregation based on GTAP 10A MRIO Database.

Table A2: Sectoral Aggregation

Sector name	GTAP concordance
Agriculture (AGR)	Paddy rice (PDR); wheat (WHT); cereal grains, NEC (GRO); vegetables, fruit, nuts (V_F); oilseeds (OSD); sugar cane, sugar beet (C_B); plant-based fibers (PFB); crops, NEC (OCR); bovine cattle, sheep and goats, horses (CTL); animal products, NEC (OAP); raw milk (RMK); wool, silkworm cocoons (WOL); forestry (FRS)
Fossil fuels (FFL)	Coal (COA); oil (OIL); gas (GAS), gas manufacture, distribution (GDT)
Minerals, NES (OXT)	Other extraction (formerly other manufacturing (omn) minerals, NEC) (OXT)
Processed foods (PFD)	Fish (FSH); bovine meat products (CMT); meat products, NEC (OMT); vegetable oils and fats (VOL); dairy products (MIL); processed rice (PCR); sugar (SGR); food products, NEC (OFD); beverages and tobacco products (B_T)
Wood and paper products (WPP)	Wood products (LUM); paper products, publishing (PPP)
Textiles and wearing apparel (TWP)	Textiles (TEX); wearing apparel (WAP); leather products (LEA)
Energy-intensive manufacturing (KE5)	Mineral products, NEC (NMM); ferrous metals (I_S); metals, NEC (NFM)
Petroleum and coal products (P_C)	Petroleum, coal products (P_C)
Chemical, rubber, and plastic products (CRP)	Chemical products (CHM); basic pharmaceutical products (BPH); rubber and plastic products (RPP)
Manufactures, NES (XMN)	Metal products (FMP); manufactures, NEC (OMF)
Electronics (XELE)	Computer, electronic, and optical products (ELE); electrical equipment (EEQ)
Motor vehicles and Machinery (XMVH)	Motor vehicles and parts (MVH); transport equipment nec (OTN); machinery and equipment nec (OMG)
Construction (CNS)	Construction (CNS)
Trade services (TRD)	Trade (TRD); accommodation, food, and service activities (AFS); warehousing and support activities (WHS)
Transport and Communication Service (TPCS)	Transport, NEC (OTP); communication (CMN); water transport (WTP); air transport (ATP)
Financial services, NEC (OFI)	Financial services, NEC (OFI)
Business services (XBS)	Real estate activities (RSA); business services, NEC (OBS); insurance (formerly ISR) (INS)
Public services (XSV)	Electricity (ELY); water (WTR); recreational and other services (ROS); public administration and defense (OSG); education (EDU); human health and social work activities (HHT); dwellings (DWE)

Source: Author's aggregation based on GTAP 10A MRIO Database.